

MODEL "APM" LASER DIODE OEM SYSTEM INSTRUCTIONS

THERMOELECTRIC DIGITAL CONTROL OPTION - D3

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 system see the technical paper **TP-APM/01**.

The Thermoelectric Digital Control Option (option D3) is a digital interface between the peltier drive circuit and a controller supplied by the customer. It allows the operator to precisely calibrate the operating temperature of the laser, store a setting in the unit's memory and retain it for future use. Unique in the laser diode OEM system industry, this interface replaces the standard mechanical potentiometer used to adjust the case temperature of the laser diode. The case temperature of the laser diode is monitored and adjusted using the feedback from a temperature sensor attached to the laser's case. Using this interface the system is not only digitally controllable but is also TTL compatible.

Operation Notes

The Digital Control option utilizes a solid state nonvolatile potentiometer. The potentiometer is a resistor array composed of 99 resistive elements with a total value of 10K Ω . 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.

The standard configuration has the full temperature range adjustment, 10° to 35°C. At the equidistant resistance setting of 5K Ω the temperature setting will be 25°C. Working through the temperature range with the 99 resistive steps you can see that this relationship is non-linear. If you have specified a smaller temperature range adjustment window, such as 10° to 25°C for example, then the 99 resistive steps within this range will give you a finer temperature adjustment. You can see from Figure 1 the implications of this adjustment resolution.

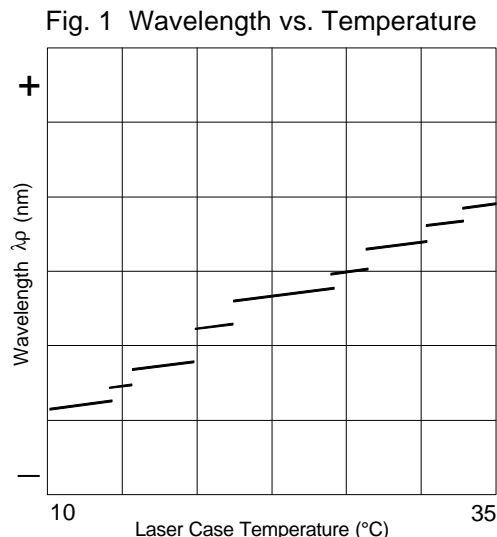


Fig. 1: As you can see the wavelength will change dramatically, as well as the spectral quality of the laser, as the temperature changes. The blank areas between each step indicate areas during the mode change where the system produces unstable lasing and minimal coherence.

This graph is for illustration only. The actual wavelength characteristics will vary because each laser will have individual and distinct lasing parameters and the position and size of each step will vary with drive current and differ from diode to diode.

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 input is low (or connected to ground) the wiper movement will be down. When the 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.

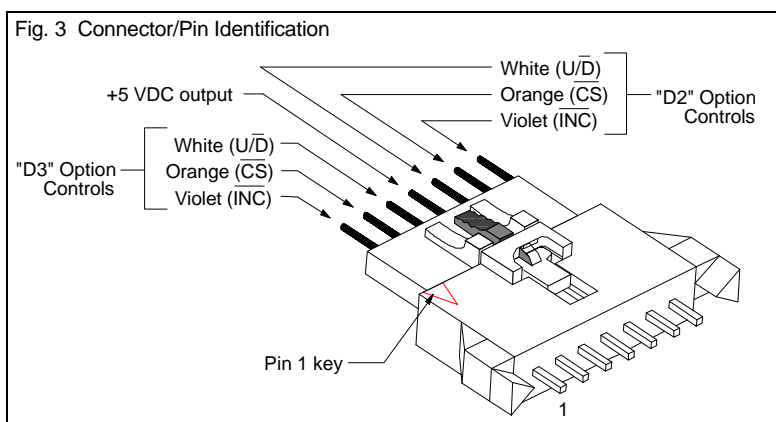
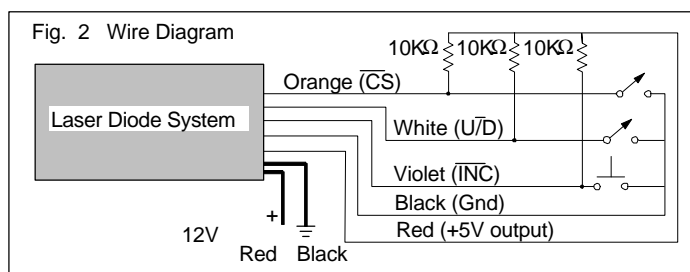


Fig. 3: Each digital control option has the same three wires/controls, refer to Fig. 2 for an illustration of how each set of wires can be used to operate each control.

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.

Temperature Adjustment: Repeated closure, or toggling open/closed, of the momentary push button switch on the (\overline{INC}) lead will change the laser case temperature in one increment for each toggle. The laser temperature will either increase or decrease depending on the setting of the switch on the (U/\overline{D}) lead.

Storing in Memory: In order to store the 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 laser temperature setting to memory. If you do not want to store the 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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