Serial API Guide

SLICE-DLC Dual Laser Controller

Revision 02

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1. Purpose

This document describes the Application Programming Interface (API) for controlling and communicating with the Vescent SLICE-DLC USB interface. This document provides command formats, parameter types, and functional descriptions of API commands.

2. Scope

This document applies to USB communication with SLICE-DLC. This API is compatible with the software configuration listed below.

SC Firmware: SC 1.228

DC Firmware: 1.26

QTC Firmware: QT 2.68

3. Serial Configuration

Communication with the SLICE-DLC via the rear panel USB interface is performed by using ASCII-based serial commands issued from an external computer via PC terminal programs such as Putty or Tera Term. Serial port settings should be as follows:

Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

A Baud Rate between 9600 and 115200 is recommended for initial setup and troubleshooting.

4. Command Structure

The USB API uses ASCII-based commands with the following format:

[command name] [parameter] [parameter] [parameter]

The command name string is followed by 0 to 3 space-delimited parameter strings. Command names are case-insensitive. Commands must be terminated with a Carriage Return character.

5. SLICE-DLC Control Boards

The SLICE-DLC has three control boards. A system control board oversees the operation of the temperature control board and the laser current control board.

The current control board has two channels. Current control board channels 1 and 2 correspond to the same channels in the Graphical User Interface (GUI).

The temperature control board has four numbered channels. The relationship between the temperature board channel numbers and the GUI channels is listed in the following table.

Temperature Board Channel	GUI Channel
1	Channel 1 Case
2	Channel 1 Laser
3	Channel 2 Case
4	Channel 2 Laser

6. SLICE-DLC Command List

Temperature control board commands have a leading ‘T’, current control board commands have a leading ‘C’, and, in most cases, system control commands start with other characters.

Commands are categorized by the functional groups listed below. In sections with both temperature and current control board commands the temperature control commands are listed first, followed by current control commands.

Functional Groups

Global SLICE Commands

#SCBKLT?	Returns the touch screen backlight setting
Parameters: None	*Example:* #SCBKLT? #SCBKLT? 5
#SCBKLT	Sets the touch screen backlight setting to the level given as a parameter
Parameters: [INT] level (0 – 20)	*Example:* #SCBKLT 3 #SCBKLT 3
#SCVOL?	Returns the touch screen and rotary knob audio feedback volume level
Parameters: None	*Example:* #SCVOL? #SCVOL? 5
#SCVOL	Sets the touch screen and rotary knob audio feedback volume to the level given as a parameter
Parameters: [INT] level (0 – 20)	*Example:* #SCVOL 8 #SCVOL 8
***RST**	SCPI Compatible Device Reset Command Restarts the device in an OFF state
Parameters: [none]	*Example:* *RST Resetting System
***IDN?**	SCPI Compatible Device Information Query Returns: Manufacturer Model Serial Number System Controller Firmware version ICE2 Board Firmware Versions (2 in this case)
Parameters: [none]	*Example:* *IDN? Vescent Photonics,SLICE-DLC-200,006543,S-V1.226,DC-V1.24,QTC-V2.67

System-Level Control Commands

These are the primary commands that should be used for turning on and off the temperature controllers and current controllers of the SLICE-DLC. Using these commands ensures that laser diodes are properly temperature controlled before allowing the current supply to turn on, among other safety features that help protect the hardware.

Users should stick to these commands for turning the lasers on and off, rather than interfacing with the temperature and current controllers directly using the commands listed later in the document.

CTCMODE?	Returns the enumerated Temperature Control mode for the DLC Channel Where: 0 = None 1 = Laser Only 2 = Laser + Case
Parameters: [Int] Channel	*Example:* CTCMODE? 1 2
CTCMODE	Sets the enumerated Temperature Control mode for the DLC Channel Where: 0 = None 1 = Laser Only 2 = Laser + Case
Parameters: [Int] Channel [Int] Mode	*Example:* CTCMODE 1 1 1
MSTRCTL?	Returns the enumerated operating mode of the DLC Channel Where: 0 = OFF 1 = STANDBY 2 = LASER ON
Parameters: [Int] Channel	*Example:* MSTRCTL? 1 MSTRCTL? 0

MSTRCTL	Sets the operating mode of the DLC Channel Returns the enumerated operating mode of the DLC Channel Where: 0 = OFF 1 = STANDBY (Temperature Control Enabled) 2 = LASER ON Returns MSTRCTL? [channel] Note: The transition to Lasers On can only be made from Standby after enabled temperature controls are stabilized at their setpoint(s) unless Temp Control is set to None. (See CTCMODE? / CTCMODE commands below)

Parameters:
`[Int] Channel`
`[Int] Mode`
	Example:
	`MSTRCTL 1 1`
	`MSTRCTL 1`

Memory Commands

T_FACTORY	Tells the temperature control board to restore and save factory default settings. Causes the device to restart with new settings.
Parameters: [Int] Any number	*Example:* T_FACTORY 1 Success
TSAVE	Saves the temperature control board's current settings into EEPROM. Unsaved changes will be lost when the board is powered off. Returns SUCCESS or FAIL.
Parameters: None	*Example:* TSAVE Success
C_FACTORY	Tells the current control board to restore and save factory default settings. Causes the device to restart with new settings.
Parameters: [Int] Any number	*Example:* C_FACTORY 1 Success
CSAVE	Saves the current control board's current settings into EEPROM. Unsaved changes will be lost when the board is powered off. Returns SUCCESS or FAIL.
Parameters: None	*Example:* CSAVE Success

Temperature Controller General Commands

TTempSet?	Returns the temperature setpoint for a Temperature Control Channel. Value is in °C
Parameters: [Int] CHANNEL	*Example:* TTempSet? 3 26.280000
TTempSet	Sets the temperature setpoint °C for a temperature control channel to TEMP. Returns output from TempSet?. *Note: temperature setpoint cannot be set outside of the bounds of the minimum and maximum temperature. If TEMP is outside that range, temperature setpoint will be set to the range limit it was attempting to exceed. The temperature returned will be displayed to 6 decimal digits and may be slightly different from the TEMP parameter due to hardware limitations on what can be represented by the temperature control DAC.*
Parameters: [Int] CHANNEL [Float] TEMP	*Example:* TTempset 3 26.28 26.280001
TBipolar?	Returns whether the temperature loop for channel CHANNEL is bipolar.
Parameters: [Int] CHANNEL	*Example:* TBipolar? 3 On
TBipolar	Sets the temperature loop for channel CHANNEL bipolar (heating only) on or off. Turn Bipolar off when driving resistive heaters. Returns output from TBipolar? STATE parameter 1 = ON 0 = OFF
Parameters: [Int] CHANNEL [INT] STATE	*Example:* TBipolar 3 1 On
TCONTROL?	Returns the status () and Mode (Manual, Servo, Auto Tune) of the temperature servo loop for CHANNEL. NOTE CONTROL CODES: OFF Manual Mode = 0 OFF Servo Mode = 1 OFF Auto Tune Mode = 2 ON Manual Mode = 3 ON Servo Mode = 4 ON Auto Tune Mode = 5
Parameters: [Int] CHANNEL	*Example:* TCONTROL? 3 1

TCONTROL	Turns the temperature servo loop for CHANNEL on or off. Returns the output of CONTROL? NOTE CONTROL CODES: OFF Manual Mode = 0 OFF Servo Mode = 1 OFF Auto Tune Mode = 2 ON Manual Mode = 3 ON Servo Mode = 4 ON Auto Tune Mode = 5
Parameters: [Int] CHANNEL [Int] CODE	*Example:* TCONTROL 3 4 4
TTEMP?	Returns the current measured temperature for CHANNEL in degrees Celsius.
Parameters: [Int] CHANNEL	*Example:* TTemp? 3 26.999193
TTERROR?	Returns the temperature error ($T_{setpoint} - T_{actual}$) in degrees Celsius.
Parameters: [Int] CHANNEL	*Example:* TError? 3 0.919101
TCURRENT?	Returns the current flowing through TEC (or resistive heater) in Amps.
Parameters: [Int] CHANNEL	*Example:* TCurrent? 3 0.117762
TTEMPMIN?	Returns the minimum temperature for CHANNEL. If the temperature is ever less than MINTEMP while temperature control is in the Servo On mode, the board will disable the temperature loop and freeze the offending temperature on the GUI with a red background. Note: Value returned is the closest value that can be represented with a 32 bit floating point.
Parameters: [Int] CHANNEL	*Example:* TTEMPMIN? 3 -5.000793

TTEMPMIN	Sets the minimum temperature CHANNEL to MINTEMP. Returns TtempMin? Note: You cannot set MINTEMP greater than the temperature setpoint. Attempting to do so will not change the minimum temperature.
Parameters: [Int] CHANNEL [Float] MINTEMP	*Example:* TTEMPMIN 3 -5 -5.000793
TTEMPMAX?	Returns the maximum temperature for CHANNEL. If the temperature is ever greater than MAXTEMP while temperature control is in the Servo On mode, the board will disable the temperature loop and freeze the offending temperature on the GUI with a red background. Note: Value returned is the closest value that can be represented with a 32 bit floating point.
Parameters: [Int] CHANNEL	*Example:* TEMPMAX? 3 49.999847
TTEMPMAX	Sets the maximum temperature CHANNEL to MAXTEMP. Returns TempMax?. Note: You cannot set MAXTEMP less than the temperature setpoint. Attempting to do so will not change the maximum temperature.
Parameters: [Int] CHANNEL [Float] MAXTEMP	*Example:* TTEMPMAX 3 50 49.999847
TTWARN?	Reads the Temperature Control Warning (locked) range [mK] for CHANNEL's temperature error value.
Parameters: [INT] CHANNEL	*Example:* TTWARN? 4 1.000000
TTWARN	Sets the Temperature Control Warning (locked) range [mK] for CHANNEL's temperature error value.
Parameters: [INT] CHANNEL [FLOAT]mK	*Example:* TTWARN 4 0.9 0.900000
TMAXCURR?	Returns the current limit for CHANNEL in Amps
Parameters: [INT] CHANNEL	*Example:* TMAXCURR? 2 2.000000

TMAXCURR	Sets the current limit for CHANNEL in Amps. Returns the result of TMAXCURR? in Amps
Parameters: [INT] CHANNEL [FLOAT] current	*Example:* TMAXCURR 2 3.5 3.500000
TPOWER?	Returns the power output for CHANNEL in watts
Parameters: [INT] CHANNEL	*Example:* TPOWER? 3 0.035269
TMAXPWR?	Returns the power limit in Watts for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TMAXPWR? 1 7.500000
TMAXPWR	Sets the power limit in Watts for CHANNEL Returns TMAXPWR? NOTE: Maximum Power for a channel is limited by the available power for the system – the maximum power allocated for other channels.
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* TMAXPWR 2 7.0 7.000000
TCVOLT?	Returns the absolute voltage [V] across the temperature control load for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TCvolt? 2 0.204979
TCURRSET?	Reads the Temperature Control Manual Mode Current Setpoint [A] for CHANNEL
Parameters: [Int] CHANNEL	*Example:* TCURRSET? 2 0.400000
TCURRSET	Sets the Temperature Control Manual Mode Current Setpoint [A] for CHANNEL Returns TCURRSET?
Parameters: [Int] CHANNEL [Float] SETPOINT	*Example:* TCURRSET 2 0.3 0.300000

TAVLPWR?	Reads the available power [W] for driving all 4 temperature control channels
Parameters: NONE	*Example:* TAVLPWR 37.046055
TTTLPWR?	Reads the total power limits [W] set for driving all 4 temperature control channels
Parameters: NONE	*Example:* TTTLPWR 30.000000
TATPCNCT?	Reads the percentage completion of an Auto Tune Returns 0 when an Auto Tune is complete
Parameters: NONE	*Example:* TATPCNCT? 85
TSFTYTMT?	Reads the shutdown timeout [s] to wait before disabling temperature CHANNEL if temperature exceeds the maximum or minimum temperature limits. Return value is a floating point number with 0.10000s being the lowest value due to timer limitations.
Parameters: [Int] CHANNEL	*Example:* TSFTYTMT? 3 0.100000
TSFTYTMT	Sets the shutdown timeout [s] to wait before disabling temperature CHANNEL if temperature exceeds the maximum or minimum temperature limits. Returns TSFTYTMT?
Parameters: [Int] CHANNEL [Float] SECONDS	*Example:* TSFTYTMT 2 5 5.000000

Temperature Loop Filter Commands

TPGAIN?	Returns the proportional gain for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TPGAIN? 2 6.456254
TPGAIN	Sets the proportional gain for CHANNEL. Returns the result of TPGAIN?
Parameters: [INT] CHANNEL [FLOAT] gain	*Example:* TPGAIN 2 1.8 1.800000
TINTEG?	Returns the integral time constant for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TINTEG? 2 1.223750
TINTEG	Sets the integral time constant for CHANNEL. Returns the result of TINTEG?
Parameters: [INT] CHANNEL [FLOAT] integral time constant	*Example:* TINTEG 2 0.8 0.800000
TDERIV?	Returns the derivative time constant for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TDERIV? 2 0.305937
TDERIV	Sets the derivative time constant for CHANNEL. Returns the result of TDERIV?
Parameters: [INT] CHANNEL [FLOAT] derivative time constant	*Example:* TDERIV 2 0.2 0.200000
TSLEW?	Returns the slew rate for CHANNEL in degrees C per minute
Parameters: [INT] CHANNEL	*Example:* TSLEW? 2 1.500000
TSLEW	Sets the slew rate for CHANNEL in degrees C per minute. Returns the result of TSLEW?
Parameters: [INT] CHANNEL [FLOAT] slew rate	*Example:* TSLEW 2 1.5 1.500000

TPGAINEN?	Returns the enabled/disabled status of the proportional gain factor for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TPGAINEN? 2 On
TPGAINEN	Sets the enabled/disabled status of the proportional gain factor for CHANNEL. Returns the result of TPGAINEN?
Parameters: [INT] CHANNEL [INT] state	*Example:* TPGAINEN 2 0 Off
TINTEGEN?	Returns the enabled/disabled status of the integral time constant factor for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TINTEGEN? 2 On
TINTEGEN	Sets the enabled/disabled status of the integral time constant factor for CHANNEL. Returns the result of TINTEGEN?
Parameters: [INT] CHANNEL [INT] state	*Example:* INTEGEN 2 0 Off
TDERIVEN?	Returns the enabled/disabled status of the derivative time constant factor for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TDERIVEN? 2 On
TDERIVEN	Sets the enabled/disabled status of the derivative time constant factor for CHANNEL. Returns the result of TDERIVEN?
Parameters: [INT] CHANNEL [INT] state	*Example:* TDERIVEN 2 1 On
TSLEWEN?	Returns the enabled/disabled status of the slew rate limiter for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TSLEWEN? 2 On
TSLEWEN	Sets the enabled/disabled status of the slew rate limiter for CHANNEL. Returns the result of TSLEWEN?
Parameters: [INT] CHANNEL [INT] state	*Example:* TSLEWEN 2 1 On

Temperature Thermistor Parameters

TTEMPLUT	Re-calculates the temperature measurement lookup table. Should be run after changing thermistor coefficients. No Return Value
Parameters: NONE	*Example:* `TTEMPLUT`
TPOL?	Returns the output polarity for CHANNEL. On indicates factory default Negative polarity, Off indicates alternative Positive polarity
Parameters: [INT] CHANNEL	*Example:* `TPOL? 1` `On`
TPOLARITY	Sets the output polarity for CHANNEL. State = 1 sets factory default Negative polarity, state = 0 indicates alternative Positive polarity
Parameters: [INT] CHANNEL [INT] state	*Example:* `TPOLARITY 1 1` `On`
TBETA?	Returns the Betatherm Beta thermistor coefficient for CHANNEL
Parameters: [INT] CHANNEL	*Example:* `TBETA? 1` `3450.000000`
TBETA	Sets the Betatherm Beta thermistor coefficient for CHANNEL. Returns TBETA? NOTE: This command triggers a recalculation of Steinhart-Hart A, B, and C coefficients.
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* `TBETA 1 3450` `3450.000000`
TREFTEMP?	Returns the Betatherm Reference temperature C for CHANNEL
Parameters: [INT] CHANNEL	*Example:* `TREFTEMP? 1` `25.000000`
TREFTEMP	Sets the Betatherm Reference temperature C for CHANNEL. Returns TREFTEMP? NOTE: This command triggers a recalculation of Steinhart-Hart A, B, and C coefficients.
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* `TREFTEMP 1 25.0` `25.000000`
TREFRES?	Returns the Betatherm Resistance at the reference temperature C for CHANNEL
Parameters: [INT] CHANNEL	*Example:* `TREFRES? 1` `10000.000000`

TREFRES	Sets the Betatherm Resistance at the reference temperature C for CHANNEL. Returns TREFRES? NOTE: This command triggers a recalculation of Steinhart-Hart A, B, and C coefficients.
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* TREFRES? 1 10000.0 10000.000000
TTCOEFA?	Returns the Steinhart Hart A coefficient for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TTCOEFA? 1 0.000684
TTCOEFA	Sets the Steinhart Hart A coefficient for CHANNEL Returns TTCOEFA?
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* TTCOEFA 1 0.000684 0.000684
TTCOEFB?	Returns the Steinhart Hart B coefficient for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TTCOEFB? 1 0.000290
TTCOEFB	Sets the Steinhart Hart B coefficient for CHANNEL Returns TTCOEFB? NOTE: This command will recalculate the Betatherm Beta value.
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* TTCOEFB 1 0.000290 0.000290
TTCOEFC?	Returns the Steinhart Hart C coefficient for CHANNEL
Parameters: [INT] CHANNEL	*Example:* TTCOEFC? 1 0.000001
TTCOEFC	Sets the Steinhart Hart C coefficient for CHANNEL Returns TTCOEFC?
Parameters: [INT] CHANNEL [FLOAT] value	*Example:* TTCOEFC 1 0.00001 0.000010

Current Controller General Commands

CCONTROL?	Returns the control state of the Laser Current for CHANNEL 0 = Off 1 = On
Parameters: [Int] CHANNEL	*Example:* CCONTROL? 1 0
CCONTROL	Sets the control state of the Laser Current for CHANNEL 0 = Off 1 = On Returns CCONTROL?
Parameters: [Int] CHANNEL [Int] STATE	*Example:* CCONTROL 1 1 1
CCURRSET?	Returns the laser current setpoint [mA] for CHANNEL
Parameters: [Int] CHANNEL	*Example:* CCURRSET? 1 200.0000000
CCURRSET	Sets the setpoint laser current [mA] for CHANNEL Returns CCURRSET?
Parameters: [Int] CHANNEL [FLOAT] CURRENT	*Example:* CCURRSET 2 123.52 123.500000
CCURROFST	Sets an offset [mA] for tuning current output to setpoint.
Parameters: [INT]CHANNEL [FLOAT] OFFSET	*Example:* CCURROFST 2 -0.002 -0.00200
CMAXCURR?	Returns the laser current limit [mA] for CHANNEL
Parameters: [Int] CHANNEL	*Example:* CMAXCURR? 1 150.000000
CMAXCURR	Sets the laser current limit [mA] for CHANNEL Returns CMAXCURR? *Note: If Laser Current is set above new current limit value, then current setpoint is lowered to new current limit value.*
Parameters: [Int] CHANNEL [FLOAT] CURRENT	*Example:* CMAXCURR 2 145 145.000000
CCURRENT?	Returns the measured laser current [mA] for CHANNEL
Parameters: [Int] CHANNEL	*Example:* CCURRENT? 1 102.042664

CLASTI?	Returns the most recent current [A] measurement recorded while the channel is / was in an On state.
Parameters: [INT]CHANNEL	*Example:* CLASTI? 1 0.092263
CCVOLT?	Reads the measured compliance voltage [V] for CHANNEL .
Parameters: [Int] CHANNEL	*Example:* CCVOLT? 2 0.180554
CLASTV?	Returns the most recent compliance voltage [V] measurement recorded while the channel is / was in an On state.
Parameters: [INT]CHANNEL	*Example:* CLASTV? 1 0.06618
CATEMP?	Returns the Inside Case Ambient Temperature measurement for CHANNEL in decrees Celsius
Parameters: [INT]CHANNEL	*Example:* CATEMP? 1 28.832947
CHWTEMP?	Returns the Hardware Temperature measurement for CHANNEL in decrees Celsius
Parameters: [INT]CHANNEL	*Example:* CHWTEMP? 2 48.023914
CLIMITS?	Returns a Current Limit [mA] for the Index parameter 0 = Minimum Current Limit for the Model 1 = Maximum Current Limit for the Model
Parameters: [INT]LIMIT INDEX	*Example:* CLIMITS? 1 200.000000
CINTERLK?	Returns the State of the Interlock switch and touch screen warning. On = Interlock switch closed (Laser Control channels are operational) Off = Interlock switch open (Laser Control channels are non-operational) NOTE: an Off state must be cleared by manually closing the Interlock switch and then clearing the error bit returned by the CERROR? [*CHANNEL*] command by writing the error code returned as the parameter to the CERROR [*CHANNEL*] [*ERROR CODE*] command.
Parameters: NONE	*Example:* CINTERLK? On

LIV Commands

CLIVSTRT?	Reads the LIV Start current setpoint [mA] for a LIV sweep of CHANNEL
Parameters: [INT]CHANNEL	*Example:* CLIVSTRT? 1 0.000000
CLIVSTRT	Sets the LIV Start current setpoint [mA] for a LIV sweep of CHANNEL (Must be less than or equal to CLIVEND) Returns CLIVSTRT?
Parameters: INT]CHANNEL [FLOAT]CURRENT	*Example:* CLIVSTRT? 1 20 20.000000
CLIVEND?	Reads the LIV Stop current setpoint [mA] for a LIV sweep of CHANNEL
Parameters: [INT]CHANNEL	*Example:* CLIVEND? 1 200.000000
CLIVEND	Sets the LIV Stop current setpoint [mA] for a LIV sweep of CHANNEL (Must be greater than or equal to CLIVSTRT) Returns CLIVEND?
Parameters: [INT]CHANNEL [FLOAT]CURRENT	*Example:* CLIVEND? 1 180 180.000000
CLIVRATE?	Reads the LIV Rate [Hz] for CHANNEL
Parameters: [INT]CHANNEL	*Example:* CLIVRATE? 1 5.000000
CLIVRATE	Sets the LIV Rate [Hz] for CHANNEL Returns CLIVRATE?
Parameters: [INT]CHANNEL [FLOAT]RATE	*Example:* CLIVRATE 2 3 3.000000
CLIVSWP	Starts a LIV Sweep sequence for CHANNEL (Laser current must be enabled before starting a LIV sweep) Returns 4 (Status On)
Parameters: [INT]CHANNEL	*Example:* CLIVSWP 1 4

CLIVSTOP	Stops a LIV Sweep before it completes on its own Returns 5 (Status Off)
Parameters: [INT]CHANNEL	*Example:* CLIVSTOP 1 5
CLIVBUSY?	Returns the status of a LIV sweep in progress for CHANNEL Return Values: 5 = Off 8 = In Progress 9 = Finished
Parameters: [INT]CHANNEL	*Example:* CLIVBUSY? 1 8

CLIVINFO?	Returns an 8 byte info header for the most recent LIV sweep of channel. Header Contents: byte 1 = type of conversion factor to convert the sweep integer data into floating point voltages bytes 2 and 3 the number of bytes of sweep data collected for the most recent sweep bytes 4 -7 the conversion factor to multiply the sweep data by to convert to floating point voltage representation byte 8 Unused. NOTE: Calling CLIVINFO? [*channel*] 0 will trigger the remaining necessary command chain to return the Sweep data.
Parameters: [INT]Channel [INT]0	*Example:* CLIVINFO? 1 0 00 0b 00 00 00 5c 3a 00 Channel: 1 LIV Sweep Data Points: 11 Voltage V 0.007553 0.002518 0.005035 0.005875 0.006714 0.007553 0.009232 0.010071 0.010910 0.012589 0.014267 EXT Voltage V 0.001526 0.003815 0.006104 0.007629 0.008392 0.011444 0.012207 0.014496 0.016022 0.017548 0.019073

Analog Input Commands

CMODEA?	Returns the Analog Input A channel and input mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Back Panel Modulation Input = 0 Front Panel Modulation Input = 2 (Channel 1 uses Input A)
Parameters: [NONE]	*Example:* CMODEA? 256
CMODEA	Sets the Analog Input A channel and input mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Back Panel Modulation Input = 0 Front Panel Modulation Input = 2 (Channel 1 uses Input A) Returns CMODEA?
Parameters: [INT]MODE MASK	*Example:* CMODEA 2 258
CMODEB?	Returns the Analog Input B channel and input mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Back Panel Modulation Input = 0 Front Panel Modulation Input = 2 (Channel 2 uses Input B)
Parameters: [NONE]	*Example:* CMODEB? 512
CMODEB	Sets the Analog Input B channel and input mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number

	Return_Value - (channel_number * 256) = mode Mode values: Back Panel Modulation Input = 0 Front Panel Modulation Input = 2 (Channel 2 uses Input B) Returns CMODEB?
Parameters: [INT]MODE MASK	*Example:* CMODEB 2 514
CAMODSEL?	Returns the analog modulation input configuration for CHANNEL 0 = Normal Back Panel Modulation input (default) 1 = Internal Analog Bus (Unused in this application same as 3) 2 = Front Panel input A for channel 1, B for channel 2 3 = No Modulation
Parameters: [INT] CHANNEL	*Example:* CAMODSEL? 2 0
CAMODSEL	Sets the analog modulation input configuration for CHANNEL 0 = Normal Back Panel Modulation input (default) 1 = Internal Analog Bus (Unused in this application same as 3) 2 = Front Panel input A for channel 1, B for channel 2 3 = No Modulation Returns CAMODSEL?
Parameters: [INT] CHANNEL [INT] CONFIG	*Example:* CAMODSEL 1 2 2
CAOUTSEL?	Returns the state of the Laser Compliance Voltage Front Panel Output for CHANNEL 0 = Off 1 = Laser Compliance Voltage Front Panel Output Enabled Channel = 1 Output on Output 1 Channel = 2 Output on Output 2
Parameters: [INT] CHANNEL	*Example:* CAOUTSEL? 2 0
CAOUTSEL	Sets the state of the Laser Compliance Voltage Front Panel Output for CHANNEL 0 = Off 1 = Laser Compliance Voltage Front Panel Output Enabled Channel = 1 Output on Output 1

	Channel = 2 Output on Output 2 Returns CAOUTSEL?
Parameters: [INT] CHANNEL [INT] STATE	*Example:* CAOUTSEL 1 1 1

Analog Output Commands

TGAIN1?	Returns the gain value for Analog Output 1 Note: Each Output 1 choice maintains a Gain Value specific to the Output mode and channel chosen. The return value reflects the Gain for the Channel and Mode chosen for the CHANNEL
Parameters: [INT] CHANNEL	*Example:* TGAIN1? 3 1.000000
TGAIN1	Sets the gain value for Analog Output 1 Returns TGAIN1? Note: Select the Output 1 mode for the channel before adjusting the Gain.
Parameters: [INT] CHANNEL [FLOAT] GAIN	*Example:* TGAIN1 3 2.5 2.500000
TGAIN2?	Returns the gain value for Analog Output 2 Note: Each Output 2 choice maintains a Gain Value specific to the Output mode and channel chosen. The return value reflects the Gain for the Channel and Mode chosen for the CHANNEL
Parameters: [INT] CHANNEL	*Example:* TGAIN2? 3 1.000000
TGAIN2	Sets the gain value for Analog Output 2 Returns TGAIN2? Note: Select the Output 2 mode for the channel before adjusting the Gain.
Parameters: [INT] CHANNEL [FLOAT] GAIN	*Example:* TGAIN1 3 2.5 2.500000
TOFFSET1?	Returns the offset value for Analog Output 1 Note: Each Output 1 choice maintains an Offset Value specific to the Input mode and channel chosen. The return value reflects the Offset value for the Channel and Mode chosen for the CHANNEL
Parameters: [INT] CHANNEL	*Example:* TOFFSET1? 1 10.000000
TOFFSET1	Sets the offset value for Analog Output 1 Returns TOFFSET1? Note: Select the Output 1 mode for the channel before adjusting the offset.
Parameters: [INT] CHANNEL [FLOAT] OFFSET	*Example:* TOFFSET1 3 2.5 2.500000

TOFFSET2?	Returns the offset value for Analog Output 2 Note: Each Output 2 choice maintains an Offset Value specific to the Input mode and channel chosen. The return value reflects the Offset value for the Channel and Mode chosen for the CHANNEL
Parameters: [INT] CHANNEL	*Example:* TOFFSET2? 1 10.000000
TOFFSET2	Sets the offset value for Analog Output 1 Returns TOFFSET2? Note: Select the Output 2 mode for the channel before adjusting the offset.
Parameters: [INT] CHANNEL [FLOAT] OFFSET	*Example:* TOFFSET2 3 2.5 2.500000
TMODE1?	Returns the Analog Output 1 channel and input mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: NO_OUTPUT = 0 TEMPERATURE_OUTPUT = 1 TEMPERATURE_ERROR_OUTPUT= 2 CURRENT_OUTPUT = 3
Parameters: NONE	*Example:* TMODE1? 513 (Channel 2 Temperature Output)
TMODE1	Sets the Analog Output 1 channel and input mode Returns TMODE1?
Parameters: [INT] CHANNEL&MODE	*Example:* TMODE1 514 514 (Channel 2 Temperature Error Output)

TMODE2?	Returns the Analog Output 2 channel and input mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: NO_OUTPUT = 0 TEMPERATURE_OUTPUT = 1 TEMPERATURE_ERROR_OUTPUT= 2 CURRENT_OUTPUT = 3
Parameters: NONE	*Example:* TMODE2? 513 (Channel 2 Temperature Output)
TMODE2	Sets the Analog Output 2 channel and input mode Returns TMODE2?
Parameters: [INT] CHANNEL&MODE	*Example:* TMODE2 514 514 (Channel 2 Temperature Error Output)
CMODE1?	Returns the Analog Output 1 channel and output mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Front Panel Output Off = 0 Front Panel Output Laser Current Sense Voltage = 1 (Channel 1 uses Output 1)
Parameters: [NONE]	*Example:* CMODE1? 256

CMODE1	Sets the Analog Output 1 channel and output mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Front Panel Output Off = 0 Front Panel Output Laser Current Sense Voltage = 1 (Channel 1 uses Output 1) Returns CMODE1?
Parameters: [INT]MODE MASK	*Example:* CMODE1 1 257
CMODE2?	Returns the Analog Output 2 channel and output mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Front Panel Output Off = 0 Front Panel Output Laser Current Sense Voltage = 1 (Channel 2 uses Output 2)
Parameters: [NONE]	*Example:* CMODE2? 512
CMODE2	Sets the Analog Output 2 channel and output mode Note: Both the Channel and Mode are contained in the returned value. Return_Value / 256 = channel_number Return_Value - (channel_number * 256) = mode Mode values: Front Panel Output Off = 0 Front Panel Output Laser Current Sense Voltage = 1 (Channel 2 uses Output 2) Returns CMODE2?
Parameters: [INT]MODE MASK	*Example:* CMODE2 1 513

Trigger Commands

TTRIGOUT?	Reads the Trigger Out flags for temperature CHANNEL Each channel has its own Trigger Out bitset. Values are as follows: Minimum Temperature Exceeded = 0x01 hex = 1 decimal Maximum Temperature Exceeded = 0x02 hex = 2 decimal Minimum or Maximum Temperature Exceeded = 0x03 hex = 3 decimal Slew Rate Limit Exceeded = 0x04 hex = 4 decimal Temperature Setpoint Reached = 0x08 = 8 decimal NOTE: There is no Invert option for output triggers due to hardware limitations.

Parameters:
`[Int] CHANNEL`
	Example:
	`TTRIGOUT? 2`
	`3`
	`(Minimum or Maximum Temperature Exceeded)`

TTRIGOUT	Sets the Trigger Out flags for temperature CHANNEL Each channel has its own Trigger Out bitset. FLAG values are as follows: Minimum Temperature Exceeded = 0x01 hex = 1 decimal Maximum Temperature Exceeded = 0x02 hex = 2 decimal Minimum or Maximum Temperature Exceeded = 0x03 hex = 3 decimal Slew Rate Limit Exceeded = 0x04 hex = 4 decimal Temperature Setpoint Reached = 0x08 = 8 decimal **NOTE:** It is possible to set more than one trigger with the same command. I.e. To set Minimum Temperature Exceeded and Maximum Temperature Exceeded add the individual values together. 0x01 + 0x02 = 0x03 **CAUTION: The Minimum and Maximum Temperature triggers are the only ones that should be chosen together. Other Combinations will yield unpredictable results.** NOTE: There is no Invert option for output triggers due to hardware limitations. Returns TTRIGOUT?

Parameters:
`[Int] CHANNEL`
`[Int] FLAGS`
	Example:
	`TTRIGOUT 2 4`
	`4`
	`(Slew Rate Limit Exceeded)`

CTRIGIN?	Reads the Trigger In flags for Laser CHANNEL Each channel has its own Trigger In bitset. Values are as follows: No Trigger Selected = 0x00 hex = 0 decimal Enable / Disable Laser Control = 0x01 hex = 1 decimal Disable Laser Control = 0x02 hex = 2 decimal Begin LIV Sweep = 0x04 hex = 4 decimal Invert Triggers = 0x80 hex = 32768 decimal NOTE: Invert Triggers applies to both channels and is added to the trigger selection value. I.e. Begin LIV Sweep on transition to active low requires the flags to be 32768 + 4 = 32772

Parameters: [INT] CHANNEL	*Example:* CTRIGIN? 1 1 (Non Inverted Enable / Disable Laser Control)
CTRIGIN	Sets the Trigger In flags for Laser CHANNEL Each channel has its own Trigger In bitset. Values are as follows: No Trigger Selected = 0x00 hex = 0 decimal Enable / Disable Laser Control = 0x01 hex = 1 decimal Disable Laser Control = 0x02 hex = 2 decimal Begin LIV Sweep = 0x04 hex = 4 decimal Invert Triggers = 0x80 hex = 32768 decimal NOTE: Invert Triggers applies to both channels and is added to the trigger selection value. I.e. Begin LIV Sweep on transition to active low requires the flags to be 32768 + 4 = 32772 Returns CTRIGIN?
Parameters: [INT] CHANNEL [INT] FLAGS	*Example:* CTRIGIN 1 32772 32772 (Inverted Begin LIV Sweep)
CTRIGOUT?	Reads the Trigger Out flags for Laser CHANNEL Each channel has its own Trigger Out bitset. Values are as follows: No Trigger Selected = 0x00 hex = 0 decimal Interlock Switch Opened = 0x01 hex = 1 decimal LIV Sweep Complete = 0x02 hex = 2 decimal NOTE: There is no Invert option for output triggers due to hardware limitations.
Parameters: [INT] CHANNEL	*Example:* CTRIGOUT? 1 0
CTRIGOUT	Sets the Trigger Out flags for Laser CHANNEL Each channel has its own Trigger Out bitset. Values are as follows: No Trigger Selected = 0x00 hex = 0 decimal Interlock Switch Opened = 0x01 hex = 1 decimal LIV Sweep Complete = 0x02 hex = 2 decimal NOTE: There is no Invert option for output triggers due to hardware limitations. Returns CTRIGOUT?
Parameters: [INT] CHANNEL [INT] FLAGS	*Example:* CTRIGOUT 1 2 2

Error Commands

TERROR?	Returns the 16 bit error register for CHANNEL All Return Values have two validation bits included (0xC000 hex = 49152 decimal) Subtract the validation value from the return value to leave the error bits. NOTE Error Bit Definitions (multiple errors can be contained in the return value so that Error_1 + Error_2 + Error_n = Return Value): Temperature Control Open Circuit = 0x0001 hex = 1 decimal Temperature Hard Limit Exceeded = 0x0002 hex = 2 decimal Temperature Bounds Exceeded = 0x0004 hex = 4 decimal Slew Rate Exceeded = 0x0008 hex = 8 decimal Current Limit Exceeded = 0x0010 hex = 16 decimal Power Limit Exceeded = 0x0100 hex = 256 decimal Incompatible Thermistor Coefficients = 0x0200 hex = 512 decimal Refresh All Channel Settings (signal) = 0x2001 hex = 8193 decimal Auto Tune No Limit Cycles Detected = 0x2002 hex = 8194 decimal Auto Tune Timed Out = 0x2004 hex = 8196 decimal Auto Tune Temperature Bounds Exceeded = 0x2008 hex = 8200 decimal Auto Tune Current Lower Bound Exceeded = 0x2010 hex = 8208 decimal Auto Tune Current Upper Bound Exceeded = 0x2020 hex = 8224 decimal Auto Tune Heater Setpoint Too Low = 0x2040 hex = 8256 decimal Auto Tune Unstable Plant = 0x2080 hex = 8320 decimal

Parameters:
`[INT] CHANNEL`
	Example:
	`TError? 2`
	`49153`
	`49153 – 49152 = 1 (Open Circuit Error)`

TERROR	Clears the error bit (s) in the CHANNEL 16bit error register. Returns TERROR? NOTE: The parameter is the value that was returned by TERROR? From the table above.

Parameters:
`[INT] CHANNEL`
`[INT] Error to be cleared`
	Example:
	`TError 2 49153`
	`49152`

CERROR?	Returns the 16 bit error register for CHANNEL All Return Values have two validation bits included (0xC000 hex = 49152 decimal) Subtract the validation value from the return value to leave the error bits. NOTE Error Bit Definitions (multiple errors can be contained in the return value so that Error_1 + Error_2 + Error_n = Return Value): Current Limit Exceeded = 0x0010 hex = 16 decimal Over Temperature Hardware = 0x0020 hex = 32 decimal Over Temperature Ambient = 0x0040 hex = 64 decimal Interlock Circuit Open = 0x0080 hex = 128 decimal Power Limit Exceeded = 0x0100 hex = 256 decimal Refresh All Channel Settings (signal) = 0x2001 hex = 8193 decimal
Parameters: [INT] CHANNEL	*Example:* CERROR? 2 49280 49280 – 49152 = 128 (Open Interlock Switch)
CERROR	Clears the error bit (s) in the CHANNEL 16bit error register. Returns CERROR? NOTE: The parameter is the value that was returned by CERROR? From the table above.
Parameters: [INT] CHANNEL [INT] Error to be cleared	*Example:* CERROR 2 49280 49152