

## **Model "APM" LASER DIODE OEM SYSTEM INSTRUCTIONS**

### **DRIVE CURRENT DIGITAL CONTROL OPTION - D2**

*with internal regulator*

### **Introduction**

These instructions are specifically intended to explain the operation of the system's digital control option only. For a more detailed description of the operation and functions of the basic system see the technical paper **TP-APM/01**.

The Drive Current Digital Control Option (*option D2*) is a digital interface between the laser diode drive circuit and a controller supplied by the customer. Unique in the laser diode OEM system industry, this interface replaces the standard mechanical potentiometer used to adjust the drive current to the laser diode. Using this interface the system is not only digitally controllable but is also TTL compatible.

The Digital Control Option D2 allows the operator to precisely calibrate the drive current, store a setting in the unit's memory and retain it for future use. With the added control comes several benefits.

The stability of the system is greatly improved. No longer can someone easily adjust a manual potentiometer and change the laser output. This means the system can more easily maintain compliance with FDA regulations. It also eliminates the need to physically handle the system and risk accidental misalignment.

The safety and reliability of the system is enhanced. By eliminating the easy access to the current adjustment, the laser is protected from inadvertent excessive current adjustment and laser burn-out. Also, the system can be preset to start-up at low or no laser output, no matter what adjustments were made before the previous shut-down. This reduces safety hazards and prevents overshoot of the drive current and helps to promote the long life of the laser diode.

### **Operation Notes**

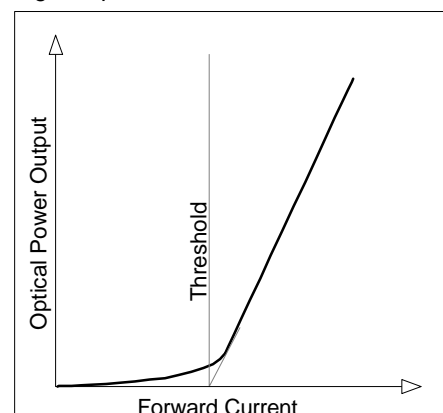
The Digital Control option utilizes a solid state nonvolatile potentiometer. The potentiometer is a resistor array composed of 99 resistive elements. Between each element and at either end are tap points accessible to the wiper element, giving 100 possible resistance settings. The position and movement direction of the wiper element is controlled by pulsed inputs through the three wire leads exiting the system (see "Lead Configuration" below), one step for each pulse. The position of the wiper can be stored in the system's nonvolatile memory and then be recalled upon a subsequent power-on operation.

When the system is powered down, the last resistance position stored will be maintained. When the power is restored, the contents of the memory are recalled and the system is reset to the value last stored. The operator may change the resistance setting without having to store the latest position in memory. The new setting would be maintained until changed by the operator or until a power off/on cycle recalled the previously stored setting.

This would allow the system to always power-on to a preset value stored in nonvolatile memory; then during system operation minor adjustments could be made. The adjustments might be based on user preference, system parameter changes due to temperature drift, etc.

*Fig. 1: Although the resolution of the potentiometer is linear and each step can therefore be calculated, the laser diode is non-linear and each has its own distinct threshold current (the point at which the laser begins to produce output). Therefore, the operator will have to send a number of pulses, if beginning from zero, before the unit will begin to lase.*

Fig. 1 Optical Power vs. Forward Current



## Lead Configuration

The three input wires that comprise the interface are described as:

- Chip Select ( $\overline{CS}$ )** The Digital Control option is selected when the ( $\overline{CS}$ ) input is low (or connected to ground). The current counter value is stored in nonvolatile memory when ( $\overline{CS}$ ) is returned high (or ungrounded) while the ( $\overline{INC}$ ) input is also high (or ungrounded). After the store operation is complete, the Digital Control will be placed in the low power standby mode until it is selected once again.
- Increment ( $\overline{INC}$ )** The ( $\overline{INC}$ ) input is negative-edge triggered. Toggling ( $\overline{INC}$ ) will move the wiper one step for each toggle, and either increment or decrement the counter in the direction indicated by the logic level on the ( $U/\overline{D}$ ) input.
- Up/Down ( $U/\overline{D}$ )** The ( $U/\overline{D}$ ) input controls the direction of the wiper movement and whether the counter is incremented or decremented. When the ( $U/\overline{D}$ ) input is low (or connected to ground) the wiper movement will be down. While ( $U/\overline{D}$ ) input is high (or ungrounded) the wiper movement will be up.

Fig. 2: The diagram not only shows the lead identification but also illustrates a possible TTL hookup. **The interface requires 5VDC as the high logic state.** This voltage is provided by an internal regulator. The larger red/black leads (22 ga.) are the 12V inputs.

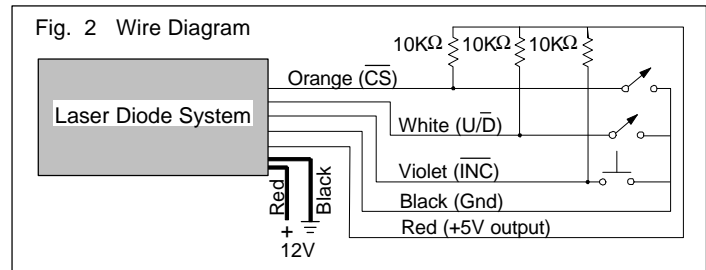


Fig. 3 Connector/Pin Identification

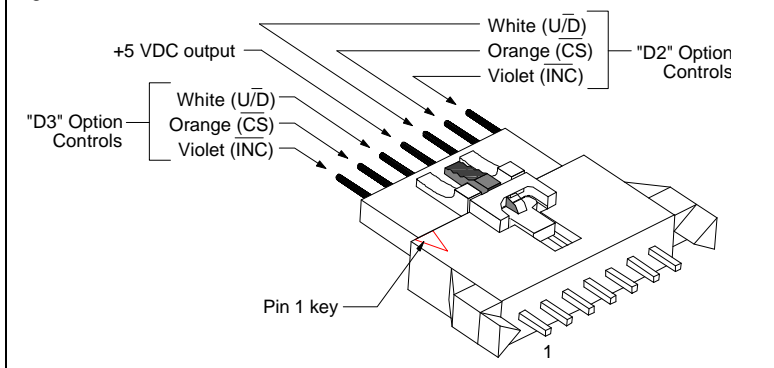


Fig. 3: Each digital control option has the same three wires/controls, refer to Figure 2 for an illustration of how each set of wires can be used to operate each control. Refer to this pin identification for the proper wire group for each control.

From the factory, the connector has a shorting wire soldered across the 7 pins. This enables the system to be operated immediately upon receipt without additional wiring. The unit will turn on to the factory stored settings.

The shorting wire should be removed and the control wires connected as in Fig. 2 to make adjustments.

## Operating Procedure

To illustrate the Digital Control operating procedure, we will use the example TTL hookup described in Fig. 2 above:

**Select The Control:** In order to operate the control or make any adjustments, the switch on the Orange ( $\overline{CS}$ ) lead must be closed. Open it to deselect the control (as outlined below) and prevent further adjustments.

**Select Direction:** Using the switch on the White ( $U/\overline{D}$ ) lead, select the direction of the adjustment you want to make.

**Current Adjustment:** Repeated closure, or toggling open/closed, of the momentary push button switch on the Violet ( $\overline{INC}$ ) lead will change the drive current in one increment for each toggle. The drive current will either increase or decrease depending on the setting of the switch on the White ( $U/\overline{D}$ ) lead.

**Storing in Memory:** In order to store the drive current setting in memory, deselect the control by opening the switch on the Orange ( $\overline{CS}$ ) lead while the ( $\overline{INC}$ ) button is not depressed. The combination of these two switches being open saves the drive current setting to memory. If you do not want to store the drive current setting in memory, or you want to retain the previous memory setting, then hold down the momentary push button switch ( $\overline{INC}$ ) while you open the ( $\overline{CS}$ ) switch, thus deselecting the control.



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