Serial Interface Specification

for the

Torrey Pines Scientific
HS50-60 Series Hotplates

Revision C

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About this Specification

This document describes the operation of the serial interface port on the Torrey Pines Scientific HS-50 and HS-60 Series Hotplates. The serial interface is used to read and set values, such as the temperature or stirrer speed, from a computer.

The specification is intended for expert software programmers who wish to write low-level drivers for the hotplate.

Note-Different features are available in different models within the HS-50 and HS-60 Series of Hotplates. Commands that are not available in a specific model are noted where appropriate within this specification.

Manual Conventions

<CR>
The notation "<CR> " refers to the ASCII character for "carriage return" which is decimal 13 or hex D. Every valid RHB20 command must be terminated by this character. In HyperTerminal the character is sent when the "enter" key is pressed. Programs written in C for example, typically send this character when "\r" is appended to the transmitted command string.

Hardware Description

The serial interface port uses standard RS-232 voltage levels and utilizes three wires: one for data from the computer to the hotplate, one for data from the hotplate to the computer, and ground.

Signal	9-Pin Serial Port
Data from Hotplate to Computer	Pin 2
Data from Computer to Hotplate	Pin 3
Ground	Pin 5

Pinout and Cable Wiring

A standard straight through serial cable may be used to connect the hotplate to the computer.

Note-The term "straight through" is intended to point out that the Pins 2 and 3 on the connector on one end of the cable are connected to Pins 2 and 3 on the connector on the opposite end of the cable. Some standard serial cable options such as the "null modem" configuration have the Pin 2 and Pin 3 connections swapped between the connectors on the cable. If you purchase or make your own cable, verify that the Pins 2,3, and 5 on the connector one side of the cable are connected to Pins 2,3, and 5 on the connector on the opposite end of the cable.

COM Settings

The transmission of the data bytes on the serial interface is:

- 9600 baud
- 1 stop bit
- no parity
- no hardware handshake

Communication Syntax

Data is sent to and from the hotplate in ASCII character strings. Data exchange is always initiated by the computer. The computer sends a character string to the hotplate and the hotplate sends a string back to the computer in response. A response is always generated by the hotplate when it receives a carriage return.

Command String: <Command> <Data> <CR>

Response String: <Data> <CR>

The command defines whether and what type of data is required in both the command and response strings.

Each string is terminated by a carriage return character. Characters may be sent to the hotplate with any amount of delay between characters. The characters are accumulated into a buffer and held until the carriage return character is received. Once the hotplate receives the carriage return character in a command string, it responds immediately. Character strings are sent from the hotplate with no or little delay between the characters.

Note - no handshaking signals are used. Synchronization of the computer and the hotplate is accomplished through the command/response sequence only.

Note - be sure not to send the hotplate extra characters, such as linefeeds, or subsequent commands may be misinterpreted.

Command Summary Table

Command	Function	Parameter Limits	Example		X=Command not Available in this Model							
			sent	response	HP50	HS50	HS55	HP60	HS60	HP61	HS61	HS65
v	Get Model and Version		v<CR>	HS65 v2.06<CR>								
a	Get Plate Temperature		a<CR>	123<CR>								
b	Get Probe Temperature		b<CR>	123<CR>								
c	Get Timer		c<CR>	000512<CR>								
d	Get Ramp		d<CR>	100<CR>	**X**	**X**	**X**					
e	Get Target Temperature		e<CR>	123<CR>								
f	Get Probe Status		f<CR>	1<CR>								
g **g**n	Get Stirrer Speed (single) (multi-stirrer)		g<CR> g3<CR>	50<CR>	**X**			**X**		**X**		
h	Get Temperature Units		h<CR>	C<CR>								
i	Get Auto Off Mode		i<CR>	0<CR>								
Chhmmss	Set Timer	MIN: 000000 MAX: 995959	C000530<CR>	Command OK<CR>								
Dv	Set Ramp	MIN: 0 MAX: 450 deg/hr	D100<CR>	Command OK<CR>	**X**	**X**	**X**					
Ev	Set Target Temperature	MIN: 0 MAX: Alum: 400C/752F Ceramic: 450C/842F	E250<CR>	Command OK<CR>								
Gv **G**n,v	Set Stirrer Speed (single) (multi-stirrer)	MIN: 50 rpm MAX: 1500 rpm	G50<CR> G3,50<CR>	Command OK<CR>	**X**			**X**				
Hv	Set Temperature Units	F=Fahrenheit C=Celsius	HC<CR>	Command OK<CR>								
Iv	Set Auto Off Mode	1=enabled 0=disabled	I0<CR>	Command OK<CR>								
J **J**n	Set Stirrer Off (single) (multi-stirrer)	n=1 to 5	J<CR> J3<CR>	Command OK<CR>	**X**			**X**		**X**		
K	Set Heater Off		K<CR>	Command OK<CR>								

Command Descriptions

Command: v
Function: **Get Hotplate Model and Version**
Description: When the command v<CR> is received by the Hotplate unit, the model number and the firmware version will be returned in a text string terminated by <CR>. If the command is not received in the proper syntax, the string “Command Failed”<CR> will be returned.

Example: Verify that the unit connected is model HS65 with firmware rev v2.06
sent: v<CR>
returned: HS65 v2.06<CR>

Command: a
Function: **Get Plate Temperature**
Description: When the command a<CR> is received by the hotplate, the current plate temperature will be returned in a text string terminated by <CR>. The returned string will represent the temperature value in degrees Celsius or Fahrenheit depending on the currently set units (see commands h/H “Get/Set Temperature Units”). If the command is not received in the proper syntax, the string “Command Failed”<CR> will be returned.

Example: Determine that the current plate temperature is 123 degrees
sent: a<CR>
returned: 123<CR>

Command: b
Function: **Get Probe Temperature**
Description: When the command b<CR> is received by the hotplate, the current probe temperature will be returned in a text string terminated by <CR>. The returned string will represent the temperature value in degrees Celsius or Fahrenheit depending on the currently set units (see commands h/H “Get/Set Temperature Units”). If an external probe is not plugged in or is not functioning properly, ---<CR> will be returned (3 dash characters followed by a carriage return). If the command is not received in the proper syntax, the string “Command Failed”<CR> will be returned.

Example: Determine that the current probe temperature is 123 degrees
sent: b<CR>
returned: 123<CR>
returned: ---<CR> (if external probe is not present or damaged)

Command: c
Function: **Get Timer**
Description: When the command c<CR> is received by the hotplate, the current value of the countdown timer will be returned in a text string terminated by <CR>. The format of the returned timer string is 6 characters in the following order: hhmmss (2 characters for hours, 2 characters for minutes, and 2 characters for seconds). The timer counts down after every second from the initial value until it reaches zero (see command C "Set Timer"). When the timer value reaches zero, the hotplate unit will emit an audible alarm consisting of a short beep every second for 5 seconds. Additionally when the timer value reaches zero the hotplate heater may or may not turn off depending on the current "Auto Off" setting (see commands i/I "Get/Set Auto Off"). If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Determine that time remaining is 5 minutes, 12 seconds
sent: c<CR>
returned: 000512<CR>

Command: Cv v=hhmmss
hh max = 99 hours, mm max = 59 minutes, ss max = 59 seconds
Function: **Set Timer**
Description: When the command Cv<CR> is received by the hotplate, the starting value of the countdown timer will be set to the value of "v", and the timer will begin decrementing. The format of the timer string "v" is 6 characters in the following order: hhmmss (2 characters for hours, 2 characters for minutes, and 2 characters for seconds). The timer counts down after every second from the initial value until it reaches zero. The current timer value may be determined by sending the "Get Timer" command (ref: Command c). When the timer value reaches zero, the hotplate unit will emit an audible alarm consisting of a short beep every second for 5 seconds. Additionally when the timer value reaches zero the hotplate heater may or may not turn off depending on the current "Auto Off" setting (see commands i/I "Get/Set Auto Off"). To stop a running timer, send the string "C000000"<CR>. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Examples: Set countdown timer to start at 5 minutes, 30 seconds
sent: C000530<CR>
returned: Command OK<CR>

Examples: Stop timer
sent: C000000<CR>
returned: Command OK<CR>

Command: d (not available on HP-50, HS-50, HS-55)
Function: **Get Ramp**
Description: When the command d<CR> is received by the hotplate, the current value of the heating ramp will be returned. The returned ramp value units are degrees Celsius or Fahrenheit per hour depending on the currently set units (see commands h/H "Get/Set Temperature Units"). If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Verify that ramp value is set to 100 degrees/hour
sent: d<CR>
returned: 100<CR

Command: Dv (not available on HP-50, HS-50, HS-55)
v min = 0, v max = 450 deg C per hour
Function: **Set Ramp**
Description: When the command Dv<CR> is received by the hotplate, the value of the temperature rise ramp be set to the value of "v". The ramp units are degrees Celsius or Fahrenheit per hour depending on the currently set units (see commands h/H "Get/Set Temperature Units"). If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Set heating ramp value to 50 degrees/hour
sent: Dv50<CR>
returned: Command OK<CR>

Command: e
Function: **Get Target Temperature**
Description: When the command e<CR> is received by the hotplate, the current target temperature will be returned in a text string terminated by <CR>. The returned string will represent the temperature value in degrees Celsius or Fahrenheit depending on the currently set units (see commands h/H "Get/Set Temperature Units"). If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Verify that target temperature/setpoint is set to 123 degrees
sent: e<CR>
returned: 123<CR>

Command: Ev

v max = 400 deg C (752 deg F) Aluminum Hotplate
v max = 450 deg C (842 deg F) Ceramic Hotplate

v min = 0 deg C (32 deg F)

Function: **Set Target Temperature**
Description: : When the command Ev<CR> is received by the hotplate, the value of the target temperature (setpoint) be set to the value of "v". The units are degrees Celsius or Fahrenheit depending on the currently set units (see commands h/H "Get/Set Temperature Units"). If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Set target temperature/setpoint to 150 degrees
sent: E150<CR>
returned: Command OK<CR>

Command: f
Function: **Get Probe Status**
Description: When the command f<CR> is received by the hotplate, the status of the external probe will be returned as a single text character terminated by <CR>. If an external probe is connected and functioning properly, the text character "1" will be returned. If no external probe is connected or if the probe is connected but not functioning properly, the text char "0" will be returned. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Verify that external probe is connected and functioning properly
sent: f<CR>
returned: 1<CR>

Command: g (Models HS-50, HS-60, and HS-61 only)
gn n=1,2,3,4, or 5 (Models HS-55 and HS-65 only)
Function: **Get Stirrer Speed** (not available on HP-50, HP-60, HP-61)
Description: For single stirrer models, the command g<CR> returns the current speed setting (rpm) for the stirrer motor as a text string terminated by <CR>. For multiple stirrer models, the command gn<CR> returns the current speed setting (rpm) for stirrer motor number "n" as a text string terminated by <CR>. The decimal value of "n" may be 1,2,3,4, or 5 corresponding to stirrer motor positions 1 through 5. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Single stirrer model, verify that stirrer is set for 50 rpm

sent: g<CR>
returned: 50<CR>

Example: Multiple stirrer model, verify that stirrer position 3 is set for 50 rpm
sent: g3<CR>
returned: 50<CR>

Command: **G**v (Models HS-50, HS-60, and HS-61 only)
Gn,v n=1,2,3,4, or 5 (Models HS-55 and HS-65 only)
v max= 1500 rpm
v min = 50 rpm
Function: **Set Stirrer Speed** (not available on HP-50, HP-60, HP-61)
Description: For single stirrer models, the command Gv<CR> sets the current speed setting to the value "v" in units of rpm. For multiple stirrer models, the command Gn,v<CR> sets the current speed setting for stirrer motor number "n" to the value "v" in units of rpm. The decimal value of "n" may be 1,2,3,4, or 5 corresponding to stirrer motor positions 1 through 5. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Single stirrer model, set stirrer motor to 50 rpm
sent: G50<CR>
returned: Command OK<CR>

Example: Multiple stirrer model, set stirrer motor position 3 to 50 rpm
sent: G3,50<CR>
returned: Command OK<CR>

Command: h
Function: **Get Temperature Units**
Description: When the command h<CR> is received by the hotplate, the setting for the current temperature units will be returned as a single text character terminated by <CR>. If the unit is set to display temperatures in Celsius, the text character "C" will be returned. If the unit is set to display temperatures in Fahrenheit, the text character "F" will be returned. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Verify unit is set to display temperature in Celcius
sent: h<CR>
returned: C<CR>

Command: Hv v=C for Celcius, v=F for Fahrenheit
Function: **Set Temperature Units**
Description: When the command Hv<CR> is received by the hotplate, the setting for the current temperature units will be set to the value v. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Set unit to display temperature in Fahrenheit
sent: HF<CR>
returned: Command OK<CR>

Command: i
Function: **Get Auto Off Mode**
Description: The Auto Off feature enables the hotplate heater and all stirrers to be turned off after the running countdown timer has reached zero (ref: c/C "Get/Set Timer" commands). When the command i<CR> is received by the hotplate, the setting for the Auto Off feature will be returned as a single text character terminated by <CR>. If the Auto Off feature is set, the text character "1" will be returned. If the Auto Off feature is not set, the text character "0" will be returned. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Verify that the unit is not set to Auto Off Mode
sent: i<CR>
returned: 0<CR>

Command: Iv (uppercase i) v=1 (enable) , v=0 (disable)
Function: **Set Auto Off Mode**
Description: The Auto Off feature enables the hotplate heater and all stirrers to be turned off after the running countdown timer has reached zero (ref: c/C "Get/Set Timer" commands). When the command Iv<CR> is received by the hotplate, the Auto Off feature will be set to v. When v=1, the feature is enabled and the heater and all stirrers will turn off when the countdown timer reaches zero. When v=0, the heater will maintain the current target temperature after the countdown timer reaches zero. If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Set the unit to Auto Off Mode
sent: I1<CR>
returned: Command OK<CR>

Command: **J** (Models HS-50, HS-60, and HS-61 only)
Jn n=1,2,3,4, or 5 (Models HS-55 and HS-65 only)
Function: **Set Stirrer Off** (not available on HP-50, HP-60, HP-61)
Description: For single stirrer models, the command J<CR> turns off the stirrer motor. For multiple stirrer models, the command Jn<CR> turns off stirrer motor number "n". If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Single stirrer model, turn off stirrer motor
sent: J<CR>
returned: Command OK<CR>

Example: Multiple stirrer model, turn off stirrer motor position 3
sent: J3<CR>
returned: Command OK<CR>

Command: K
Function: **Set Heater Off**
Description: The command K<CR> turns off the plate heater. The hotplate unit does not power down and the target temperature will be set to zero. To turn the plate heater back on, set the unit to a target temperature (ref: cmd E "Set Target Temperature"). If the command is not received in the proper syntax, the string "Command Failed"<CR> will be returned.

Example: Turn off the heater plate
sent: K<CR>
returned: Command OK<CR>