REVISIONS						
DCN	LTR	DESCRIPTION	DATE	CHANGED	CHECKED	APPROVED
	--	RELEASED FOR PRODUCTION	120410	PJ		DW
6292	A	REVISED PER DCN	130619	PJ		DW
6376	B	REVISED PER DCN	131112	PJ		DW

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PJONES	120410	Tim Cable	120410
LEAD APPROVAL	DATE	FINAL APPROVAL	DATE
Dwight Wildon	120411	John Harwick	120412

TOLERANCES

DECIMAL
.XX = N/A
.XXX = N/A

ANGULAR
X = N/A

TITLE

OPERATING MANUAL
MODEL 763 SEED LASER DIODE DRIVER

SCALE	SIZE	FSCM	SHEET	DRAWING NUMBER	REV
N / A	A	61651	1 OF 11	8499	B

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Introduction

The Model 763 Laser Diode Driver is a high performance general purpose OEM laser diode driver. The driver uses a 14 pin butterfly packaged laser module with a common industry pinout supported by several laser manufacturers.

The driver is optimized for lower current driver output (less than 1.0A) however, operation up to 1.2A is possible for average powers less than 1Watt. It is implemented as a transconductance amplifier (analog voltage in, scaled current out).

The driver circuitry operates from a single +5VDC power source. All other needed voltages are generated on the board by high efficiency switching power supplies.

The driver supplies a bidirectional PID switching TE cooler controller with current capability to ±3A and voltage capability to ±4V.

Safety

The driver does not generate or use any hazardous voltages, so high voltage precautions are not required in mounting or use. The driver is easily capable of producing enough laser light at the fiber tip to cause serious eye and skin damage. All reasonable precautions should be employed to avoid this. Keep work areas policed up of fiber fragments and off trims. Safe disposal of these is very important to avoid injury.

Mounting

The diode driver is normally shipped without a laser diode installed. The first step is to determine the worst case use parameters. For all but the very lowest power applications, a heat sink will be required. Determine the power dissipated in the laser, and TE cooler. Most TE coolers cannot hold the diode temperature with a differential from die to heat sink much over 45°C. Generally that is the requirement which determines the specifications for the heat sink attached to the laser diode mounting flange and any need for forced air, etc. The drive FETS and TEC controller dissipate their heat into the PC board. Use heatsink grease or other thermally conducting medium on the heat transfer surfaces of the laser. The laser connections to the board will have to bear the mechanical load of either the PCB or the laser heatsink. To avoid this strain the board and the heatsink should be screwed together, or each should be mounted to a third support.

Mounting the Laser

See Table 3 for acceptable laser pinout. To minimize mounting stress the following procedure should be followed:

1. If the board is being mounted with standoffs, screw to heat sink, but do not tighten.
2. Place the laser through the hole in the board, and insert the mounting screws in all corners. Leave loose.
3. Move the board around as needed to align the laser pins with the solder pads. Tighten the board mounting screws.
4. Carefully trim the laser pins to fit on the pads. Removing the laser from the PCB may make this easier.
5. When the pins have been trimmed and passed a trial fit, coat the bottom of the laser with heat transfer material, and screw down to the heat sink.
6. Solder the laser leads to the pads.

Before Powering Up

Review Table 1 against the specifications for the laser diode to determine if pre-turn on adjustments should be made to the driver. Most of the adjustments must be made with the power on, so for the present simply turn the control pot in the indicated direction at least 5 turns. See Fig. 1 for potentiometer locations.

Adjustment	Factory Setting	Pot	Turn Pot to Lower Setting
TEC Temperature	25°C.	R98	CCW
Offset Adjust	+1mV(~2mA)	R7	CCW
Laser Fire Threshold	10mV	R105	CCW
Current Limit Adjust	2.11V (1.1A)	R109	CCW
TEC Max Voltage	3.14V	R71	Fixed Resistor
TEC Max Current	1.8A	R70	Fixed Resistor

TABLE 1 – ADJUSTABLE PARAMETERS AND METHOD OF ADJUSTMENT

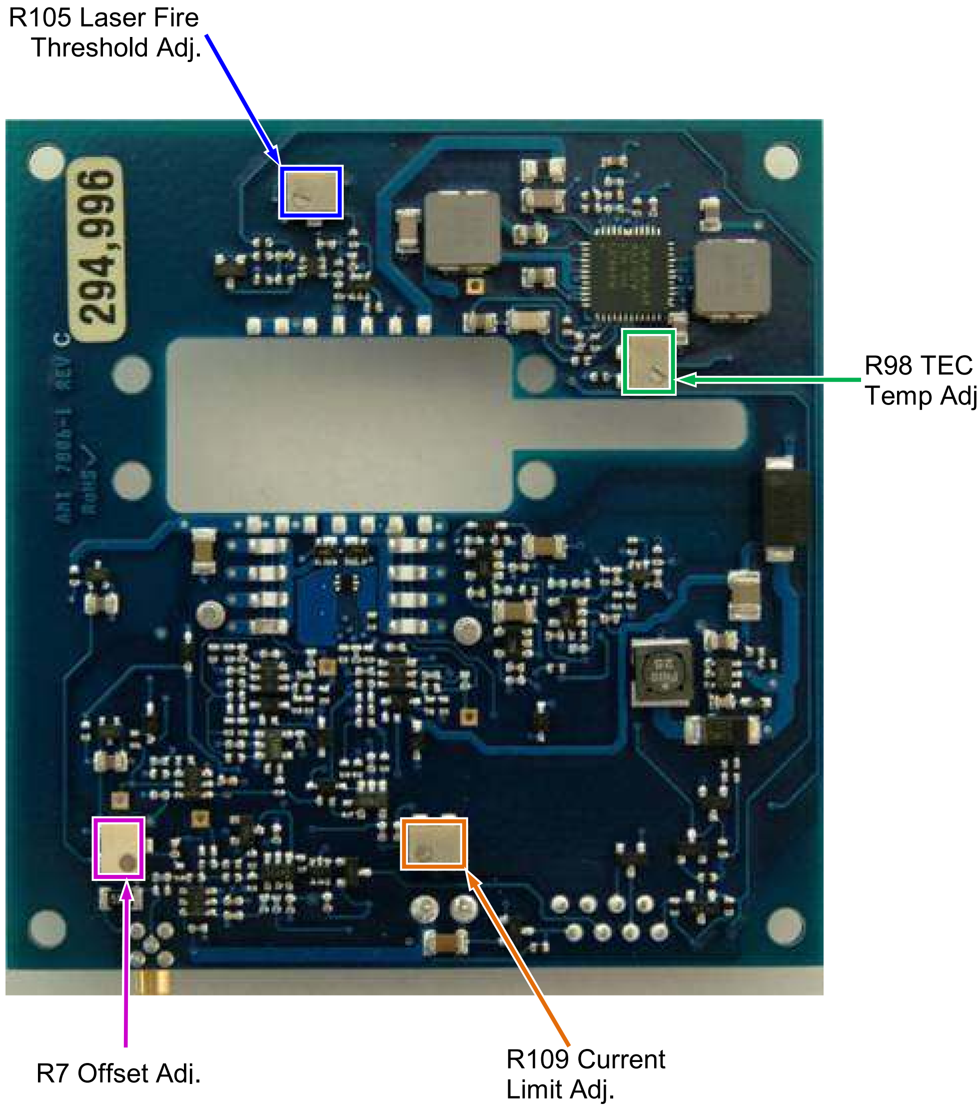

FIGURE 1 – ADJUSTMENT POTENTIOMETERS

Electrical Interface

The model 763 connections ,signals, and signal behavior are described here.

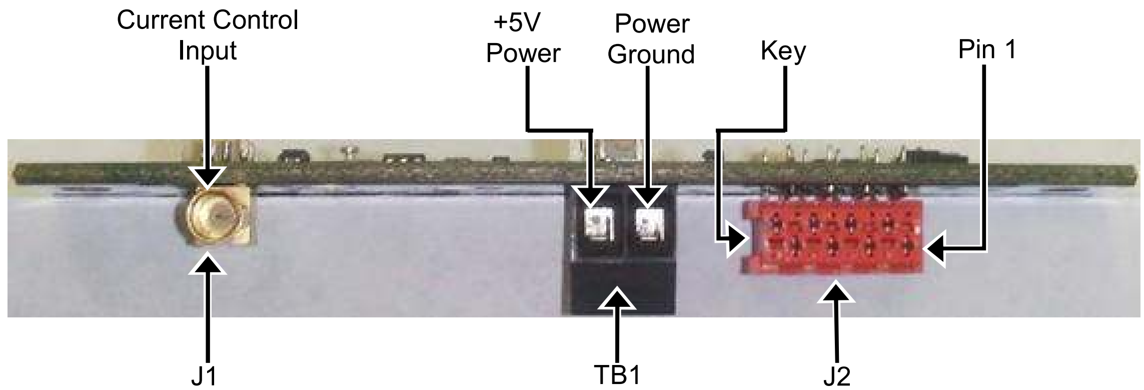

FIGURE 2 – INPUT/OUTPUT AND POWER CONNECTORS

J1 – MMCX Jack

J1 is a miniature 50 Ω MMCX jack that mates with a straight or right angle MMCX plug and 50 Ω coaxial cable assembly.

TB1 – Input Power Screw Terminal Block

The screw terminal block accepts between 16 AWG to 28 AWG wire for driver power and ground.. All connection locations are shown in Figure 2.

J2 – 8-pin MicroMatch Receptacle

J2 mates with a keyed 8-pin MicroMatch IDC style header connected to 8-position, 28 AWG ribbon cable. The J2 pin descriptions and locations can be found below in Table 2 for further clarification.

I/O CONNECTOR Pinout	
J2	
Pin	Function
1	$\overline{\text{Enable}}$
2	GND
3	$\overline{\text{Temp Fault}}$
4	GND
5	$\overline{\text{Over Current}}$
6	GND
7	Laser Fire
8	GND

TABLE 2 – J2 PIN DESCRIPTION

Laser Pinout	
Pin	Function
1	TEC +
2	Thermistor
3	BFM Anode
4	BFM Cathode
5	Thermistor
6	N/C
7	N/C
8	N/C
9	N/C
10	LD Anode
11	LD Cathode
12	N/C
13	Case Ground
14	TEC -

TABLE 3 – LASER DIODE 14-PIN BUTTERFLY PACKAGE PINOUT

Inputs

+5 Power

Driver power should be +5V±0.25V, up to 3A. Voltage levels apply at the board input terminals under minimum to maximum loads.

Power Ground

This is the return line for the input power. Size wiring run accordingly.

Current Control Input

This is an analog input. The input impedance is 50Ω. The laser current is scaled to the input voltage at 0.333 A/V, not to exceed 4.5V. The laser current will follow the control input thru any modulation waveform within the bandwidth of the driver. The driver bandwidth is approximately 50MHz. The input voltage is offset by the offset control and limited by the current limit control.

Enable

This input is compatible with TTL, 3.3V and 5V CMOS logic, open drain or collector switches, and mechanical switches and relays. The input is pulled up to +5V with a 10K resistor. If 3.3V CMOS is used to drive it connect a 15K resistor from the input to ground to protect the driving logic from over voltage. Any input value which lowers the voltage at the Enable input below 0.4V will enable the laser driver. This includes logic outputs, or simply shorting to ground. Any time the input voltage is above 2.4V, the laser will be disabled. This includes logic outputs, or open circuiting the input. Between 0.4 and 2.4V the state is indeterminate.

Outputs

Temp Fault

This signal is active low, and asserts whenever the driver has been disabled by the temperature monitoring system. The signal is open drain with an internal 4.75K pull up to +5V. The signal is capable of driving TTL, 3.3 and 5V CMOS, sensitive relays, transistors, FETs, and LEDs. The application will determine which devices are appropriate. If the output is being used to drive 3.3V CMOS, install a 6.8K resistor from output to ground to prevent over voltage on the logic input. The maximum sink load should be limited to 25mA.

This signal can be asserted by two separate causes. First, it will be asserted whenever the laser diode die temperature is outside a window of approximately ±1 degree from the set point temperature. Second, the signal will be asserted when the laser current driving FETs junction temperature exceeds approx 125°C. Both of these causes will disable the driver while the FETs cool below 125°C, or the TEC controller regains control of the die temperature. The source of the shutdown can be identified by noting the “off” time. It will be seconds for a TEC controller shutdown, and milliseconds for a FET shutdown. If the TEC controller is shutting down, Reduce the load or ambient temperature, or increase the heat sinking for the laser. If it’s a FET shutdown, reduce the load or ambient temperature, or add a cooling fan for the PCB. It is not recommended that the unit be operated in a manner that causes repeated temp faults.

Over Current

This signal is active low. It is asserted when the current limiting circuits are clipping the input signal. The signal is open drain with no internal pull up to +5V. The signal is capable of driving TTL, 3.3V and 5V CMOS, sensitive relays, transistors, FETs, and LEDs. The application will determine which devices are appropriate. The user may insert the load between the output and some positive voltage ≤12V for current operated loads like LED’s and relays. An external pull-up resistor will be required to drive voltage operated loads like transistors and logic inputs.

Laser Fire

This signal is active high. The signal is open drain with an internal 4.75K pull up to +5V. The signal is capable of driving TTL, 3.3 and 5V CMOS, sensitive relays, transistors, FETs, and LEDs. If the output is being used to drive 3.3V CMOS install a 6.8K resistor from output to ground to prevent over voltage on the logic input. The maximum sink load should be limited to 25mA. The output will generate a pulse approximately 1.0μs wide for each laser optical output pulse. If the pulse is wider than 1μs, the signal will remain high for the duration of the pulse. If the off time is insufficient for the circuits to reset, the output pulse will narrow. The signal will remain synchronized to the laser output up to approximately 1.5MHz modulation rate.

SETTINGS AND ADJUSTMENTS

Check Table 1, any setting which has been set by the factory to the values required for the application, can be skipped in what follows. See Table 1 for a list of adjustable parameters and their settings. Those parameters which can be adjusted by potentiometers will be dealt with first. To make these adjustments, the user will need a voltmeter with 1% basic accuracy and 0.1mV resolution for voltages below 0.4V. See Figure 3 for probe points for each adjustment. Ground meter or scope at input connector for all but the laser current measuring. For this, use the post grounds for each of the current test points. These grounds give effectively a differential measure across the sense resistors.

TEC Temperature Setting

Different Laser manufacturers use different thermistors in their products. Although, 10K value at +25°C is the most common value and is what the controller circuitry is designed for, the thermistor curves are not identical. To assure accurate temperature settings a chart of resistance vs. temperature is needed for the thermistor in question. Look up the value at the desired operating temperature, and use the formula below to determine the measurement point voltage for that thermistor resistance. Adjust the measured voltage to the calculated value.

$$V_{set} = \frac{1.5 * R_{th}}{(R_{th} + 10000)}$$

EQUATION 1 – THERMISTOR RESISTANCE TO VOLTAGE

Current Limit Adjust

Determine the desired setting of limiting current. Use the following formula to determine the set point voltage at the current limit measurement point:

$$V_{set} = Current\ Limit * 1.918$$

EQUATION 2 – CURRENT LIMIT SET POINT VOLTAGE

Preliminary Offset

Adjust for 0 volts at the measurement point.

Final Offset and Laser Bias Current

This setting must be made with the laser enabled. The current calibration at the measurement point is 1mA/mV. Adjust for the desired DC bias current. There are two measurement points and their corresponding grounds. The laser current is the sum of the two. Should the desired current be 0, approach the final setting from a few millivolts positive and stop turning as soon as the voltage at the test point stops moving. The voltage can't be reduced at the test point any further, but if the adjustment is turned more negative, the current pulse will be clipped, and will not reach its full value based on the scale (0.333A/V).

If it is desired to use a digital signal into the input, the laser bias can be offset negative to accommodate the logic “0” voltage of the source. Put the logic “0“ signal in and adjust for the desired bias current. If the logic “0” stability vs. power supply, or temperature is not adequate, use an emitter follower to drive the input. When turned off, the 50 Ohm input resistor will drag the input down to a few micro volts. Set the Current Limit to the actual value of current (see above) you desire, and it will clip the Logic “1” level to the appropriate value. In this configuration an “over current” output pulse will be produced for each input pulse.

Laser Fire Output Threshold

Because there are large variances in the back facet photo diode output with laser current also variations in the laser operating conditions, a simple setting is not given. If your application does not require the laser fire signal, skip this section. If the laser operation will be at various currents as opposed to a single drive level, this procedure will attempt to obtain a laser fire signal across the operating range. Pulse unit at the minimum current that will be used. Adjust the setting down until the signal is displayed. There are some lasers which have very low BFM sensitivity. Some of the BFM diode response times are very sluggish. These were designed for use in the CW mode, or at least with long pulses. The bandwidth of the laser fire circuitry is sufficient to pick up fast pulses of small amplitude with fast BFM diode response. BFM diodes with low and slow response may be inseparable from the circuit noise.

TEC Controller Maximum Current and Voltage Parameters

Should these parameters need to be reset from the factory settings for a particular laser, proceed as follows:

Max voltage

Determine the maximum required. This can be set no higher than 4.3V. Use the following equation to determine the value to install for R71.

$$R71 = \frac{60000 - (10000 * \ V_{TEC})}{V_{TEC}}$$

EQUATION 3 – R71 VALUE CALCULATION

Max current

Determine the maximum required. This can be set no higher than 3A. Use the following equation to determine the value to install for R70.

$$R70 = \frac{2.6 \times 10^5 * \ I_{TEC}}{50 - 13 * \ I_{TEC}}$$

EQUATION 4 – R70 VALUE CALCULATION

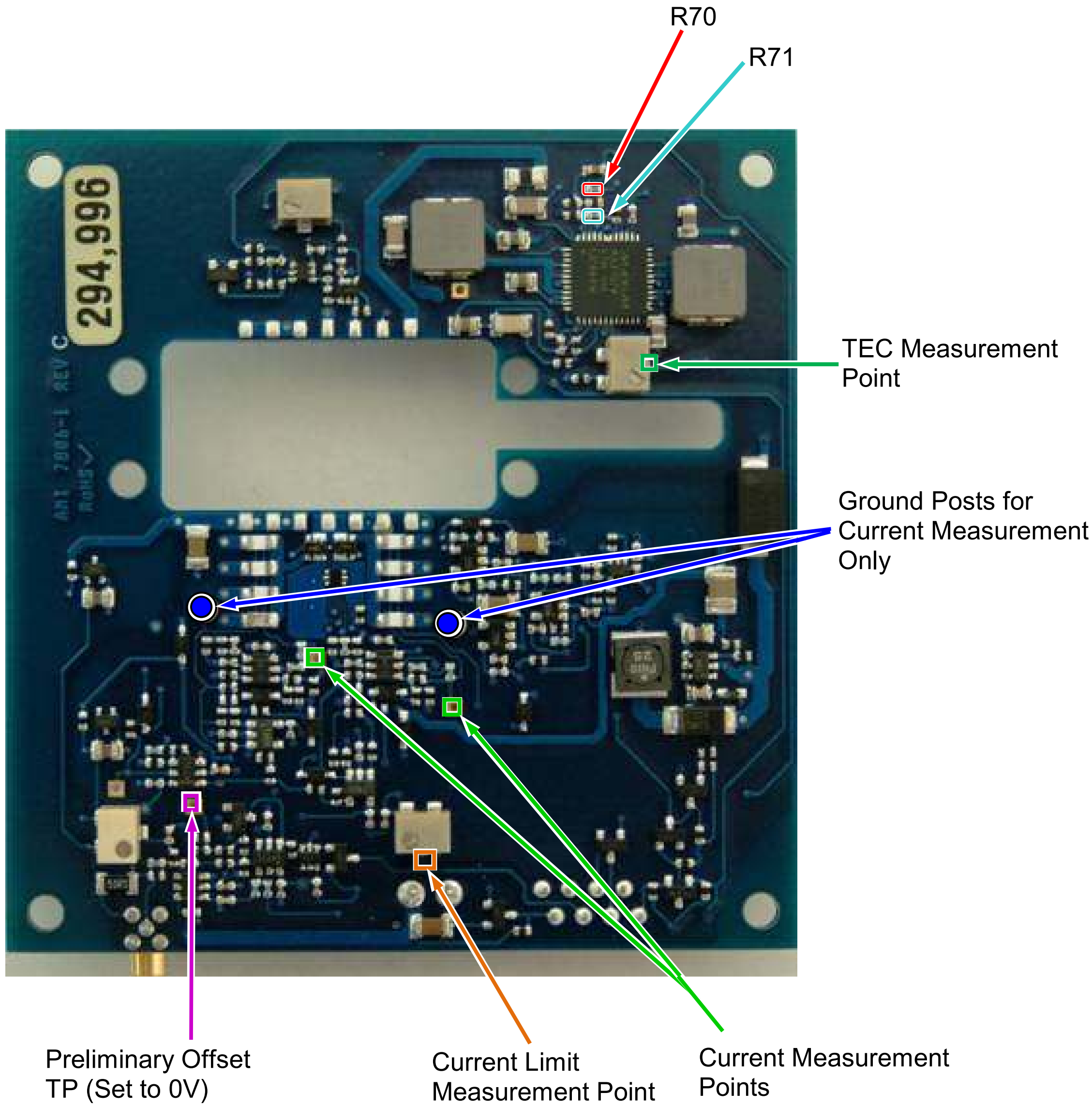

FIGURE 3 – ADJUSTMENT POTENTIOMETERS AND MEASUREMENT POINTS

Board Outline and Dimensions