

# FlexMod P3 Users Manual

Rev. 1.3 ©2010 Nautilus Integration

The FlexMod P3 driver is an advanced high speed, high current capability, linear current-regulated diode driver with a very small footprint. It is designed for flexible industrial, experimental, and custom optical applications, and is also fit for driving current-regulated loads such as high-power LEDs and small current controlled heating and cooling devices. The FlexMod driver is capable of driving diodes from 100mA to 4A with a modulation bandwidth of DC-160kHz and with no overshoot.

## Features:

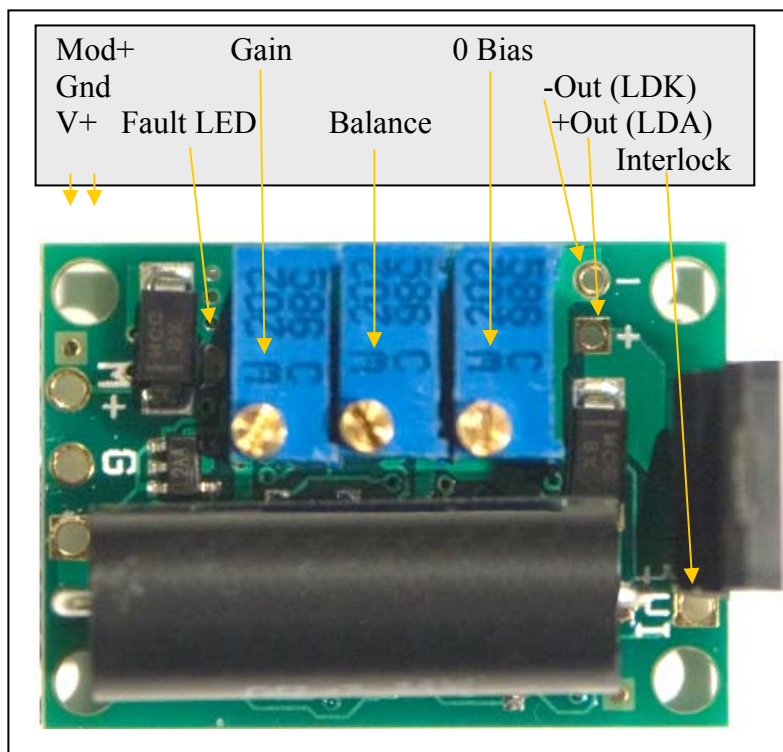
- Power input: 5-24VDC
- Analog Input: 0-5.0V, clamped for protection.
- TTL input: 0-5V Off-On
- Gain setting: 25 turn potentiometer 0-4A output.
- Bias setting: 25 turn potentiometer range 0-1A output
- Output loop circuit sensing
- Interlock loop
- Positive regulation (high side)
- Input ESD protection
- Output ESD protection (of the driver)
- Soft-start delay
- Dimensions: 1.25"x0.87" (32x22mm)

## Disabling Soft Startup Safety Delay:

The 7 second startup delay can be disabled by applying a solder bead jumper between the rightmost pads of the 5-pad series at the bottom left of the top side of the driver.

## Description of Operation:

The FlexMod P3 can be considered a sophisticated voltage to current converter with added diode protection and safety features. It can accept input power in the range of  $V_{Diode} + 1.5V$  up to 24V and the output voltage will match the load requirement. Typically, a laser diode has a lasing threshold current above which its light output increases rapidly. In order to keep the diode in a low impedance and ready state, a below-threshold bias current is passed through the diode continuously, even with 0 modulation input. This current is set with the 0-bias potentiometer. Modulation is input to the M+ connection on the PCB. Driver output current will rise linearly with respect to



Caution: Discharge the output contacts after turning the driver off before connecting the load.

Caution: Static sensitive components. Ground yourself and your soldering workstation while handling.

Caution: Sensitive elevated components. Do not twist or excessively bend or internal lead disconnection may result.

Parameter	Specification	Unit
Input Voltage (Vdd)	5 - 24	V
Max Output (Diode) Voltage	Vdd - 1.5	V
Output Current	0.01 - 4.0	A
Bias Current	0 - 1000	mA
Regulation Ripple (1Hz -100kHz)	< 1.0	%
Input Impedance	99	kΩ
Maximum diode lead loop length	3	ft
Maximum continuous power dissipation	25	W

Pin	Description
M+	Modulation input connection: 0-5V
G	Power ground and modulation ground connection
V+	Power input connection: 5-24V
-	Output return (Gnd) (LDK)
+	Positive current output (LDA)
Int	Interlock connection; connect to V+ via interlock loop

modulation input up to a modulation input of 5V, at which point the driver output current will remain steady. This maximum current is in addition to the bias current and is set with the Gain potentiometer.

Upon power-up, the unit will briefly pass the set bias current and test whether the interlock is closed (interlock input at V+ potential) and the diode loop is complete. If both are ready, the bias current output will continue while a 7 second timer starts, during which time the modulation input will have no effect. After 7 seconds and if the interlock remains closed, the driver will go into operation mode and accept modulation input control. If the interlock circuit is open initially, or if the output is open circuit, a red LED will illuminate and no current will be passed to the laser diode until the diode circuit is complete and the interlock reset.

If, at any time during operation the output circuit goes open, the driver will shut off output and illuminate the red LED until the output circuit is closed and the interlock is reset.

If you intend to use several drivers at once, the interlock connections can be ganged with each Int input tied together.

## Setup and operation:

### Preliminary setup:

- 1) Locate a 5 to 24V regulated (preferably) power supply. If the power supply is not regulated (typical of wall-warts), measure its output voltage to verify that it is at or below 24V. Maintain a closed interlock throughout setup.
- 2) Solder lead wires of the appropriate length to the board connection holes, but to not connect the load yet.
- 3) Attach the transistor to a heat-sink (necessary for modulation currents over 250mA or power supplies over 5.5V). The included heatsink is adequate for currents up to 500mA with a 5V supply. If the heatsink gets too hot to touch during operation, switch to a larger one.

### Current Adjustment:

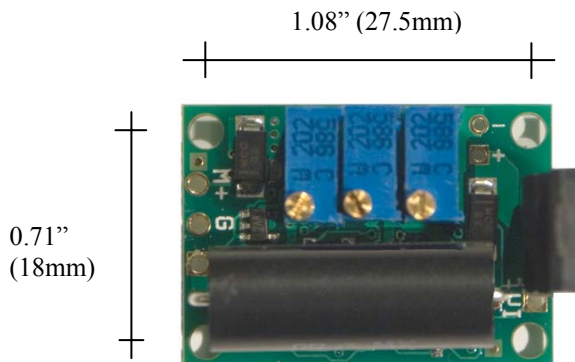
- 4) Connect the output wires to your multi-meter, set to Amps mode.
- 5) Short the modulation input wires together and power on the driver, you should get a reading on your multi-meter of 50-150mA. Adjust 0Bias until you reach the desired standby current. Clockwise turns the current up, counterclockwise turns it down.
- 6) Un-short the modulation input wires and while maintaining power to the driver apply 5V to the Mod+ input and adjust gain to the maximum desired current. A clockwise adjustment increases current.

### Final Connection:

- 7) Power off the driver and temporarily short the output. Connect the output wires using the shortest length possible (no longer than 3 feet total length) to the load. Observe proper polarity. (Inner + pad connects to diode anode, outer – pad connects to cathode and is grounded.)
- 8) Connect the modulation input to your DAC or modulation test apparatus. Make sure that no wires are crossed, and the board is not contacting any electrically conductive surface.
- 9) Power on and test your application!

### Balance Adjustment (optional):

The Balance adjustment is set at the factory, however it can be tuned in some situations. If your application has a power source with output that varies more than a few volts during operation, you may want to adjust the drivers balance with the central potentiometer for highest power supply rejection. Set up a power supply, test load, and output current measuring rig. Then, sweep your power supply output voltage along the range expected in your application and adjust Balance for the smallest output change.



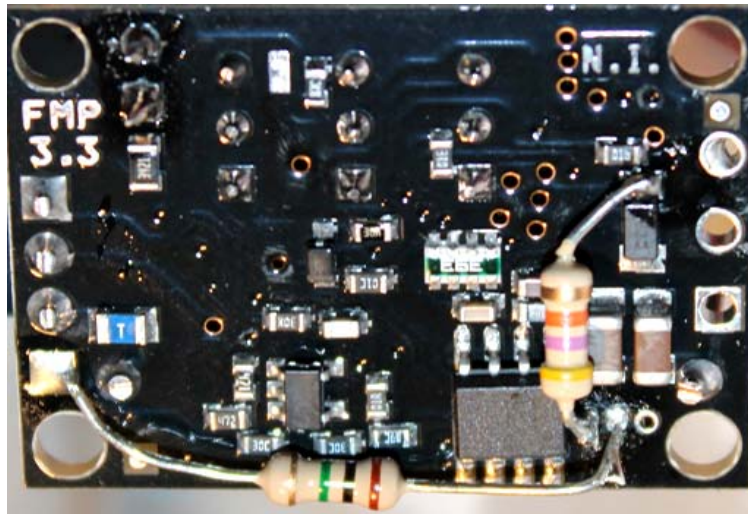
**Hole Dimensions**

## Startup Delay Disable:

It is possible to disable the startup delay of the P3 by soldering a bridge across the two rightmost pads of the group of five pads underneath the large cylindrical black resistor on top of the board.

## Standby LED Beam Suppression:

If ordered, your driver is capable of suppressing the standby glow produced by the laser when modulation is off. To enable this feature, you must solder two resistors to the PCB. First, solder the 47k Ohm resistor from the top end of the small black component to the leftmost via hole visible of the set of 3 on the bottom right, as shown in the photo. Second, solder the 1 Meg Ohm resistor from the interlock pad to the middle of the 3 vias visible at the bottom right. With standby beam suppression, the interlock and open output loop sensing functions are not available.



If soldering both resistors to the via holes is challenging, you may also solder either or both of those ends to the corresponding larger pad on the other side of the board. Do not short the vias or pads as doing so will impede operation of the unit. Do not allow the resistor leads to short against other components on the PCB. Check for this before powering on.

## Fuse:

The FM P3.3 is equipped with a protection fuse in case of a short or power component failure. It is rated at 5A, and is the blue component marked 'T' at the left in the photo above. In case of no output, check the fuse for continuity. Replacement fuses are available from Digikey, part #MFU08055.00CT-ND.

## Live Current Measurement:

It is possible to measure and adjust the output current of the P3 while it is active. First, power the driver off. Second, clip leads from each side of the large black cylindrical resistor on top to a multimeter and ensure the multimeter is set to measure volts or millivolts and that its leads are plugged into the correct jacks. Next, power the driver on. The multimeter will show a reading, and the current output is 1 Amp per 200 milliVolts. For example, if you read 300mV on your multimeter (0.3V) the driver output will be 1.5A at that time.