



Model 200 Series
Programmable Option
Users Manual

WEEE/RoHS Compliance Statement

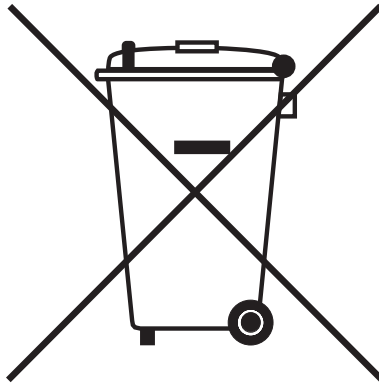
EU Directives WEEE and RoHS

To Our Valued Customers:

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for our products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive - Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of our products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. We will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.



- **Do Not Dispose Product with Municipal Waste**
 - **Special Collection/Disposal Required**

KDS Programmable Pumps

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KDS Programmable Pumps

General Information

KEYPAD PROGRAMMABLE PUMPS

The "program mode " is available on all Series 200 models and permits multistep dispenses without the need for computer control.

From the pump keypad, a custom program can be entered, which will control the pump from seconds to days; permit the flowrate to be changed for discrete time periods; repeat dispenses; control output TTL signals to coordinate with other laboratory instruments (or valves); or respond to inputs from other devices, such as switches or relays, and to perform loops, where dispense sequences are repeated.

The program is divided into time periods called STEPS, each of which can be up to 12 hours long. Each step is automatically numbered and, to simplify programming, a menu prompts the user to select the options available in each STEP.

The flowrate can be ramped up or down, or kept constant for a defined time period for a volume dispense. The initial and final flowrate for each period is entered and the pump automatically makes rate changes over the time period. No need to enter increments for a ramp up or down; the pump automatically ramps the rate linearly.

The pump can be paused and then restarted, either by a time delay or by a TTL input. Both TTL inputs and outputs can be controlled by the pump. The pump can therefore, respond to switch closures or send out signals to actuate valve, or other relays, switches etc.

Two separate loops can be programmed so that steps can be repeated. The number of repeat operations is controlled by the "loop count". For example, this is helpful when a volume dispense is required repeatedly, triggered by a switch.

The two loops can be "nested" so that the program can run for days and complex dispenses can be repeated many times.

KDS Programmable Pumps

Features

PARAMETERS WHICH CAN BE PROGRAMMED IN EACH STEP

Time duration

Infuse or withdraw

Start flowrate

End flowrate

TTL output settings

Pause, wait for TTL input actuation

Loops to repeat previous steps

To simplify the programming, previously programmed settings are stored in non-volatile memory and are displayed when **Program Mode** is selected. Whenever possible, options are displayed with the "active" option flashing. If flashing, this parameter can be selected or changed.

The pump can be programmed by first selecting **MODE** on the mainline menu and then selecting **Program** (PRGM).

DISPLAY AND PROGRAMMING SEQUENCE

After selecting Program Mode, display reads:

Table Dia Step Mode

DIA and TABLE

If the pump was previously used in Program Mode the pump will be initialized in Program Mode when it is switched on. For convenience, should a syringe change be required, it is possible to enter a new syringe size, either from the stored Table or DIA, without leaving the Program Mode.

If a syringe size change is made however, this will change all program values to defaults and will require reprogramming.

It is possible to review the syringe size in "Dia" or "Table" without changing the programmed settings.

In "Table" review the settings but select "QUIT", do not enter a diameter.

In "Dia" the settings will not change if there is no change to the diameter entered.

MODE

Mode selection reverts back to other pump operations.

STEP

Step selection starts the programming sequence.

KDS Programmable Pumps

Menu Operation

After selecting MODE and then PROGRAM the display will show STEP which leads into editing the program.

1) **Number of STEPS**

Menu prompts " NUM of Steps". Enter total number of program steps using numerical keypad and press SELECT or ENTER to save a maximum of 8.

2) **Edit STEP #**

The menu automatically increments the step number, however, it is possible to enter a different number.

If the step number displayed (flashing) is required then press SELECT to save and continue editing.

3) **Time**

Step # Time xx:xx:xx.

Time xx:xx:xx in hours, minutes and seconds.

Use the → key to move from left to right and enter the time using the numerical keypad. When the correct time is displayed press ENTER to load this time into memory.

4) **Infusion/ Withdraw**

The direction of travel for each step must be selected.

Initially, " Infusion " direction will be flashing. The direction keys, → and ← are used to switch between directions. SELECT key is then used to load the direction into memory.

5) **Rate**

The program requires the initial rate (Start), the ending rate (End), and the units.

a) Display reads: #Start: xxxxx uuu

is step number, automatically assigned.

xxxxx is the numerical flowrate.

Enter from the numerical keypad.

uuu are flowrate units.

Use the arrow key → to select units (displayed flashing)

Repeat to move through the unit options. Options are: $\mu\text{l}/\text{m}$ or $\mu\text{l}/\text{h}$, ml/m or ml/h

The ← key is used to move back to the numerical display.

Press ENTER to save.

The menu now prompts for the final rate which is entered in the same manner.

b) #End: xxxxx uuu

xxxxx numerical and uuu units of flowrate

KDS Programmable Pumps

Menu Operation (Continued)

5) Rate (Continued)

c) Options:

- 1) if $R1=R2=0$ The pump is stopped, no flowrate.
- 2) if $R1<R2$ Flowrate increases LINEARLY from R1 to R2 over the step duration.
- 3) if $R1>R2$ Flowrate decreases LINEARLY from R1 to R2 over the step time.

6) PIN OUT

TTL Output pins can be controlled to set the levels high (H) or low (L) during the step. This change in status of an output pin can be used to trigger another external event.

Pins 1 and 6 on the 9-pin TTL connector can be controlled in the program.

The display reads: # Pinout: 1= H, 6= H

Options: HH, HL, LH, LL

The arrow keys are used to toggle through the options. Select and Enter are used to save the settings.

7) Pause

If the Pause option is selected in a step, the pump completes the step and pauses at the end of the step.

The display reads: Paused @ end of n where n is the step number

The pump is programmed but stopped, waiting to be actuated, either by:

- a) Run/Stop key
- b) "RUN" command via RS232
- c) TTL input, Pin 8 ; level change from High to Low.

The display reads: # Pause: Inactive Active

Use the arrow key and SELECT to save.

8) Loop

A loop permits the program to return to and execute a previous step, or steps, and repeat these steps a specified number of times (up to 100).

The menu first prompts for a loop selection: # Loop?: Yes No

Loop selection is made using the arrow keys to move to Yes or No. SELECT to save.

a) LOOP to STEP

The menu now prompts for the Step # the program Loop should return to. For example, if the program is at step 5 and the loop step selected is #3, then the program executes step 3, 4 and 5 again.

KDS Programmable Pumps

Menu Operation (Continued)

8) Loop (Continued)

b) LOOP COUNT

After setting the initial step number of the loop, the menu will prompt for the "loop count", the number of times the loop will be repeated.

Maximum repeat number is 100.

Display reads: # Loop Count: x

The number of loops to be executed, x is entered from the numerical keypad followed by ENTER.

Note:

a) Maximum number of loops is two.

Once both loops are entered the loop option will NOT be displayed in menu.

b) Changing Loops

To change loops, if two are already entered, one loop must be cancelled before the new loop can be programmed.

c) A LOOP within a LOOP

It is possible to have a loop running within a loop.

9) Saving the Step

As there are many options in each step the program gives one more option, "Redo" to make changes before storing the Step.

menu prompts: # Step: Save Redo

The arrow keys are used to highlight the required option which can be saved with ENTER or SELECT.

10) Program End

After saving the step the program prompts: # Next Step Done

"Next Step" is selected, unless all steps are completed, and the above process is repeated for the number of steps required, up to 8. When all steps are programmed "Done" should be entered, with SELECT or ENTER to complete the programming.

The pump and display will now move to Step 1 ready to start the programmed dispense.

display reads: Stp 1 xx:xx:xx →

KDS Programmable Pumps

Running The Program

Run

The Run key starts the program; the displayed time counts down and the direction arrow flashes.

Hold/Continue

If the Run/Stop key is pressed while running a program, the pump is stopped but gives an option to end the program, or restart the pump and continue the program to its end.

Program changes when operating

Once a step has commenced no changes are possible in that step. However, while dispensing changes are permitted to steps still to be executed.

Syringe size changes

If the pump was previously used in Program Mode the pump will be initialized in Program Mode when it is switched on. For convenience, it is possible to enter a new syringe size, either from the stored Table or DIA, without leaving the Program Mode.

Note: If a syringe change is made this will change all program values to the default settings and will require reprogramming. A diameter change causes the pump to stop; resets the "number" of steps to 1; resets the "activestep" to 1; and all values will be set to the initial default settings. The initialization of the new settings takes approximately two seconds.

Stall Condition

The Fast Forward & Fast Reverse features do not work in Program Mode. Should a stall occur then go to Infusion Mode where the Fast Forward/Fast Reverse features works, and use these features to end the stall condition.

By going to the infusion mode the program is still saved in memory.

Changing programs containing loops

Only two loops are permitted in a program and it is necessary to remove from memory the previously used programs which contain loops. A convenient way to do this is to input a one step program which does not have a loop. This way, all loops are deleted from memory and the new program containing loops can be added.

KDS Programmable Pumps

RS232 Commands and Responses

All commands and responses in standard pumps remain the same, however, the program mode does have additional commands and responses.

Each pump can be controlled either from the keypad or via RS232 at all times, but the pump can only respond to one command at a time. When under RS232 control the display reads "REMOTE". All settings made via RS232 are stored in non-volatile memory.

To move the pump from Remote (RS232) to keypad control press **select**.

Changes to program parameters cannot be made when the pump is running therefore parameter setting commands, such as, step, travel, rate etc. are not applicable [NA] when the program is running.

When the pump is running all queries are disallowed except activestep?, timeleft?, and loops?

Commands are not case sensitive

After each command is received and executed the pump responds with prompt sequence:

a) Query commands:

carriage return (<CR>)|line feed, text, <CR>, line feed, 1 or 2 digit address, prompt character

b) Other commands:

<CR>, line feed, 1 or 2 digit address, prompt character

Prompts

>	running in infusion direction
<	withdrawing
:	stopped
NA	not applicable
E	error (see error? command)
P	pump is paused
carriage return <CR>	All pumps chain interpret this as a stop command
pump address, <CR>	Pump with the specified address responds with a prompt
pump address (optional), command, <CR>	Pump at the address executes the command and then responds with a prompt.

Note: If there are multiple pumps in the daisy chain and a pump address is not used then all pumps will respond to the non-specific command and return prompts. Multiple prompts results in a communications breakdown.

Note that withdrawal and continuous mode commands are recognised only by the infusion/withdrawal models.

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RS232 Commands and Responses (Continued)

mode prgm	sets pump in program mode. Response :
number n	sets number of steps in program. n = 1 - 8
step n	sets step number to be programmed. n = 1 - 8 important that step number be set before entering program settings
time xx:xx:xx	sets time duration of step to be programmed. hr:min:sec
travel i (w)	sets direction to infusion (withdrawal)
rateb nnnnn uuu	sets step beginning rate where nnnnn is . , 0 to 9 where uuu are units μlm , μlh , m/m , ml/h. Note: if set rate is out of range then response is NA; rate is set a zero
ratef nnnnn uuu	sets step finish rate where nnnnn is . , 0 to 9 where uuu are units μlm , μlh , m/m , ml/h. Note: if set rate is out of range then response is NA; rate is set a zero
portout p	sets status of output pins 1 and 6 where p is HH (1=high, 6=high) HL (1=high, 6=low) LH (1=low, 6=high) LL (1=low, 6=low)
pause y or n	sets status of pause y = active n = inactive
loop y or n	sets loop status y = yes n = no
loopto n	set step number to loop to where n = 1 to 8
loopcnt b	sets number of loops to be repeated where b = 1 to 100
save	saves step settings important that each step is saved
done	saves all programmed steps important that "done" is entered after all steps saved
wait	stops pump (pauses), but can be restarted
continue	restarts pump after "wait" command, program continues
nextstep	causes program to jump to the next step
mode?	query mode. Response PGM
activestep?	queries step running response: n where n = 1 to 8

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RS232 Commands and Responses (Continued)

timeleft?	queries time remaining in active step response: xx:xx:xx where hr:min:sec
number?	queries number of steps in program response: n where n = 1 to 8
step?	queries step being programmed (Not the active step) response: n where n = 1 to 8
time?	queries time in program step (Not the active step) response: xx:xx:xx where hr:min:sec
travel?	queries direction of travel in programmable step (not active step) response: I or W where I is infusion, and W is withdrawal Note: Prompts > or < indicate direction of active step
rateb?	queries beginning rate response: nnnnn uuu where nnnn is . , 0 to 9uuu is $\mu\text{l}/\text{m}$, $\mu\text{l}/\text{h}$, ml/m , ml/h
ratef?	sets finish rate response: nnnnn uuu where nnnnn is . , 0 to 9 uuu are units $\mu\text{l}/\text{m}$, $\mu\text{l}/\text{h}$, ml/m , ml/h .
portout?	queries status of output TTL pins 1 and 6 response HH, HL, LH, LL
pause?	queries whether pause response: Y or N where Y is yes, N is no
loops?	queries whether loops in program response: Sn:x Sn:x where Sn is the step number containing a loop x is the number of loops remaining to be executed (counts down)
loop?	queries loop status in the step response: Y or N where Y is yes, N is no
loopto?	queries step number to which program loops (not available if no loops) response: n where n = 1 to 7
loopcnt?	queries number of loop repeats (not available if no loops programmed) response: n where n = 1 to 100

NOTE:

a) It is important to save each step before programming next step

b) Only two loops are permitted, therefore recommend to query number of loops in an existing program before modifying the program. If loops are present it will be necessary to delete an existing loop before a new loop can be programmed.

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RS232 Commands and Responses (Continued)

PROGRAM EXAMPLE

Syringe selected, 4.70 mm diameter

RS232 programming

mode prgm	Select Program mode
Number 4	Sets number of steps in the program
Step 1	Selects Step 1 for programming
time 00:00:10	Step 1 time duration is 10 seconds
travel I	Infusion selected
rateb 0 mlm	Step 1 beginning rate is 0 ml/minute
ratef 1 mlm	Step 1 finishing rate is 1 ml/minute
portout hh	Output pins 1 and 6 set at high/high
pause n	Pause inactive
loop n	No loops
save	Save step settings
Step 2	Ready to program step 2
time 00:00:15	Set time duration to 15 seconds
rateb 1 mlm	Assumes previous travel direction (infusion), and sets step 2 beginning rate 1 ml/minute.
ratef 0.1 mlm	Finishing rate 0.1 ml/minute
loop y	Select a loop
loopto 1	Program will loop back to step 1 after completing step 2
loopcnt 1	Will repeat the loop one time
save	
step 3	Ready to program step 3
time 00:00:20	Time of step 3 is 20 seconds
rateb .3 mlm	Sets begin rate to 0.3 ml/min. Assumes no direction change.
ratef 0 mlm	Sets finish rate to 0 ml/min.
save	
Step 4	Program step 4
time 00:00:12	Time duration 12 seconds
travel w	Change direction to withdrawal
rateb 1 mlm	Withdraw rate set to 1.0 ml/minute.
ratef 1 mlm	Finish rate 1 ml/min.
loop y	Select a loop
loopto 3	After step 4 will loop back to and repeat step 3.
loopcnt 1	Will repeat loop one time.
save	
done	completes and saves program

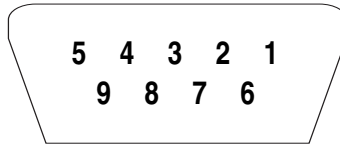
Queries: a) loops? S2:1 S4:1 loop in step 2, loop count is 1; loop in step 4, count 1

 b) step 3 portout? HH Portout set in step 1 and remained unchanged

 c) step 1 ratef? 1 ml/m Finish rate in step 1 is 1.0 ml/minute

KDS Programmable Pumps

TTL Specifications



As viewed from rear of the pump.

Pin	1,6	Controlled Output	High/Low states set at start of each step (could be used for valve control)
	2	Directional Output	High - infuse, low - refill (stays high when stopped)
	5	Audible Alarm Option	Pulses with "end of program" audible alarm feature
	7	Run Indicator	High - running, low - stopped

To actuate the pump connect ground, Vss to the following pins.

3	Vss , Ground Ref.	
8	Trigger	Falling edge ends [1] starts the program and [2] ends pause and starts next step
4	Jump	Program jumps to the end of the step in progress
2	Directional Output	High - infuse, low - refill (stays high when stopped)
5	Audible Alarm Option	Pulses with "end of program" audible alarm feature
9	Wait/Continue	When running, High/Low state change acts like run/stop key, or the RS232 commands wait/continue
4+ 9	End Program	Change simultaneously - ends the program
Logic Low	0 - 0.5V, max	2ma current sink
Logic High	2V - 5V	

KDS Programmable Pumps

Limited Warranty

KD Scientific Inc. warrants to the first consumer purchaser, for a period of one year from the date of purchase that this unit, when shipped in its original container, will be free from defective workmanship and materials and agree that it will, at its option, either repair or replace the defective unit.

This warranty does not extend to misuse, neglect or abuse, normal wear and tear, accident, modification or unauthorised repair.

KD Scientific will not be liable or in any way responsible for any incidental or consequential economic or property damage. Some States do not allow the exclusion of incidental or consequential damages, so the above exclusion may not apply to you.

There are no implied warranties of merchantability, or fitness for a particular use, or of any other nature. Some states do not allow this limitation on implied warranty, so the above limitation may not apply to you.

If a defect arises within the warranty period contact KD Scientific Inc., (see address below).

The customer is responsible for shipping charges and must first obtain a Return Material Authorization number (RMA) before the unit will be accepted. If a replacement unit is issued it is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

Note: This pump is not registered with the FDA and is not for clinical use on human beings.

Syringe pumps are manufactured by:

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