Current Controller and Peak Lock Servo Board

Model No. ICE-CS1

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Please read Limited Warranty and General Warnings and Cautions prior to operating the ICE-CS1.

ICE-CS1 web page.

Description

The Current Controller & Peak Lock Servo Board has either a 200 mA (ICE-CS1-200) or 500 mA (ICE-CS1-500) precision current source based on the Libbrecht-Hall[1)] circuit and integrated peak-lock laser servo. The ICE-CS1 contains a tunable PID loop filter for tight locking to the error signal, which is generated by demodulating the internal 4 MHz dither signal on the laser.

Absolute Maximum Ratings

Note: All modules designed to be operated in laboratory environment

Parameter	Rating
Environmental Temperature	>15°C and <30°C
Environmental Humidity	<60%
Environmental Dew Points	<15°C

Specifications

	ICE-CS1-200	ICE-CS1-500	Units
Current Source			
Current range	0-200	0-500	mA
Current setpoint resolution	200	500	µA
Current noise density[2)]	<100	<200	pA /√Hz
RMS Noise (10Hz - 100kHz)[3)]	<50	<100	nA
RMS Noise (10Hz - 1MHz)[4)]	<100	<150	nA
RMS Noise (10Hz - 10MHz)[5)]	<300	<500	nA
Absolute accuracy	2		%

	ICE-CS1-200	ICE-CS1-500	Units
Current Source			
Peak Lock Servo			
Bandwidth[6]	3		MHz
Input Voltage Range	±1		V
Dither Frequency	4		MHz
Phase Shift Resolution	5.6		deg
Input Voltage Noise[7]	TBD		nV/√Hz
Loop Filter Parameters			
Proportional Gain (ref to DC Error)	-22 to +20		dB
Proportional Gain Resolution	2		dB
Integrator	3, 10, 30, 100, 300		kHz
Differential	Off, Fixed at 3 times integrator pole		
Differential Gain	18		dB

Electrical Specifications				
	Min	**Typical**	**Max**	**Units**
5V_A Current Draw		N/A		A
5V_D Current Draw		70		mA
+15V Current Draw (ICE-CS1-200)[8]	100		300	mA
+15V Current Draw (ICE-CS1-500)[9]	100		600	mA
-15V Current Draw		60		mA

I/O (ICE-BOX)

Only when purchased with the ICE-Box.

Laser Current

The Front Panel for the ICE-CS1 has two SMA connectors. The top SMA goes to the laser and drives positive current to the laser. The center conductor of the SMA goes to the laser anode.

Error Input

The Front Panel for the ICE-CS1 has two SMA connectors. The bottom SMA is the Error Input. It is a 50Ω source that measures the laser frequency. Typically this the output of a photodetector looking at saturated absorption spectroscopy (SAS). This input signal must have bandwidth greater than 4 MHz to see the 4 MHz dither on the laser.

I/O (OEM Only)

Only for OEM versions of the ICE-QT1 purchased without the

ICE-Box.

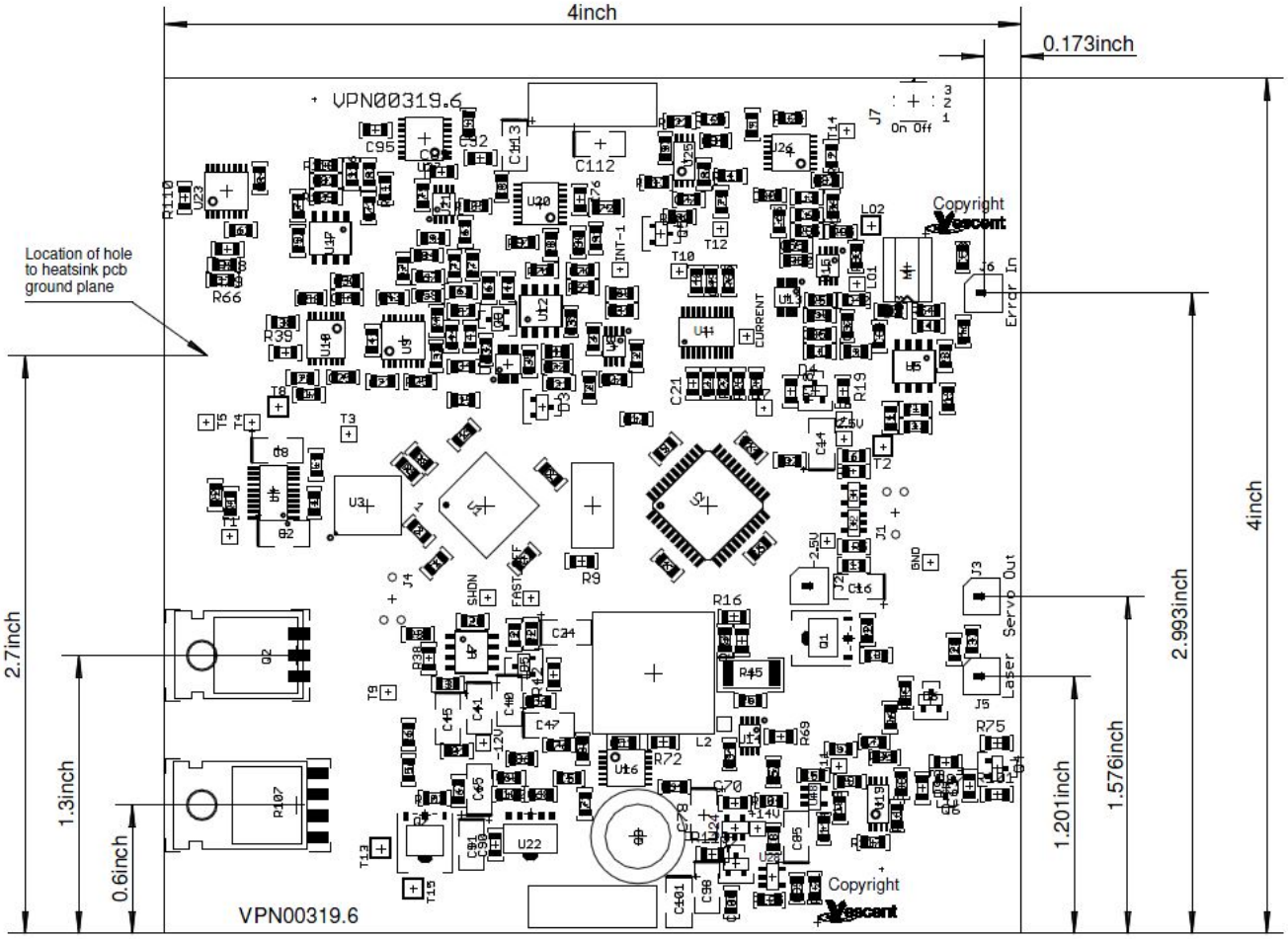

Fig. 1: Component and connector positions on PCB.

Laser Current

The ICE-CS1 board has two UMCC connectors. The one labelled “Laser” goes the laser and drives positive current to the laser. The center conductor of the UMCC goes to the laser anode.

Error Input

The ICE-CS1 board has two UMCC connectors. The one labelled “Error In” is the Error Input. It is a 50Ω source that measures the laser frequency. Typically this the output of a photodetector looking at saturated absorption spectroscopy (SAS). This input signal must have bandwidth greater than 4 MHz to see the 4 MHz dither on the laser.

Quick Start Commands Guide (Laser Current)

Please see Overview of Commands and Basic Usage, Common Commands to all Slave Boards and Common Laser Current Controller Commands for a complete command list. Set the ICE-MC1 to communicate with the slot that this ICE-SC1 is in (see Master and Control Board Overview for details).

The ICE-SC1 can drive one laser diode. The first thing to do is set the current limit for your laser diode with the **CurrLim** command. The command has units of mA.

```
CurrLim 125
125.0
```

Next, set the desired current to the laser diode with **CurrSet** command. The command also uses mA. As usual, the command returns the actual current setpoint which may different from the setpoint send to the ICE-CS1 because of the quantization of the available current setpoints.

```
CurrSet 110.15
110.2
```

The status of the laser (On, Off, Fault) can be queried with the **Laser?** command. And the laser can be turned on or off with the **Laser** command

```
Laser?
Off

Laser On
On

Laser Off
Off
```

Once the right values are set on the ICE-CS1, use the **Save** command to save the current settings so that these settings will be remembered when the device is power cycled. Please note that the laser always starts off and must be turned on the the **Laser** command

```
Save
Success
```

Quick Start Commands Guide (Peak Lock Servo)

Please see Overview of Commands and Basic Usage, Common Commands to all Slave Boards and Current Controller & Peak Lock Servo Commands for a complete command list. Set the ICE-MC1 to communicate with the slot that this ICE-CS1 is in (see Master and Control Board Overview for details).

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1)
Libbrecht and Hall, A Low-Noise, High-Speed Current Controller, Rev. Sci. Inst. 64, pp. 2133-2135 (1993).

2) 3) 4) 5)
All measurements guaranteed on design and verified experimentally on D2-105 which uses same circuit.

6)
Calculated based on RF dither frequency of 4 MHz which limits servo bandwidth

7)

Referenced to 50Ω load
[8] [9]
,
Current draw depends on output current to laser diode.

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