

# **“Rainbow Slice”**

## **Macintosh Color Classic RGB Power LED / Button Board**

### **Instruction Sheet**

#### **1.0 Introduction:**

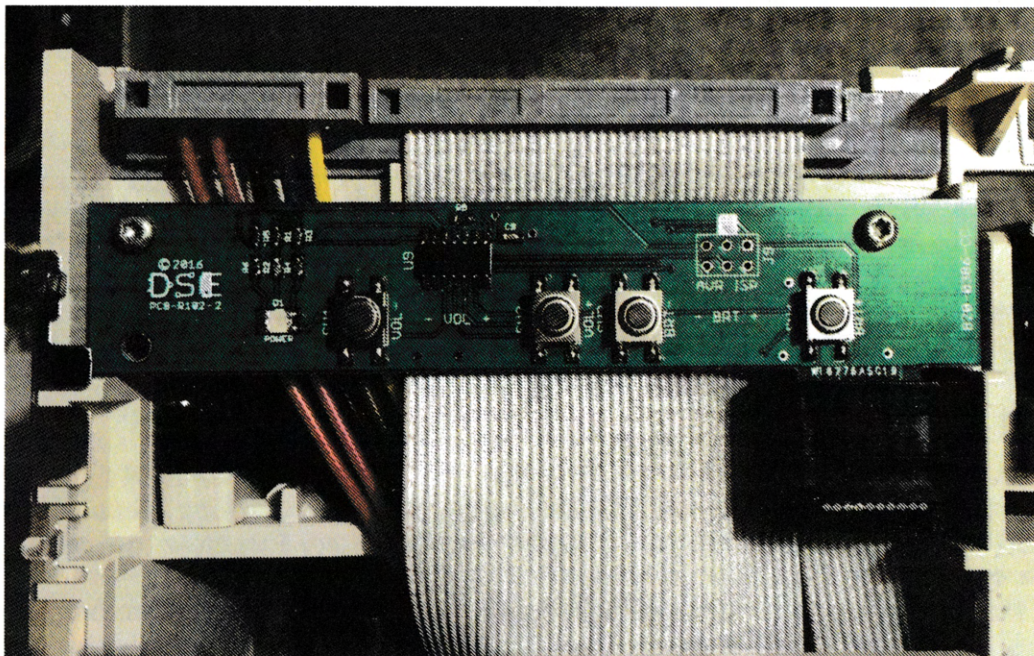
Congratulations on your purchase of the “Rainbow Slice” replacement Power LED/Button Board for the Macintosh Color Classic computer! This board replaces your Color Classic’s factory green power LED with an RGB led driven by a small micro-controller to provide eight modes of coloration to the LED. The modes are selected and programmed by using the Color Classic’s front panel Volume and Contrast buttons, while still retaining the original functionality of those buttons with some exceptions(see operating procedure section).

#### **2.0 Installation:**

Installing the Rainbow Slice board into your Color Classic involves extensive disassembly of the unit and should only be performed by a technician experienced in the repair of CRT based monitors/equipment. Your Color Classic contains dangerously high voltages that may be retained for some time after power off or unit unplugging. Additionally, the metal EMI shield has very sharp edges and corners! Neither the creator nor the seller of the Rainbow Slice board will be liable for any injury to persons, property, or to the Color Classic itself as a result of improper installation or insufficient precautionary measures. This PCBA was assembled using lead based solder, so please exercise the same precautions in handling/storing as you would take with the other PCBs in your vintage machine which also utilize lead-based solder.

#### **2.1 Note to the installer:**

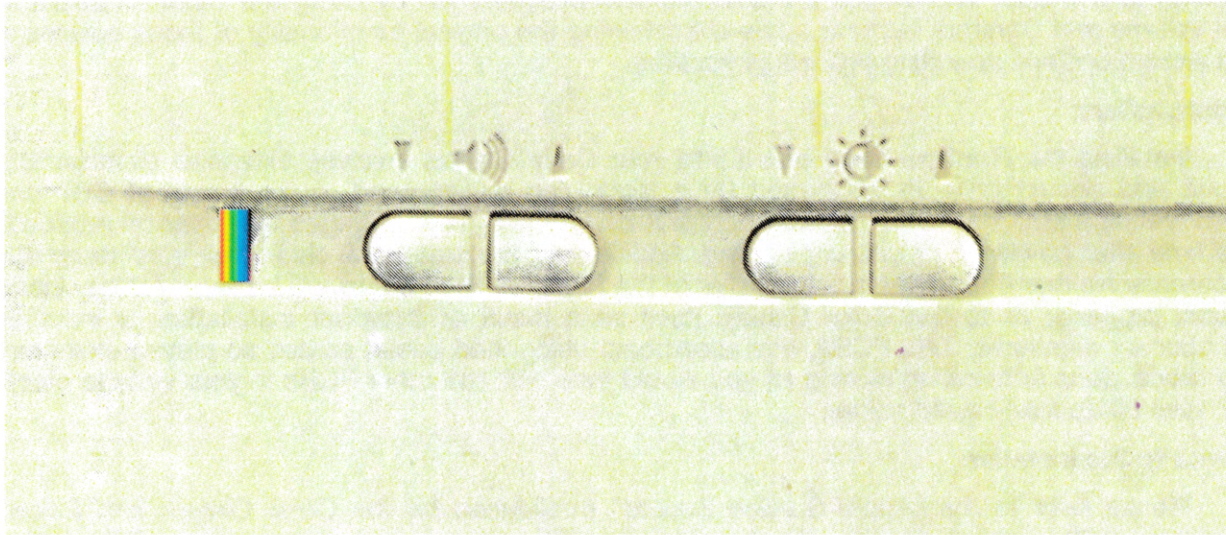
Please refer to the “Apple Service Source” publication for the Color Classic and follow all instructions with respect to the “Pushbutton Board” removal and replacement. This includes disconnection from AC power, removal of the rear cover and analog board, separation of the chassis from the front bezel, and removal of the bottom shield. Anti-static protection is advised for handling of any of the boards including the Rainbow Slice board, which contains a CMOS device. The above summary is not intended to serve as a comprehensive installation guide, nor to be construed as encouragement for non-experienced personnel to attempt this installation. For installer reference only, below is a photo of the board after installation in the chassis and just prior to re-fastening the front portion of the bottom shield.





### 3.0 Operating Procedure:

Operating the Rainbow Slice is easy! From the “factory” it comes preconfigured in “Rainbow Flurry” mode, but can be programmed to operate in eight different modes, including a temperature sensing mode! Each LED mode has one or more adjustments which can be made as well. When the mode and adjustment parameters are “Saved” to the MCU’s onboard EEPROM(explained in detail later), your Rainbow Slice board will retain the current settings even through resets or power cycles of your Color Classic! For the purposes of these instructions refer to the following photo of the front panel buttons on the Color Classic:



The buttons normally control speaker volume and the screen contrast. In the instructions we’ll simply refer to the buttons(as seen from left to right) as V-, V+, C-, and C+.

There are three types of button press that the Rainbow Slice board recognizes: short presses( from roughly 0.1 seconds to just under 1 second), long presses(about 1 second), and extra long presses(about 5 seconds). Long and extra long presses are used to put the Rainbow Slice board into one of four alternate operating modes: Primary Parameter Adjust, Secondary Parameter Adjust, Self Test Mode, or Restore Factory Defaults. While in one of the two parameter adjust modes, short button presses control different functions(as described in the following sections). The combination of different button depress timings and the four alternate modes allow the Rainbow Slice to “override” the volume and contrast buttons to create a sophisticated user interface.

#### 3.1 Normal Operating Mode:

When you first power on the Color Classic, the Rainbow Slice is in the “Normal” operating mode. In this mode, short button presses behave largely as they did on your stock Color Classic with a couple of minor exceptions: First, short button press actions occur when the button is released, unlike with the stock button board where the actions happen on the button press. Second, you can no longer press and hold a button to repeat volume or contrast steps. Both of these differences are because long button presses are used to set the Rainbow Slice board into one of its various programming or testing modes as discussed below.

#### 3.2 LED Mode Selection/Parameter Adjust Modes:

When you perform a long press of the V- button, the LED will flash **GREEN** three times and will enter the Primary Parameter Adjust Mode. Similarly, when you perform a long press of the V+ button, the LED will flash **BLUE** three times and you will enter the Secondary Parameter Adjust Mode. While in either of these operating modes, short presses of the V-/V+ buttons will cycle you through the eight available LED Modes. The Rainbow Slice defaults to Mode 6(**Rainbow** Flurry) from the factory.



Short presses of the C-/C+ buttons adjust the either the Primary or Secondary parameters for the currently selected LED mode according to the table below:

| LED Mode | LED Behavior            | Primary Adjustment   | Secondary Adjustment  |
|----------|-------------------------|--|---|
| 0        | RED Only                | Coarse Brightness Adjust(16 Steps)                                     | Fine Brightness Adjust(256 Steps)                                     |
| 1        | GREEN Only              | Coarse Brightness Adjust(16 Steps)                                     | Fine Brightness Adjust(256 Steps)                                     |
| 2        | BLUE Only               | Coarse Brightness Adjust(16 Steps)                                     | Fine Brightness Adjust(256 Steps)                                     |
| 3        | RGB Combo               | Coarse Brightness Adjust(16 Steps)                                     | Fine Brightness Adjust(256 Steps)                                     |
| 4        | WHITE Only              | Coarse Brightness Adjust(16 Steps)                                     | Fine Brightness Adjust(256 Steps)                                     |
| 5        | Rainbow                 | Coarse Step through spectrum (48 steps)                                | Fine Step through spectrum (768 steps)                                |
| 6        | Rainbow Flurry(default) | Coarse speed adjust of sweep through rainbow colors(16 steps)          | Fine speed adjust of sweep through rainbow colors(64 steps)           |
| 7        | Temperature Sense       | Adjust Temperature Offset calibration parameter(+/-100°C)[Default 0°C] | Adjust Temperature Span calibration parameter(4°C-20°C)[Default 12°C] |

It is possible to stay in the overall programming mode by moving back and forth between Primary Parameter Adjust and Secondary Parameter Adjust modes with alternating long presses of either the V- or V+ buttons. Once you have chosen the LED mode you desire and adjusted it's parameters, simply Long Press and hold the button that corresponds to the current programming mode you are in(V- for Primary or V+ for Secondary). The LED will flash **RED** three times to alert you that the settings have been written to EEPROM and the Rainbow Slice will return to normal operating mode. If you power down the Color Classic while still in an active parameter adjust mode without performing this final step, you will lose the changes you made to the LED Mode and Parameters.

Many modes, like the brightness adjustment modes and the rainbow color "step", will "wrap around" in parameter value if you adjust past the maximum or minimum values. Other modes, like the Rainbow Flurry speed adjust and the Temperature mode calibrations will "hard stop" when you hit the minimum or maximum limits. This is denoted by a single **RED** LED flash when you attempt to adjust past the limits. In addition, since the Temperature Span calibration parameter is somewhat tricky, the LED will blink **OFF** briefly for each button press to help you "count" to the value you wish to set. See Section 4 for more information on Temperature Sense calibration settings.

### 3.3 Self Test Mode:

An extra long press of the C- button will cause the Rainbow Slice to perform a brief self test. During the self test, none of the buttons perform any function nor will they respond until the test has completed. The self test will first check the **RGB** LED by cycling through the following colors: **RED**, **YELLOW**, **GREEN**, **CYAN**, **BLUE**, **MAGENTA**, and finally **WHITE**, for about 1.0 second each. Next the self test will perform three volume down steps, three volume up steps, three contrast down steps, and three contrast up steps, each about 0.5 seconds apart. While the volume and contrast steps are tested, the Color Classic should respond to the automated button presses. When the self test is complete, the Rainbow Slice will revert back to normal mode and the previously chosen LED mode.

### 3.4 Restore Factory Defaults Mode:

In the case where you would like to return the Rainbow Slice to its factory defaults(handy if you get a little "lost" in the temperature calibration), simply perform an extra long press of the C+ button. The LED will flash **RED** five times to signify that all parameters and settings have been reverted to the factory defaults. The Rainbow Slice will then revert back to the Normal operating mode.



## 4.0 Temperature Sense Calibration:

One thing to keep in mind when dealing with the temperature calibration is that the measurement to color correlation is “all relative”. Depending on the chosen offset and span, the measurement points for “cold” or **BLUE** and “hot” or **RED** will be based around the offset and span at the time of calibration. Choosing the temperature span, which is considered an advanced setting, may end up being an exercise in trial and error. Some users may want to see a very slow or gradual change in color based on temperature, and some may want to see a lot of “action” and as such would want to make the temperature span narrower. The factory default span of 12°C or roughly 22°F was intended, after setting the offset, to allow for measurements between 68°F which may be the internal temperature in a cool room when the machine has not been used for many hours and 90°F which may be reached inside the Color Classic after considerable power on time and/or use in a room that is hot to begin with. If that is the desired goal, the suggestion would be to start with a “cold” machine that has acclimated to the temperature of the room and perform just the Temperature Offset Adjustment described below only.

### 4.1 Temperature Offset Adjustment:

To perform an initial Temperature Offset Adjustment, power on the Color Classic and put the Rainbow Slice immediately into the Primary Parameter Adjust Mode(no need to wait for the machine to fully boot, the Rainbow Slice is fully operational once the machine is powered on). Then, select the temperature sense LED mode(Mode 7) if it was not already “saved” in that mode from a previous session. Next simply adjust the temperature offset using the C-/C+ buttons until the color of the LED matches the “feel” of the room temperature. If the room is very cool, adjust the offset down until the LED is just transitioning from **CYAN** to **BLUE**. If the room is somewhat warm, adjust until the LED is **GREEN**. If the room is hot, or the machine has already been powered on for a considerable time, adjust the offset up to produce a color between **YELLOW** and **RED**. It's not an exact science; it's meant to be fun! Don't forget to Long Press the V- button to commit the calibration values to EEPROM so they are available at subsequent power-ups.

### 4.1 Temperature Span Adjustment:

Your Rainbow Slice board is programmed from the factory to respond to temperatures in a roughly 12°C(~22°F) span relative to a temperature offset that can be adjusted in the above LED Mode Selection/ Primary Parameter Adjust Mode. This should cover the internal operating temperatures of your Color Classic such that after an initial offset calibration(see section above), the power LED will be a **BLUE** shifted color when the machine is cooled down to a more **RED** shifted color when the machine has fully warmed up. Of course ambient temperature and other environmental conditions may affect the usability of the temperature sensing mode. For that reason, an additional advanced adjustment has been provided to allow adjustment of the total temperature span that is represented by the **BLUE** through **RED** LED spectrum, adjustable from a 4°C to 20°C span. This will allow the user to vary the amount of “action” seen on the LED in response to temperature. When an adjustment is made to the temperature span, it will usually require a re-adjustment of the temperature offset parameter as well. Depending on environmental conditions, the process may require more than one iteration.

To enter into the temperature span adjustment mode, perform a long press of the V+ button. The LED will flash **BLUE** three times to inform you that you have entered the Secondary Parameter Adjustment Mode. Then select the temperature sense LED mode(Mode 7) if it was not already “saved” in that mode from a previous session. Next, use the C- or C+ buttons to decrease or increase the temperature span by 1°C each press. The LED will “BLANK” or blink **OFF** briefly for each button press to help you count the steps. Recall the factory default is a 12°C span. Once you are satisfied with the temperature span you have chosen, just perform another long press of the V+ button. The LED will flash **RED** 3 times signifying you have stored the parameter into the EEPROM and the Rainbow Slice will return to it's Normal Operating Mode.