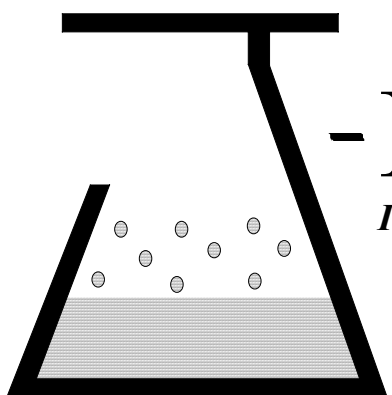


# Custom Products for Research

## Programmable Syringe Pump



**-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.

## Index

<b>Hardware Description</b> .....	<b>4</b>
<b>Program One. Timed Addition</b> .....	<b>5</b>
<b>Program Two. PC Control</b> .....	<b>8</b>
<b>Program Three. Program Loader</b> .....	<b>11</b>
<b>Preparing a File for Upload using NotePad</b> .....	<b>15</b>
<b>Uploading a Program Using HyperTerminal</b> .....	<b>16</b>
<b>Entering Numeric Data into the Controller</b> .....	<b>18</b>
<b>Using the Controller's Manual Prime Function</b> .....	<b>19</b>
<b>Changing Syringes and Distribution Valves</b> .....	<b>20</b>
<b>Programming Mode</b> .....	<b>21</b>
<b>I/O Port Connections</b> .....	<b>22</b>
<b>Appendix (hand held probe selection)</b> .....	<b>23</b>

## 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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## *Here's an offer you can't refuse*

### **J-KEM's Syringe Pump is not a static instrument.**

J-KEM's goal is to make the finest products available to the research community, period. 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 new 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.*

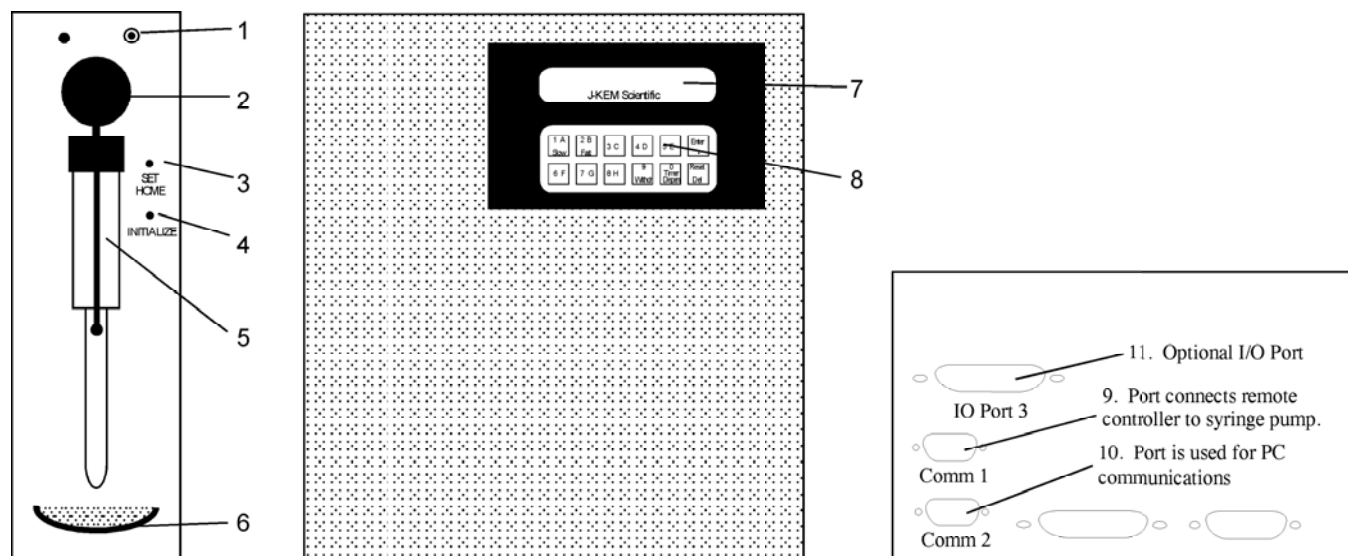
President

### **Pump Overview**

The syringe pump is programmed with 3 standard programs plus one optional, user-defined program. The three standard programs are:

1. **Timed Delivery.** This program delivers a user specified amount of liquid over a user specified amount of time. This program is useful for the controlled delivery of a reagent to a reaction. Allows the user to construct a program of 1 to 16 discrete steps.
2. **PC Remote Control.** This program allows the syringe pump to be controlled directly from a remote PC.
3. **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.

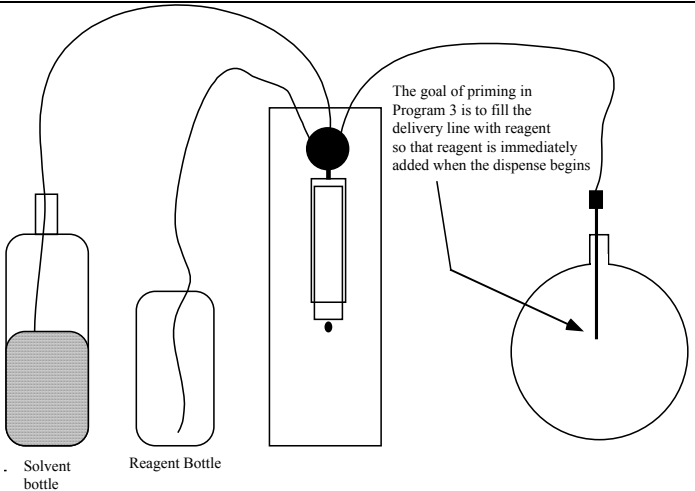
# Hardware



1. Hand Held Probe Electrical Connection. Hand held probes with probe mounted triggers are useful for Programs 1&2. For various probe designs, see the Appendix.
2. Multi-Port Distribution Valve. Valves connect various solvent reservoirs or distribution points. Any port can be used for withdrawal or distribution.
3. Set Home Button. Used when changing syringes (see Changing Syringes). Don't press this button during normal use.
4. Initialize Button. Used when changing syringes (see Changing Syringes). Don't press this button during normal use.
5. Syringe. Syringes from 10  $\mu$ l to 50 ml are available (see Changing Syringes).
6. Manual Syringe Adjustment. Used when changing syringes (see Changing Syringes). Don't press this button during normal use.
7. Controller LCD Display. The display shows user relevant information for the program being run.
8. Controller Keypad. The keys have multiple context sensitive meanings with the most common meanings printed on the keys.
9. For syringe pumps equipped with remote controllers, this port connects the syringe pump to the controller via a 9-pin cable.
10. PC communications port connects to a standard PC comm port. Used for PC control of the syringe pump (see Program 4) or flash memory reprogramming.
11. Optional I/O port connections. For units equipped with I/O port connections, see section titled I/O Ports for connection diagram.

# Program One Description.

This program adds a user specified volume of reagent over any specified period of time. The user can enter up to a 16-step timed addition program.

1	<p><b>Program Setup:</b></p> <p>1. Connect a piece of Teflon tubing from any of the valves ports to a reservoir containing the reagent to be dispensed.</p> <p>2. Connect a second piece of Teflon tubing to the reaction the reagent is being delivered to.</p>	 <p>The goal of priming in Program 3 is to fill the delivery line with reagent so that reagent is immediately added when the dispense begins</p> <p>Solvent bottle      Reagent Bottle</p>
2	Select Program one by answering '1' to the question:	Select Program [1-3] Program:
3	The controller displays the name of the program and allows you to select it or start again. To run this program press the '2' key (i.e., the key below 'Yes'). To select a different program, press the '5' key, (i.e., the key below 'No').	Run Timed Delivery? Yes      No
4	You are presented with the option of recalling a previously stored program (1) or entering a new program via the controllers keypad (2).	1= Recall Program 2= Load New Program
5	<p><b>If you chose to Recall an existing program:</b></p> <p>The controller prompts for the program number to recall (a program must have been previously stored in this program number to recall it). Enter the desired program, the press ENTER. <b>Skip to Question 17 below.</b></p>	Recall Program Number[1-3]:
6	<p><b>If you chose to Enter a new program:</b></p> <p>A new programs consists of entering the ports to fill from and dispense to, and the volume to dispense over what period of time. These four questions constitute a single step in a program. Programs can be from 1 to 16 steps long.</p>	
7	<p>For Step **, enter the amount of time you want the program to take add the reagent used in this step. <b>Note:</b> only the blinking digit can be changed on the clock. The format of the clock is: Hr:Min:Sec To enter 35 minutes, press '0' '0' '3' '5' 'Enter' (trailing zeros don't need to be filled in). See the section titled "Entering Numeric Data into the Controller". To stop entering data short of the full 16 steps possible, enter a time of '0'. A time of '0' is entered in response to this question by simply pressing the ENTER key while the clock reads '00:00:00'.</p>	For Step **, Enter Duration: 00:00:00

8	For Step **, enter the port on the pumps distribution valve that the reagent is attached to.	For Step **, Enter Reagent Port:
9	For Step **, enter the port on the pumps distribution valve that the reaction flask is attached to.	For Step **, Enter Dispense Port:
10	<b>For Step 1, and only Step 1</b> , of any program, the controller presents the option of adding an Absolute or Relative volume of reagent. For Steps 2-16, skip to Question 13.	
11	The program presents the option of adding an absolute volume of reagent, for example, add 3.500 ml from a stock solution in a reagent bottle, or adding a relative volume of reagent. Adding a relative volume means adding the entire content of the syringe that is manually loaded into the syringe by the user via the controller's keypad.	Add ABSOLUTE [1] or RELATIVE [2] volume?
12	For <b>ABSOLUTE Addition</b> , the following question is asked:  Enter the total amount of reagent to add to the reaction.  A <b>RELATIVE Addition</b> 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 Step **, Enter Volume[ml]:  Fill manually Press ENTER to start
13	Enter the volume of reagent to add (in milliliters). Volumes are floating point numbers, for example 12.55ml. In this example, to enter 12.55ml: first enter the '12' by pressing '1' '2', then a decimal point by pressing ENTER (enter is both the enter key and the decimal point key), then the '55' by pressing '5' '5', then enter the number by pressing ENTER (a second time). See the section titled "Entering Numeric Data into the Controller".	For Step **, Enter Volume[ml]:
14	<b>Repeat Questions 7 to 13 until the program description is complete.</b>	
15	After a new program is entered, you are given the option of storing the program for future recall.	Store Program? Yes          No
16	If you elect to store the program, you are prompted for the storage location. The controller stores 3 independent program.	Store at Program Number[1-3]:

17	<p>The program gives the option of priming the pump manually. See the section titled “Using the Controller’s Manual Prime Function”.</p> <p>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 10.0ml of reagent in total and 234 <math>\mu</math>l remains in the syringe from priming, when the delivery is started the pump will withdraw 9,766 <math>\mu</math>l of reagent to add to the residual 234 <math>\mu</math>l for a total of 10.0ml.</p>	<p>Prime pump manually?</p> <p>Yes      No</p>
18	<p>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 washes with this solvent after every program step.</p>	<p>Flush when done?</p> <p>Yes      No</p>
19	<p>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.</p>	<p>Press any key to Start [Exit=RESET]</p>
20	<p>The programs run-time screen shows the amount of reagent delivered and the time remaining in the program.</p>	<p>Dispensed: 12.323 ml Time Left: 12:43:18</p>
21	<p>The program can be paused for an indefinite period of time by pressing the ‘Pause’ key. To resume the program, press the ‘Enter’ key</p>	<p>Delivery Paused Hit ENTER to resume</p>

**Keys active during program execution.**

1. Pressing the Pause key, stops the addition until being manually restarted by the user. The program resumes at the point that the pause key was pressed.
2. Pressing the ‘Reset’ key aborts the program.

## Program Two Description.

Program two allows the actions of the syringe pump to be controlled by a remote PC.

- 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.

Select Program two by answering '2' to the question	Select Program [1-3] Program:
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 PC Control Yes            No
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 introductory run-time screen is shown here. The controller then displays the most recently executed command.	Ready...

The syntax for pump commands is very exacting, a command with the wrong syntax will most likely hang the program. All commands are case sensitive.

### Sending Commands

The Infinity controller communicates via a standard 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
<b>WITHDRAW(volume)</b>  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)OK\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.
<b>DISPENSE(volume)</b>  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.
<b>PORT(port)</b>  Port is the port number you want the distribution valve to advance to.	PORT(4)\r  PORT(1)\r	PORT(4)OK\r  PORT(1)OK\r	This command sends the pump to the specified port. The controllers reply is the command sent with OK appended to the end.
<b>RATE(rate)</b>  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.
<b>HOME()</b>	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.

<b>FILL()</b>	FILL()\r	FILL()OK\r	Causes the syringe to fill to its maximum setting.
<b>DELAY_MS(value)</b> 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.
<b>DELAY_SEC(value)</b> 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 <sup>8</sup> .
<b>BEEP(value)</b> 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.
<b>WARNING()</b>	WARNING()\r	WARNING()OK\r	Causes the controller to emit a 3-beep tone useful as an attention getting warning signal.
<b>PAUSE()</b>	PAUSE()\r	PAUSE()OK\r	Causes the program to pause until the RESET key is pressed on the controller's keypad.
<b>LITERAL(Command)</b>	LITERAL("/IL4R")\r  NOTE: <b>Do not</b> include the '\r' character in the native command.	LITERAL("/IL4R")OK\r	Allows the user to pass any native pump command to the pump. There are about 160 native pump commands available. Contact J-KEM for a list of commands. Do not include the '\r' character in the native command.
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.

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.

**Table of Default, Minimum, and Maximum Syringe Speeds.**

Syringe Size	25µl	50µl	100µl	250µl	500µl	1ml	1.25ml	2.5ml	5ml	10ml	25ml	50ml
<b>Default Speed (vol/min)</b>	156µl	312µl	624µl	1.56ml	3.12ml	6.24ml	7.8ml	15.6ml	31.25ml	62.5ml	118.8ml	125ml
<b>Minimum Speed (vol/min)</b>	1.25µl	2.5µl	5µl	12.5µl	25µl	50µl	62.5µl	125µl	250µl	500µl	1.25ml	2.5ml
<b>Maximum Speed** (vol/min)</b>	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 Three Description.

Program three 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 3 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 2 can be used.

In addition to the commands available for program 2, 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.

1	Select Program three by answering '3' to the question	Select Program [1-3] Program:
2	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
3	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
4	<b>If you selected to Run an existing program, the following questions are asked. If you selected to Load a new program, go to Question 9.</b>	
5	The syringe pump stores 3 user defined programs of 300 steps each. Enter the program you want to recall.	Load program[1-3]:
6	You are given the option of sending the recalled program to an application like HyperTerminal, where it can be printed. To download and print the program see the section titled "Program Printer Using HyperTerminal".	Print Program? Yes          No
7	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
8	The program is ready to start. Press the Enter key to begin.	Program Ready... Continue -> Enter
9	A running program can be paused by pressing the PAUSE key. The currently running step must finish running and then the program will pause. The program is resumed by pressing the Enter key.	Program PAUSED.. Continue -> Enter

10	<b>The controller asks the following questions if you selected to Load a new program. See examples of loading a new program below.</b>	
11	Enter an address to store the new program at	Store as Program Number[1-3]:
12	The controller is ready for the PC to begin uploading the program.	Ready for upload
13	When the program begins to upload, the screen changes to show the number of commands received.	Commands Received ###
14	When the program is done uploading, the total number of commands read is displayed.	### Commands Read Continue -> ENTER
15	You are given the option of sending the uploaded program to an application like HyperTerminal, where it can be printed. To download and print the program see the section titled “Program Printer Using HyperTerminal”.	Print Program? Yes No
16	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.	Error at Line ### Continue -> ENTER  WITHDRA(500.0)r Continue -> ENTER
17	The program upload is aborted. You must correct the offending command and re-upload the program.	Program Aborted 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 section titled “Uploading a Program Using HyperTerminal”.

**Keys active during program execution.**

1. Pressing the Pause key, stops the program until being manually restarted by the user. The program resumes at the point that the pause key was pressed.
2. Pressing the ‘Reset’ key aborts the program.

**Program 1 Example** Simple command script

<b>Command</b>	<b>Effect</b>
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
<b>END</b>	End of program. <b>NOTE: The “END” command is</b>
<b>END</b>	End of program <b>required to appear twice</b>

**Program 2 Example** 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. <b>NOTE: The “END” command is required to appear twice</b>
END	End of program <b>required to appear twice</b>

**Program 3 Example.** 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. <b>NOTE: The “END” command is required to appear twice</b>
END	End of program <b>required to appear twice</b>

## 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)
HOME()
LOOP_START(5)
PORT(2)
FILL()
LOOP_START(3)
DISPENSE(200.0)
DELAY_MS(800)
LOOP_END()
LOOP_END()
END
END
```

# Uploading a Program Using HyperTerminal

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

## To Initially Configure HyperTerminal

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).

## To Upload Data Using HyperTerminal

1. Start Program 3 in the syringe pump 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 “To Initially Configure HyperTerminal”.

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 in 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.

# Entering Numeric Data into the Controller

Since all programs require entering numeric data, the method of entering the three types of data requested is summarized below.

	<b>Controller Display</b>	<b>Solution</b>											
1	<p align="center"><b>Floating Point Numbers</b></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 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>2</td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>0</td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Enter ▪</td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>3</td></tr></table> <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Enter ▪</td></tr></table> on the J-KEM controller [Note: the <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Enter ▪</td></tr></table> key is both the decimal point and Enter key. The first time you press <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Enter ▪</td></tr></table> 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 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Reset Del —</td></tr></table> key. You must correct your mistake BEFORE pressing the <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Enter ▪</td></tr></table> key the second time to enter the number. Negative numbers are entered by pressing the <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Reset Del —</td></tr></table> first to create the “-” sign.</p>	2	0	Enter ▪	1	3	Enter ▪	Enter ▪	Enter ▪	Reset Del —	Enter ▪	Reset Del —
2													
0													
Enter ▪													
1													
3													
Enter ▪													
Enter ▪													
Enter ▪													
Reset Del —													
Enter ▪													
Reset Del —													
2	<p align="center"><b>Integer Numbers</b></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 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Reset Del —</td></tr></table> key. Negative numbers are entered by pressing the <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Reset Del —</td></tr></table> first to create the “-” sign.</p>	Reset Del —	Reset Del —									
Reset Del —													
Reset Del —													
3	<p align="center"><b>Entering a Time</b></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. Negative numbers are entered by pressing the <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>Reset Del —</td></tr></table> first to create the “-” sign.</p>	Reset Del —										
Reset Del —													

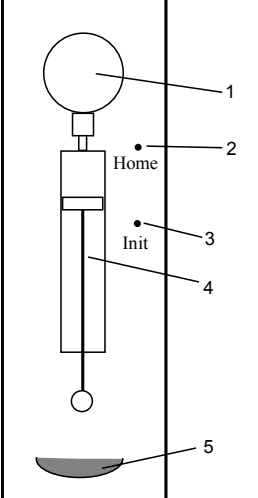
## Using the Controller's Manual Prime Function

### 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 the 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"> <li>• Change ports by pressing the 'A - H' keys.</li> </ul> <p>The top line of this display shows the active keys, which are: The PORT keys (A-H), the <b>Withdraw</b> key, the <b>Dispense</b> key, and <b>RESET</b></p> <p>Select port C by pressing the C key.</p> <ul style="list-style-type: none"> <li>• Pull reagent into the syringe by pressing the 'Withdr' key.</li> </ul>	<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></p>	<p></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>	

# Changing Syringes and Distribution Valves

## 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	"Number of pumps in system?" Enter the number of syringe pumps in your system. In this case, enter the number 1. "Enter Pump 1 Data?" Answer this question YES.								
12	"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).								
13	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.								
14	"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.								
15	"PAW Delay = ##### 1=[OK] 2=[Change]". PAW Delay stands for 'Pause After Withdrawal Delay'. 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, but a delay time can be entered for any syringe size. Enter the number of milliseconds you want the program to pause after making a withdrawal with 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" style="margin-left: 20px;"> <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.								

# Programming Mode

Programming mode allows configuration of syringe pump and communication parameters. To enter programming mode, turn power to the controller off for 5 seconds then turn power back on. When power is restored, three quick ‘beeps’ sound and the message “Recall Data” appears, press and release the ENTER key while this message is in the display. Upon entering programming mode a program number appears. This is a unique program number useful to J-KEM when debugging errors. When in programming mode, the dialog boxes below appear.

1	<b>Edit PC COMMS?</b> 1= Yes 2= No	This section allows setting communication parameters between the PC and the syringe pump controller.
		Baud = 9600 1= OK 2= Change  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.
		Data Bits= 8 1= OK 2= Change  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.
		Parity is NONE 1= OK 2= Change  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.
		Stop Bits= 1 1= OK 2= Change  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.
2	<b>Edit Pump COMMS?</b> 1= Yes 2= No	These values should not be changed from the factory default. The defaults are:  Baud = 9600 Data Bits= 8 Parity is NONE Stop Bits= 1
3	<b>Edit Pump Data?</b> 1= Yes 2= No	This section is entered when a new syringe size or valve is installed on the syringe pump. See the section titled “Changing Syringes and Distribution Valves” for an explanation of the options in this section. Options allow setting syringe size, valve port positions, default syringe speeds, and certain delay times.

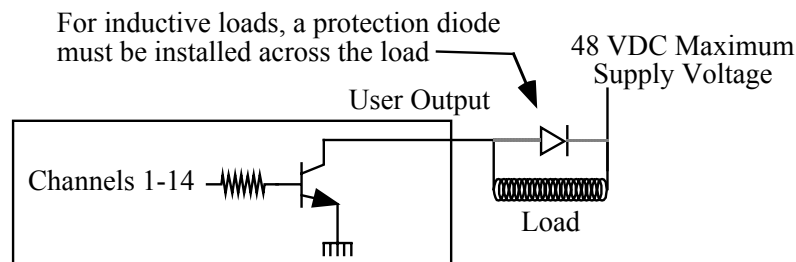
## I/O Port Connections (optional syringe pump feature)

An optional feature is customized digital input/output registers. Not all models of syringe pumps have digital inputs and outputs implemented. Digital inputs and outputs are useful to coordinate the solvent dispensing functions of the syringe pump with other pieces of equipment. To implement this option, contact J-KEM.

PC Command	Example	Infinity Response	Comments
<b>INPUT(line)</b>  Line is the input line number.	LINE(4)\r	LINE(4)1OK\r  LINE(4)0OK\r	This command queries the state of input line #4. If the state is low, the command returns '0', if the state is high the command returns '1'.
<b>OUTPUT(line,state)</b>  Line is desired output line. State is the desired state of the line.	OUTPUT(3,1)\r  OUTPUT(5,0)\r	OUTPUT(3,1)OK\r  OUTPUT(5,0)OK\r	Sets the specified output line to the specified state. A state of 1 sets the output line to its high state, and a state of 0 sets it to its low state.

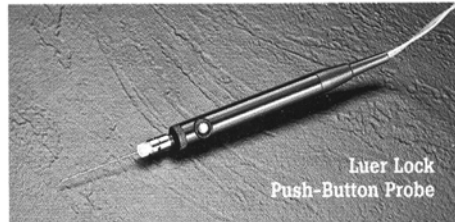
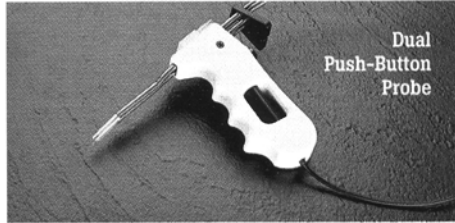
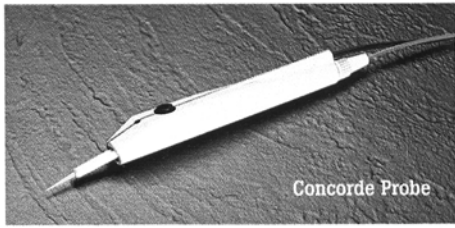
Input and Output port connections support optional features on J-KEM's syringe pumps. Except for digital input 1 which supports the use of external hand held probes (see next section), the function of each of the input and output lines requires custom programming by J-KEM. The pin out of the 15-pin I/O port is listed below.

<b>Inputs</b>		
Digital input #	Pin Number on 15-pin Connector	Function
1	1	Supports the use of hand held or foot peddle operated dispensing probes.
2	2	Not defined
3	3	Not defined
4	4	Not defined
<b>Outputs</b> <b>Maximum TOTAL supply current from all inputs summed together is 500ma</b>		
Digital output #	Pin Number on 15-pin Connector	Function
		Open collector outputs Maximum input voltage: 48 VDC Maximum supply current per outlet 170ma
1	9	Not defined
2	10	Not defined
3	11	Not defined
4	12	Not defined
<b>Grounds</b>		
Pin Number on 15-pin Connector	Function	
Pins 5, 6, 7, 8	All 4 pins are ground connections and are used for both the digital inputs and outputs	



All digital outputs have open collector outputs as shown in the drawing. When the output is turned ON the load is pulled to ground. When turned off the load is allowed to float. Care must be taken when driving inductive loads, the user must provide a reverse biasing diode directly across the load or damage to the output will occur. **The maximum current on any one output is 170ma and the total current for all outputs can not total more than 500ma. The maximum input voltage is 48 VDC.**

# Appendix



The probes on this page are designed to work with the syringe pump. Each probe incorporates a push button that can be used to signal a program to initiate a dispense or withdraw operation or other program option.

Please contact J-KEM for information.