



DCLS125(v1.2)Feburay 5,2011

High-stability DC Laser Source

Summary

This DCLS application note document describes the installation and operational procedure of the DCLS.

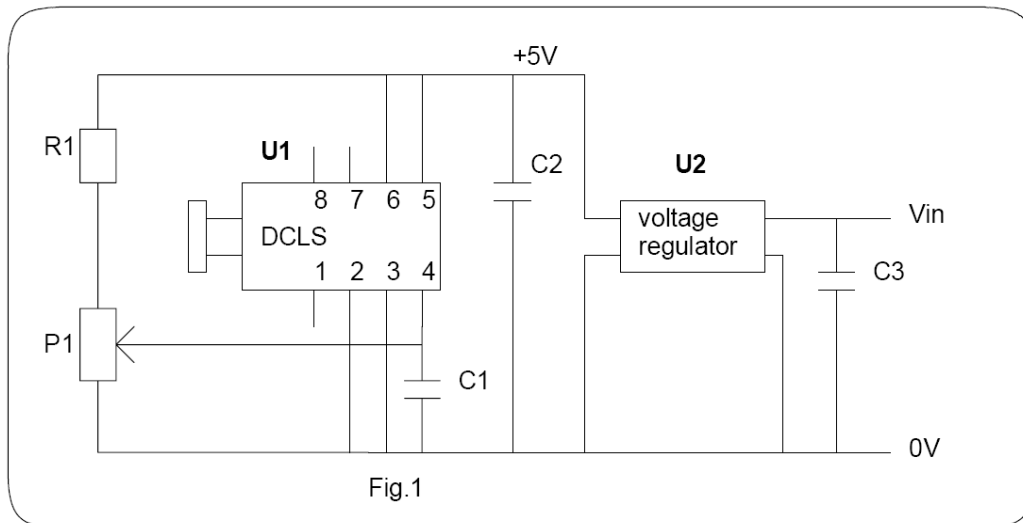
The basic

The circuit shown in Fig. 1 is a basic configuration with the manual adjustable output optical power and without laser over current protection.

application of

DCLS

U1 is the module of DC laser source. The pins 2,3 are connected to 0V while pins 5,6 connected to the +5V from the voltage regulator U2.



A 10 μF tantalum capacitor is recommended for the decoupling capacitor C2, which should be mounted closed to U1 as possible.

U2 is the voltage regulator to provide a constant +5V to U1. Since the maximum current of U1 is 50 mA, U2 is recommended to have the load capability of 80 mA at least. The input voltage of U2 should be selected according to the system power supply voltage.

R1 and P1 form a voltage divider to apply a manual adjustable voltage of 0 to 2.5 V to pin 4 of U1 as an input control voltage. Since the input impedance of pin 4 of U1 is 10 Kohms, R1 and P1 are recommended to 1K ohms. A

0.1 uF ceramic capacitor is recommended for C1. R1, P1 and C1 should be mounted closed to U1 pin 4 as possible. The decoupling capacitor C3 should be selected according to the specification of U2.

P1 is recommend as a multi turn potential meter to reach fine adjustemtn of the output optical power.

U2 is commended as LP2950/2951, 5V, 100mA, the manufacture is National semiconductor.

The calibration procedures are

Calibration Procedures

1. Before the system is powered on, turn P1 and set the voltage applied to pin 4 of U1 is zero. Use a optical patch cord to connect the laser module to an optical power meter. Before the connecting, the FC plugs and receptacles must be cleaned by fiber free tip with water free alcohol A voltage meter is used to measure the voltage of pin 8 of U1 to monitor the current through the laser to avoid over current. Since the FC connector could introduce optical insertion loss, the voltage meter can be used to measure the voltage of pin 1 of U1 to monitor the real optical power from the laser diode.

2. Turn on the power. Measure the voltage of pin 5, 6 to make sure the voltage is +5V. If U2 is an adjustable voltage regulator, tune it until the voltage reaches to +5V accurately.

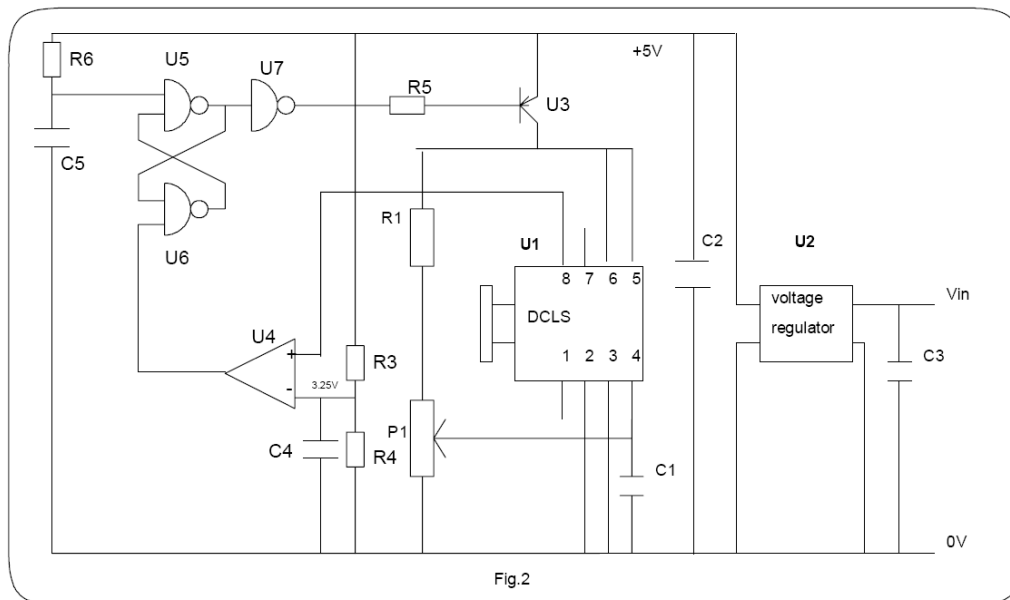
3. Tune P1 and increase the voltage of pin 4 of U1, the optical power meter should indicate the increase of optical power from the laser. Keep tune up P1 and monitor the voltage of pin 8 of U1 until the optical power reaches the nominal value shown in the test report attached to the laser module and the voltage of pin 8 of U1 is higher than the minimal value shown in the same test report. If the voltage of pin 8 drops to the minimum value in the test report, but the optical power still does not reach the nominal value, measure the voltage of pin 1, if the voltage of pin 1 reaches the maximum value shown in the test report, it indicates the FC connectors introduce too large insertion loss, they should be cleaned again, or replaced.

The principles shown in steps 1. to 3. are available to all applications.

The circuit shown in Fig. 2 is an application of the laser source with over current protection.

Application with Over Current Protection

U3 is a PNP bipolar transistor which is connected between the +5V power supply and the power supply pins of DCLS. When U3 is turned on, DCLS is powered, when U3 is turned off, DCLS is disconnected from the power supply.



U4 is a high input impedance voltage comparator.

R3 and R4 form a voltage divider to generate a reference voltage of 3.25V for over current detection.

Two NAND gates U5, U6 form a RS register to response the over current status.

U7 is an inverter to provide the control logic of U3.

R5 is the base current resistor of U3. The value of R5 can be calculated from the following formula:

$$R5 = G \cdot (5V - V_{be}) / I_{max} \quad (1)$$

where G is the gain of U3 at saturation, the typical value

is about 10.

V_{be} is the base forward voltage of U3, the typical value is about 0.7V.

I_{max} is the maximum operation current of the laser. For DCLS, I_{max} is 50 mA.

R5 is 860 ohms

R6 and C5 generate a power-on reset. When the power supply of +5V is turned on, the input of U5 is at logic low for a while due to the capacitor C5, U5 output is at logic high, the RS register keeps the reset logic status until a over current occurs. The input of U7 is at logic high, the output of U7 is at logic low, U3 is turned on, the laser module starts operation. U7 should be selected to handle 5mA sink current.

The values of R6 and C5 are recommended 10K ohms and 10 μ F.

In the normal operation, the voltage of U1 pin 8 is higher than 3.25V, the output of the voltage comparator is at logic high, it doesn't trigger the RS register. If a over current occurs in the laser module, the voltage at U1 pin 8 drops below 3.25V, the U3 output is at logic low, the RS register is triggered, U6 output is at logic high, U5 output is at logic low, U7 output is logic high, U3 is turned off to cut off the power supply to the laser module.

C4 is a filter capacitor to filter out the noise on the reference voltage of U4.

If a LED is used to indicate "over current", an extra inverter is connected to the output of U5, the extra inverter provides the driving current of the LED.

DON'T connect a LED to U5 output directly.

The recommendation components used in Fig. 1 and Fig. 2 are listed in Table 1

Component Number	Part Number	Manufacturer Name
U2	LP2950/2951, 5V, 100mA	National Semiconductor
U3	2N3906, PNP, 200mA	Fairchild
U4	LMC6762, dual voltage comparator	National Semiconductor

Table 1

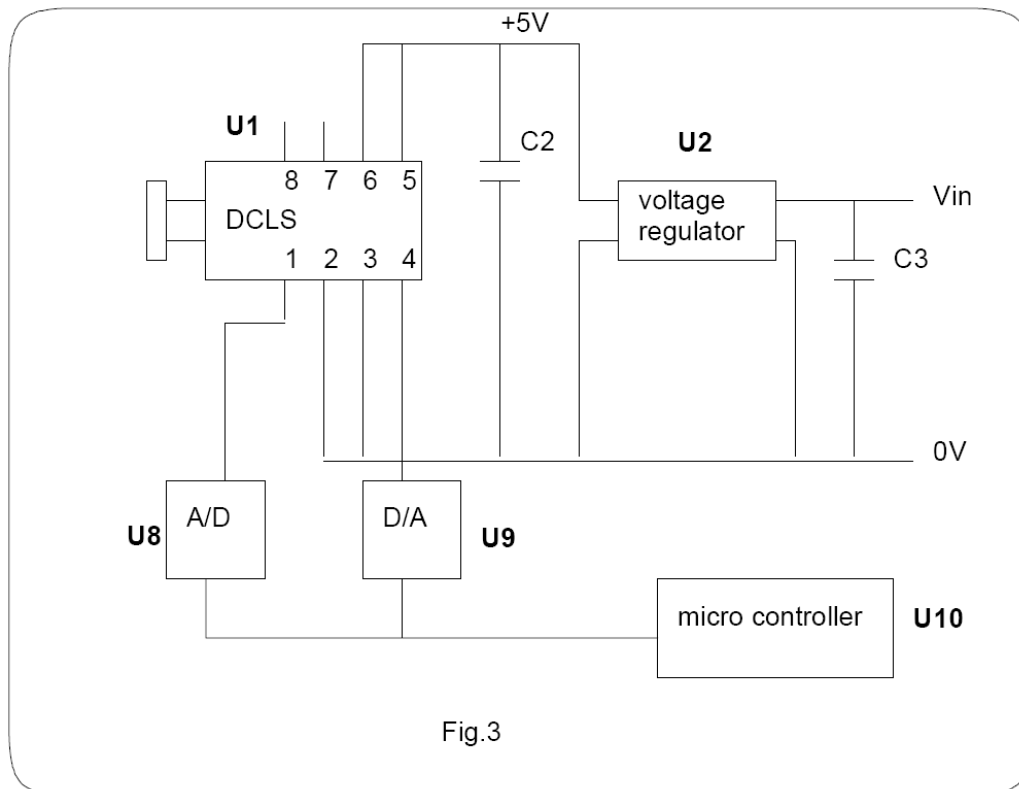


Fig.3

Application with Output Optical Power Stability Compensation (based on the voltage of pin 1 of

The circuit shown in Fig. 3 has the compensation function to reach very high output optical power stability. U9 is a digital to analog converter, U9 generates the control voltage, V_{con} , applied to pin 4 of U1 under the control of the micro controller U10, the setting procedure is similar to that of the potential meter.

When the optical power reaches the nominal value, the analog to digital converter U8 reads the monitor voltage V_m from pin 1 as a reference voltage. If V_m is higher than the reference voltage, the micro controller will decrease U9 output voltage, V_{con} , when V_m is lower than the reference voltage, the micro controller will increase



the module)

U9 output voltage, V_{con} so that the optical power from the laser is very stable.

Application with

The temperature sensor should be equipped near HQM. If multi HQMs are used and the temperature distribution is not uniform in the locations of HQM, one temperature sensor for each HQM is recommended.

Output Optical

Power Stability

Compensation

(based on an

The temperature sensor may be the type of analog output or digital output, the sensitivity of the sensor should be about 1°C . The temperature sensor should be close to HQM as possible.

optical power

coupler)