PUMP CHAIN COMMANDS

The Pump Chain commands allow all pump control information to be managed from an external computer source. These commands can also be used to control a series of pumps (up to 100) from a single computer interface.

Pump 11 Elite Series commands are communicated to the pump via a USB port interface through a terminal Method such as Harvard Apparatus' Method Manager or HyperTerminal. In using the Pump Chain commands, you will need to assign each pump in the pump chain a unique address, using the Set Pump Address command in the Settings menu. The address range is from 00 to 99. This address value is used to identify which pump is to receive a command and which pump is responding. The first pump in the chain, the one connected to the computer, must use address 0 (zero). Configure each pump with its assigned address and baud rate as described in the Pump Settings section of this guide.

NOTE

NOTE: When daisy-chaining using the optional RJ-11 connectors, all pumps must use the same baud rate. Values above 38400 are recommended.

NOTE

NOTE: If you are using the optional RJ-11 connections for daisy-chaining, the connection from the computer must come through either the RJ-11 or RS-232 connectors.

NOTE

NOTE: Once communication is established, if you manipulate the touch screen, you must reestablish communications to the PC (<CR> will do this)

NOTE

NOTE: System commands and start/stop commands can be executed from Method or Method configuration screens. However, for parameter commands (rate, dia, vol, etc) it is necessary to execute from the Quick Start configuration screen.

NOTE

NOTE: To maximize communication speed [as fast as 50 ms rate changes]: (a) prefix commands with the @ symbol to turn off GUI updates (ex: @irate 100 u/m) (b) use the 'NVRAM off' command to turn off writes of rate to memory.

Using the Pump 11 Elite Series Pump Chain Commands

The following instructions will help you to utilize the Pump Chain commands feature on the Pump 11 Elite Series pump.

Commands may be abbreviated to the first four letters, i.e. address would be abbreviated addr. A space must follow the command if arguments are included.

If the pump address is nonzero, the one or two-digit pump address precedes the command. For example, to set the infuse rate for pump 12, the command would look like "12irat 3.2 u/m".

NOTE

If the USB port is used on a pump with a nonzero address, the pump address does not need to be used.

Every line of the response from a pump with a nonzero address is prefixed by the two digit pump address (prefixed with a 0 if necessary) followed by a colon. No colon is used to seperate the pump address from the prompt however.

In the command list below, the following convention is used:

{ }	Required parameter
[ ]	Optional parameter
| choices	Separator between parameter
# zeros	Numeric value without preceding
###	Numeric value with preceding zeros
#-#	A range of values
<cr>	Carriage return
<lf>	Line feed
<sp>	Space
[prefix]	Pump address prefix in the format #: if the pump address is not zero
<prompt>	Prompt (see below)

The following prompts are returned after a command is executed:

:	The pump is idle
>	The pump is infusing
<	The pump is withdrawing
*	The pump stalled
T*	The target was reached

If the pump is in poll REMOTE mode, there will be no prompts or carraige returns.

If the pump is in poll ON mode, a XON character is added after the prompt.

If the pump address is nonzero, the pump address is prefixed to the prompt without a colon.

In the following list of commands:

- The pump address is prefixed to every response line followed by a colon.
- <lf>[##]<prompt> is the response unless otherwise noted.

Error Messages

Error messages are displayed if the entered command cannot be executed for some reason. The error message will take up two lines with the first line being the message type and the second line describing the error itself. The second line may be up to 80 characters long.

Command Errors

Command errors are displayed when the command is unrecognized, entered in the wrong mode, or the state of the pump keeps the command from executing (i.e. using the IRUN command if a limit switch is active).

The command error has the following format:

<lf>[##:]Command error:<cr>

<lf>[##:]<sp><sp><sp>{error message}<cr>
<lf>[##]<prompt>

Argument Errors

Argument errors are displayed when a command argument is unrecognized or out of range. The argument in question will be displayed except in the case of missing arguments.

The argument error has the following format:

<lf>[##:]Argument error: [bad argument]<cr>

<lf>[##:]<sp><sp><sp>{error message}<cr>
<lf>[##]<prompt>

System commands

ADDRESS

Sets or displays the pump address. Valid range is 0 to 99.

Command format:

address [0-99]

Query response:

<lf>[##:]Pump address is #<cr>

<lf>[##]<prompt>

Notes: Pumps with an address of 0 are masters, and pumps with an address between 1 and 99 are slaves.

BAUD

Sets or displays the baud rate. Valid baud rates are 9600, 19200, 38400, 57600, 115200, 128000, 230400, 256000, 460800, and 921600. Note that some computers may not be able to handle baud rates above 115200.

Command format:

baud [9600 | 19200 | 38400 | 57600 | 115200 | 128000 | 230400 | 256000 | 460800 | 921600]

Query response:

<lf>[##:]# baud<cr>

<lf>[##]<prompt>

CATALOG

Displays a catalog of Methods stored in the pump.

Command format:

cat

Query response:

<lf>[##:]Method name Size<cr>

<lf>[##:]---------- ----<cr>

<lf>[##:]{Method name} #<cr> This line is repeated for each file on the disk

<lf><lf>[##:]# file(s) using # steps<cr>

<lf>[##]<prompt>

Notes: The file size is the number of steps in the Method plus one for the file information header.

The last line shows the number of files and the total number of steps being used on the disk.

DELMETHOD

Deletes a Method stored in the pump.

Command format:

delMethod {Method}

DIM

Sets or displays the backlight level in percent. Valid range is 0 to 100. Note that specifying 0 will turn the backlight off so that the screen will not be visible.

Command format:

dim [0-100]

Query response:

<lf>[##:] #%<cr>

<lf>[##]<prompt>

ECHO

Sets or displays the USB echo state. Valid states are on or off.

Command format:

echo [onloff]

Query response:

<lf>[##:] OFF<cr>

<lf>[##]<prompt>

or:

<lf>[##:] ON<cr>

<lf>[##]<prompt>

FORCE

Sets or displays the infusion force level in percent. Valid range is 1 to 100.

Command format:

force [1-100]

Query response:

<lf>[##:]#%<cr>

<lf>[##]<prompt>

FTSWITCH

Sets or displays the footswitch setting. The footswitch may be used in a toggle on or off mode (momentary), a press to run mode (falling), or a release to run mode (rising).

Command format:

ftswitch [mom l risel fall]

Query response:

<lf>[##:]Momentary<cr>

<lf>[##]<prompt>

or:

<lf>[##:]Active high<cr>

<lf>[##]<prompt>

or:

<lf>[##:]Active low<cr>

<lf>[##]<prompt>

METRICS

Displays the pump metrics. The operation of this command is covered in the 11 Elite Configuration document.

Command format:

metrics

POLL

Sets or displays the polling mode state.

When polling mode is off, prompts are displayed when an event happens, such as a target being reached.

When polling mode is on, prompts are not displayed when an event happens, and a XON character is output when the pump is ready for another command

When polling mode is in remote mode, the following occurs

- Prompts are not displayed
- Carraige returns are not displayed
- The pump address is displayed even if 0
- Echo is forced off and the echo command is illegal

Command format:

poll [onloff]

Query response:

<lf>[##:] OFF<cr>

<lf>[##]<prompt>

or:

<lf>[##:] ON<cr>

<lf>[##]<prompt><xon>

or:

[##:] REMOTE<lf>

TILT

Calibrates the tilt sensor.

Command format:

tilt

Query response:

<lf>[##:]Calibrating the tilt sensor...<cr>

<lf>[##]Tilt calibration value is #<cr>

<lf>[##]<prompt>

TIME

Sets or displays the date and time.

Command format:

time [mm/dd/yy] [hh:mm:ss]*

Query response:

<lf>[##:]##/##/## ##:##:## #M<cr>

<lf>[##]<prompt>

* 24 hour time format

SYRMANU

Sets or displays the syringe manufacturer. Quick Start mode only. Valide 3-character manufacturer codes are shown in the table below:

air	Air-Tite, HSW Norm-Ject
bdg	Becton Dickinson, Glass (all types)
bdp	Becton Dickinson, Plasti-pak
cad	Cadence Science, Micro-Mate Glass
has	Harvard Stainless Steel
hm1	Hamilton 700, Glass
hm2	Hamilton 1000, Glass
hm3	Hamilton 1700, Glass
hm4	Hamilton 7000, Glass
hos	Hoshi
ils	ILS, Glass
nip	Nipro
sge	SGE (Scientific Glass Engineering)
smp	Sherwood-Monoject, Plastic
tej	Terumo Japan, Plastic
top	Top

Typing 'syrm' with no arguements displays the current syringe setting.

Typing 'syrm ?' displays a list of manufacturers with their associated 3-letter code.

Typing 'syrm {code} ?' shows a list of syringe sizes associated with their specified manufacturer.

Command format:

syrm [? | {3 char code} ? | {volume} ul | ml]

Query response:

<lf>[##:] {manufacturer}, {diameter} mm<cr>

<lf>[##]<prompt>

or:

<lf>[##:] Custom, {diameter} mm<cr>

<lf>[##]<prompt>

or:

<lf>[##:] {code}, {diameter} mm<cr> (this line is repeated for each syringe manufacturer)

<lf>[##]<prompt>

or:

<lf>[##:] {volume}, {unit}<cr> (this line is repeated for each syringe size)

<lf>[##]<prompt>

VER

Displays the short version string.

Command format:

ver

Query response:

<lf>[##:] 11 Elite #.#.#.#<cr>

<lf>[##]<prompt>

VERSION

Displays the full version string.

Command format:

version

Query response:

<lf>[##:]Firmware: v#.#.#.#<cr>

<lf>[##:]Pump address: #<cr>

<lf>[##:]Serial number: C######<cr>

<lf>[##:]Device ID: ########<cr>

<lf>[##]<prompt>

Run commands

IRUN

Runs the pump in the infuse direction. Quick Start mode only.

Command format:

irun

RRUN

Runs the pump in the opposite direction. Quick Start mode only.

Command format:

rrun

RUN

Simulates a key press of the run button located in the lower right corner of the screen.

Command format:

run

STOP / STP

Stops the pump.

Command format:

stop

stp

WRUN

Runs the pump in the withdraw direction. Quick Start mode only.

Command format:

wrun

Rate commands

CRATE

Displays the current rate that the motor is running at. A valid response is returned only in dynamic situations (while the pump is running). Quick Start mode only.

Command format:

crate

Query response:

<lf>[##:]Infusing at # xl/xxx<cr>

<lf>[##]<prompt>

or:

<lf>[##:]Withdrawing at # xl/xxx<cr>

<lf>[##]<prompt>

DIAMETER

Sets or displays the syringe diameter in mm. Quick Start mode only.

Command format:

diameter [{syringe diameter}]

Query response:

<lf>[##:]#.#### mm<cr>

<lf>[##]<prompt>

IRAMP

Sets or displays the infusion rates while ramping. Quick Start mode only.

Command format:

iramp [{start rate} {start units} {end rate} {end units} {ramp time in seconds}]

Query response:

<lf>[##:]Ramp not set up.<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# xl/xxx to # xl/xxx in # seconds<cr>

<lf>[##]<prompt>

IRATE

Sets or displays the infusion rate. Quick Start mode only. The rate argument may be replaced by "max" or "min" to set the maximum or minimum rate, respectively. "lim" may be used to display the range limits.

Command format:

irate [max | min | lim | {rate} {rate units}]

Query response:

<lf>[##:]# xl/xxx<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# xl/xxx to # xl/xxx<cr>

<lf>[##]<prompt>

WRAMP

Sets or displays the withdraw rates while ramping. Quick Start mode only.

Command format:

wramp [{start rate} {start units} {end rate} {end units} {ramp time in seconds}]

Query response:

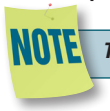
<lf>[##:]Ramp not set up.<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# xl/xxx to # xl/xxx in # seconds<cr>

<lf>[##]<prompt>



To clear a ramp, use CTTIME command.

WRATE

Sets or displays the withdraw rate. Quick Start mode only. The rate argument may be replaced by "max" or "min" to set the maximum or minimum rate, respectively. "lim" may be used to display the range limits.

Command format:

wrate [max | min | lim | {rate} {rate units}]

Query response:

<lf>[##:]# xl/xxx<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# xl/xxx to # xl/xxx<cr>

<lf>[##]<prompt>

For commands requiring rate units, use the following format: m, u, n, p/h, m, s. ex: m/m = milliliter/minutes ex: n/s = nanoliter/second

Volume commands

CIVOLUME

Clears the infused volume. Quick Start mode only.

Command format:

civolume

CTVOLUME

Clears the target volume. Quick Start mode only.

Command format:

ctvolume

CVOLUME

Clears both the infused and withdrawn volumes. Quick Start mode only.

Command format:

cvolume

CWVOLUME

Clears the withdrawn volume. Quick Start mode only.

Command format:

cwvolume

IVOLUME

Displays the infused volume. Quick Start mode only.

Command format:

ivolume

Query response:

<lf>[##:]# xl<cr>

<lf>[##]<prompt>

SVOLUME

Sets or displays syringe volume. Quick Start mode only.

Command format:

svolume

Query response:

<lf>[##:]#.#### ul<cr>

<lf>[##]<prompt>

or:

<lf>[##:]#.#### ml<cr>

<lf>[##]<prompt>

TVOLUME

Sets or displays the target volume. Quick Start mode only.

Command format:

tvolume [{target volume} {volume units}]

Query response:

<lf>[##:]Target volume not set<cr>

<lf>[##]<prompt>

or:

<lf>[##:] # xl<cr>

<lf>[##]<prompt>

WVOLUME

Displays the withdrawn volume. Quick Start mode only.

Command format:

wvolume

Query response:

<lf>[##:]# xl<cr>

<lf>[##]<prompt>

Time commands

CITIME

Clears the infused time. Quick Start mode only.

Command format:

citime

CTIME

Clears both the infused and withdrawn times. Quick Start mode only.

Command format:

ctime

CTTIME

Clears the target time. Quick Start mode only.

Command format:

cttime

CWTIME

Clears the withdrawn time. Quick Start mode only.

Command format:

cwtime

ITIME

Displays the infused time. Quick Start mode only.

Command format:

itime

Query response:

<lf>[##:]# seconds<cr>

<lf>[##]<prompt>

or:

<lf>[##:]##:##:##<cr>

<lf>[##]<prompt>

TTIME

Sets or displays the target time. Quick Start mode only.

Command format:

ttime [{target time}]

Query response:

<lf>[##:]Target time not set<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# seconds<cr>

<lf>[##]<prompt>

or:

<lf>[##:]##:##:##<cr>

<lf>[##]<prompt>

WTIME

Displays the withdrawn time. Quick Start mode only.

Command format:

wtime

Query response:

<lf>[##:]# seconds<cr>

<lf>[##]<prompt>

or:

<lf>[##:]##:##:##<cr>

<lf>[##]<prompt>

Digital I/O commands

INPUT

Reads and displays the trigger input port status.

Command format:

input

Query response:

<lf>[##:] Low.<cr>

<lf>[##]<prompt>

or:

<lf>[##:] High.<cr>

<lf>[##]<prompt>

OUTPUT

Sets the level on the output port.

Command format:

output {1} {high I low}

Internal commands

STATUS

Displays the raw status for use with a controlling computer.

Command format:

status

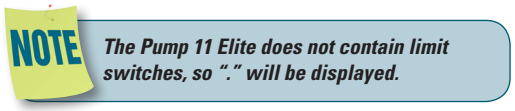
Serial Command Notes

The output is in three integer fields and one flag field, all separated by spaces and terminated by a carriage return/linefeed pair. The first integer is the current rate in femtoliters per second. The second integer is the infuse time in milliseconds. The time has a granularity of 1 millisecond. The third integer is the infused volume in femtoliters. All three values are for the current direction.

The flag field consists of six flags.

Flag one is the motor direction and will be "i or I" if the pump is infusing and "w or W" if the pump is withdrawing. If the letter is lower case, the pump motor is idle. If upper case, the pump motor is running.

Flag two is the limit switch status. If the infuse limit switch was hit, "i or I" is displayed. If the withdraw limit switch was hit, "w or W" is displayed. If no limit switch was hit or the pump does not have limit switches, "." is displayed.



Flag three is the stall status and will be "S" if the pump has stalled. Otherwise it will be ".".

Flag four is the trigger input state and will be "T" if high and "." if low.

Flag five is the direction port state and will be "i or I" for infuse and "w or W" for withdraw.

Flag six is the target reached status. It will be "T" if the target time or volume was reached and "." if not.