

SECTION FIVE: REMOTE CONTROL

Remote Analog Control

The Remote Analog control allows control of the laser through discrete analog and digital circuitry. All of the Remote Analog controls are located in the J10 "Analog Interface" Connector on the CDRH controller LP rear panel. The connector is a standard 25 pin DB-25S female connector with one pin blocked. The functions on this connector are:

Table 5-1. Pin-Out for External Analog Interface Connector (DB 25S Female)

SETTING	PIN	DESCRIPTION
Interlock	Pin 1 (+) & Pin 3 (-)	<15 VDC, 12.5 mA typ. Connect Pins for laser on (disabled by DIP Switch SW3-1 in on position), Can be used for laser warning light (LED)
ON/OFF Control	Pin 2	Turns ON/OFF TEC and Laser PIN 2 to Ground : Off PIN 2 no connection : On If Autostart mode is disabled an OFF to ON reset at Pin 2 is required to turn on TEC and Laser.
Standby/Run Mode Control	Pin 4	PIN 4 to Ground : Standby PIN 4 no connection : Run Mode
Spare Digital Input	Pin 5	Digital input TBD
Spare Analog Input	Pin 6	TBD
Laser Output Power Control	Pin 7	Analog input 0 V to +2.048 V, 7 bit resolution: 10% to 110% power; minimum power if no connection. 10 Kohm input impedance enabled by Pin 18
Power Monitor	Pin 8	Analog output 10 mA max, 10 mW/V
LD Current Monitor	Pin 9	Analog signal, 1 V for 1000 mA laser diode current, max. 10 mA
Signal/Power Return	Pin 10, 11, 14, 20, 21, 22, 24	Ground (return) for all signals and power
N/A	Pin 12	Not connected
DC Output	Pin 13	+12 VDC, 20 mA max. (Output comes directly from DC supply)
Base Temp Monitor	Pin 15	Analog output temperature monitor signal (0 V to 4.096 V for 0°C to 100°C)

Table 5-1. Pin-Out for External Analog Interface Connector (DB 25S Female) (Continued)

SETTING	PIN	DESCRIPTION
Laser Ready	Pin 16	TTL Logic, High when Output Power is Set Power ± 1 mW
Not Used (Key inserted)	Pin 17	Keying plug installed. PIN must be removed from the mating connector at his location.
Analog Interface Enable	Pin 18	Enables Laser Control from Pin 2, 4, 7 PIN 18 to Ground : enabled PIN 18 no connection : disabled
Spare Digital Output	Pin 19	TBD
Fault Output	Pin 23	TTL logic output, high when laser is in a fault mode
Chassis Ground	Pin 25	Connects to connector shell, and mounting holes on OEM Controller LP PCB only

The circuit figure below explains the control of the laser diode (LD) and TEC function using PIN 2 and PIN 4.

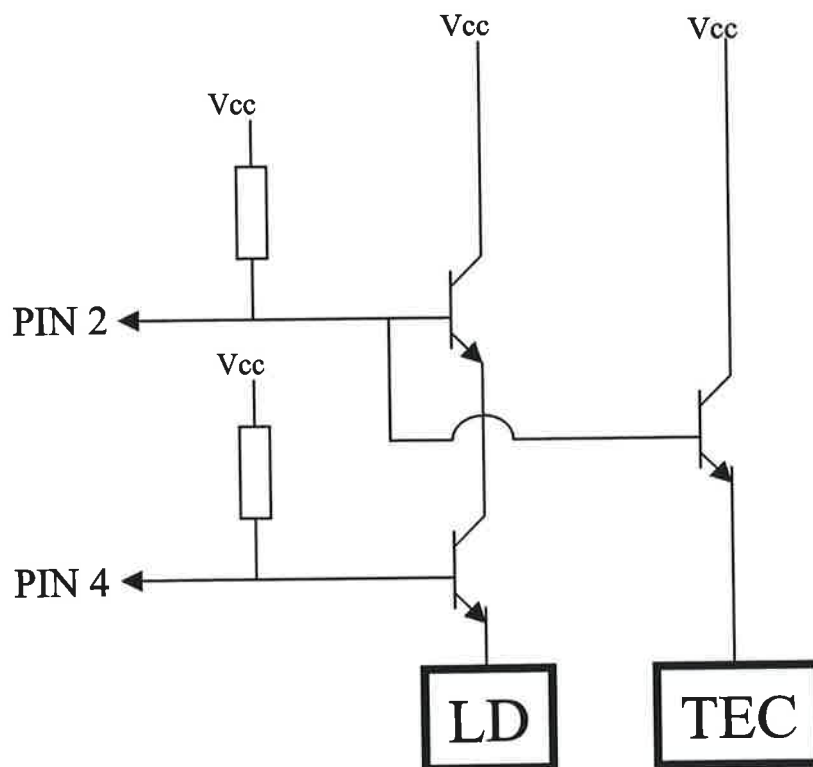


Figure 5-1. Sapphire Standby-ON-OFF

Remote RS-232 Control

The Remote RS-232 control allows control of the laser through digital communication with the microprocessor within the laser CDRH controller LP. The RS-232 interface is located in the J20 "RS-232" Connector on the CDRH controller LP rear panel. The connector is a standard 9 pin DE-9S female connector. The functions on this connector are:

Table 5-2. Remote RS-232 Control

SETTING	PIN	DESCRIPTION
DCD	Pin 1	No connection
TXD	Pin 2	RS-232 transmitter in Laser System
RXD	Pin 3	RS-232 receiver in Laser System
DTR	Pin 4	Connected to DSR
GND	Pin 5	Signal Ground
DSR	Pin 6	Connected to DTR
RTS	Pin 7	Connected to CTS
CTS	Pin 8	Connected to RTS
RI	Pin 9	No connection

The RS-232 communication parameters are:

- 19,200 Baud
- 8 data bits
- 1 stop bit
- No parity
- No flow control

These parameters cannot be changed.

A cable with straight through connections (i.e., pin 1 connects to pin 1, pin 2 connects to pin 2, etc.) will allow communication with the 9-pin RS-232 connector on most personal computers. The necessary RS-232 interface cable is included in the delivery volume.

Hints For Software Integration

The Sapphire firmware supports a local echo as a default setting. That means the controller LP directly returns each character you sent. The local echo can be switched off using the "E" command.

The "Sapphire" system prompt can also be switched off using the ">" command.

It might be easier to switch off the local echo and the system prompt for a proper handling in your own software.

Don't send more than one command after another. After the response you can directly send the next command or query.

A command will be answered by a CR LF (carriage return/line feed). If the command is wrong an additional error message string will be sent.

A query will be answered always by CR LF and a string. The string can be also an error message.

Warning: Communication faults of the RS-232 are mostly related to defect hardware like cables. In rough electromagnetic interference environments communication faults also can be more likely.

We strongly recommend to program a time-out to prevent potential faults caused by RS-232 communication. A time-out period of 1 second is sufficient. After such an event send a CR LF to clear the controller LP buffer.

To handle temperature faults etc. use the "?FL" or the "?FF" query repeatedly.

RS-232 Commands and Queries

Most commands follow the format “**command**=<value>” and the queries follow “**?query**” format unless otherwise specified.

Table 5-3. RS-232 Commands and Queries

“>”	Type: Query and Command This command turns on or off the command prompt. 1=ON 0=OFF
“BT”	Type: Query Read the BasePlate temperature. Value returned is in °C (degrees centigrade).
“C”	Type: Query Read laser diode current. Returns the value of measured current in Amps. To read back set current value, use “?sc” command.
“CLS”	Type: Command Clears text from a serial communication screen (only when VT100 emulation is being used)
“DST”	Type: Query Read Diode Set temperature in the system. This is a value in °C (degrees centigrade).
“DT”	Type: Query Returns the value of measured temperature in degrees centigrade. To read back set diode temperature value, use “?dst” command.
“E”	Type: Query and Command Sets or reads Echo Off feature. This feature turns on or off character echo on serial communication terminal. This feature is useful if a computer script/program rather than a person was controlling the laser. 1=ON 0=OFF
“F”	Type: Query This command checks for faults in the system and if there is one, it returns that fault number. If there are multiple faults present in the system, it returns the first fault detected from a list of faults. See “?FL” or “?FF” queries for different ways to receive fault status.

Table 5-3. RS-232 Commands and Queries (Continued)

"FF"	<p>Type: Query</p> <p>This command checks for faults in the system and if there is one, it returns a two-byte result in following format:</p> <p>MSB: 15 Not Implemented 14 Not Implemented 13 Not Implemented 12 EEPOT2 fault 11 EEPOT1 fault 10 OEM Controller LP EEPROM fault 9 Head EEPROM fault 8 System Warming/Waiting for TEC servo to reach target temperature. 7 Diode Temperature Fault (only Light servo turned OFF) 6 BasePlate Temperature Fault (only Light servo turned OFF) 5 Analog Interface Fault 4 Diode Current Fault 3 OEM Controller LP Temp. Fault (both TEC and Light servo's turned OFF) 2 BasePlate Temperature Fault (both TEC and Light servo's turned OFF) 1 Diode Temperature Fault (both TEC and Light servo's turned OFF) LSB: 0 External Interlock Fault</p>
"FL"	<p>Type: Query</p> <p>This command checks for faults in the system and if there is one, it returns a list of all faults present. If there is no fault in the system, it says "system ok". This command shows faults in text rather than in number(s). See "?F" or "?FF" queries for different ways to receive fault status.</p> <p>Fault List:</p> <p>0 System OK (No fault) 1 External Interlock Fault 2 Diode Temperature Fault 3 BasePlate Temperature Fault 4 OEM Controller LP Temperature Fault 5 Diode Current Fault (under current or over current) 6 Head EEPROM fault 7 OEM Controller LP EEPROM fault 8 EEpot1 fault 9 EEpot2 fault 10 ADC fault 11 Analog Interface fault</p>
"HH"	<p>Type: Query</p> <p>Returns the usage hours stored in the HEAD EEPROM. The format is "?hh". Head Hours are updated every time there is at least minimum current flowing through the laser diode. See "psh" query to check the Power-Supply usage hours.</p>
"HID"	<p>Type: Query</p> <p>Reads the Head ID. Value is numerical (floating point value).</p>
"K"	<p>Type: Query</p> <p>This command is used to check the status of Key Switch (if implemented) in the hardware.</p>

Table 5-3. RS-232 Commands and Queries (Continued)

“L”	<p>Type: Query and Command</p> <p>This command is used to Read or Set the Light Servo status. Setting L=1 will close the Light Servo, enabling automatic servo regulation. TEC servo MUST be ON (T=1, automatic TEC servo regulation) to set L=1. Setting L=0 will set Light Servo to an OPEN state, disabling automatic servo regulation. L=0 will also turn off the Laser output. A query of this command (?L) will return status of the Light Servo.</p>
“P”	<p>Type: Query and Command</p> <p>This Command/Query sets or reads Laser Power. Light Servo MUST be enabled (L=1) to get a laser output using this command. A query returns the read power level of OPS unit. Value is numerical, in floating-points.</p>
“PI”	<p>Type: Query</p> <p>Read Power-In value from the Analog Interface connector. The value returned is in A-to-D counts (12 bit value).</p>
“PID”	<p>Type: Query</p> <p>Reads the Power-Supply ID. Read value is numerical (floating point value).</p>
“PSH”	<p>Type: Query</p> <p>Returns the usage hours stored in the OEM Controller LP EEPROM. The format is “?psh”. This value represents the on-time of Sapphire unit. This value starts updating every time Sapphire unit is turned on. See “hh” query to check the Head usage hours.</p>
“PST”	<p>Type: Query</p> <p>Controller temperature readout is currently not available.</p>
“SVPS”	<p>Type: Query</p> <p>This query is used to read the software version stored in the Power-Supply EEPROM. Read value is numerical, in floating point.</p>
“T”	<p>Type: Query and Command</p> <p>This command is used to Read or Set the TEC Servo status. Setting T=1 will the TEC Servo, enabling automatic servo regulation. Setting T=0 will set the TEC Servo to an OPEN state, disabling automatic servo regulation. T=0 will also turn off the Laser output. A query of this command (?T) will return status of the TEC Servo.</p>