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## The Single-Chip Color Correction/Modchip Solution (An Illustrated Example)

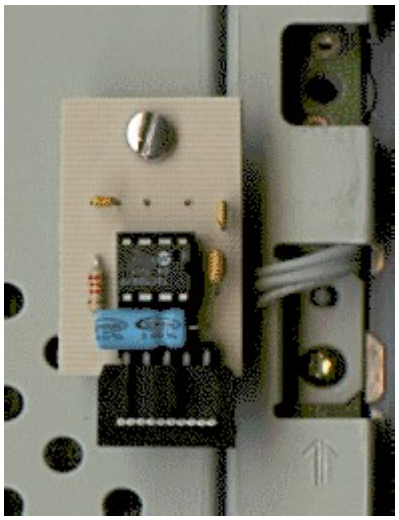
## Abstract:

This example illustrates how the single-chip color-correction plus modchip circuit can be implemented. The example is performed using an SCPH-100x console model which has a PU-8 revision mainboard. The covered topics are: module overview, module mounting, mainboard preparation, wiring to the mainboard and assembly suggestions. Note that this is not intended to be an installation manual, but rather a walkthrough of how this type of modification might be done. Note: Some 1001-series NTSC machines refuse to run PAL games. Most likely caused by the same software incompatibility that causes many Japanese models to crash when trying to run imports. Short of changing the kernel ROM, not much can be done about this.

## Disclaimer

Once again I must stress that this is not a project for beginners. It is too easy to irreparably damage your machine if you do not know exactly what you're doing. The author of these pages cannot and will not assume responsibility for any damages that may occur while attempting this project. You're on your own, folks.

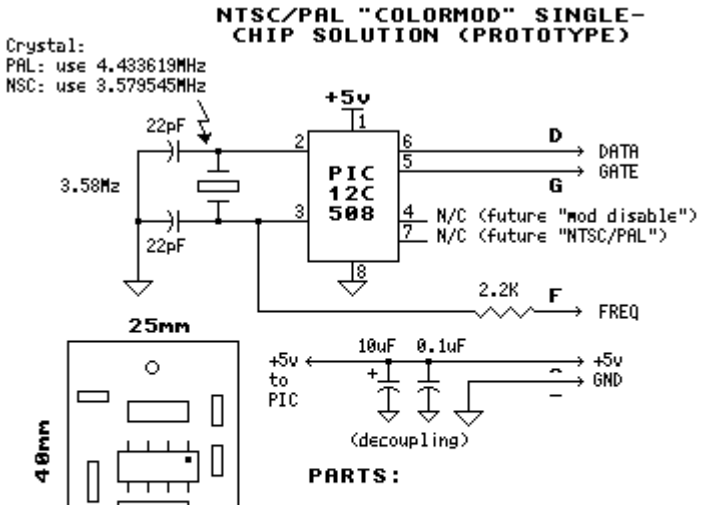
## Module Overview

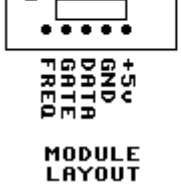


The single-chip color-correction/modchip solution (which I call **Colormod**) is a small circuit based around the already-popular PIC12C508 microcontroller used by many mod chip vendors (most of whom use my MODV53 source code). At left is an image of the prototype as installed on the upper chassis plate of an SCPH-1001 console. The board measures approximately 25mm by 40mm and implements the circuit shown below to the right.

As can be seen, the circuit is quite simple. It is a textbook implementation of a crystal oscillator as supported by the PIC12C508's internal clock circuit. The key to its dual-purpose operation is in the selection of the quartz crystal that determines the PIC's clock frequency. For PAL color, this crystal has a value of 4.433619MHz. For NTSC color, the value is 3.579545MHz. (The crystal on this module is hidden under the board--it is too tall to mount on top. A low-profile version of the crystal will fit on top, however).

As with a "standard" mod chip, the two signal lines (**data** and **gate**) are present, as are the power supply leads. The only curious component is the 2k2 resistor that connects to the "output" side of the on-chip oscillator. The other side of this resistor is what provides the colorburst clock needed for color correction, along with two small modifications to the mainboard. Two 22 picofarad capacitors



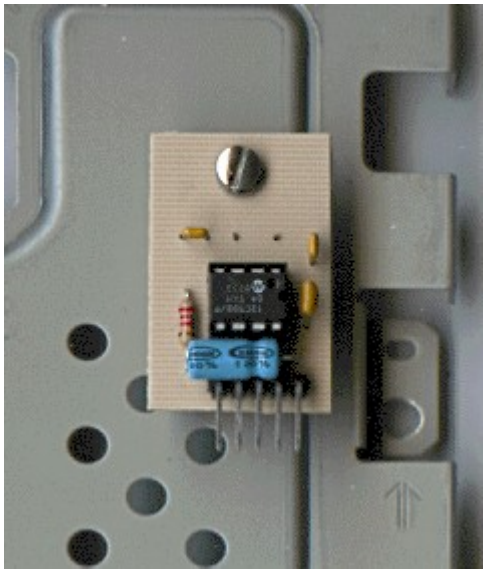



MODULE LAYOUT

22pF cap (2)
0.1uF cap (1)
10uF cap (1)
2k2 resistor (1)
crystal (1)
PIC12C508/9 (1)
PC board (1)
5-pin 0.1"
rt. ang. hdr. (1)

provide stability trimming for the oscillator; the 0.1 microfarad and 10 microfarad capacitors provide power-supply decoupling--an important thing to include in any digital circuit. The PIC is socketed for easy upgrading, if needed in the future. The module is cabled to the mainboard by a removable 10-pin dual-inline IDC ribbon cable connector, of which five pins are used.

## Module Mounting

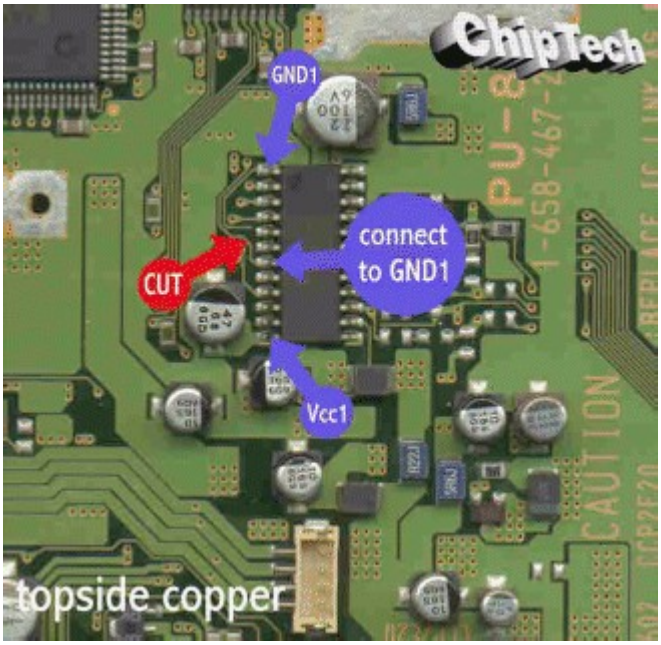
I chose to mount the module to a convenient location on the upper chassis plate for two reasons: I wanted to mount it in a solid, secure location (as opposed to sealing it up in tape and wedging it under the chassis plate as is done with many mod chips), and I wanted to make it easy to change out PIC chips. (Remove the top cover and there it is--no further disassembly or soldering/desoldering).

The module is mounted using a single 10mm (3/8 inch) spacer, screw and locknut. **The hole on the chassis plate is already there for the SCPH-100x**; I will post notes on mounting to a 55xx chassis plate as soon as I get another one to work on.

In this view, the pins of the cable header are visible just below the blue capacitor. The cable itself loops neatly under the space to the right of the module. The top cover fits over the module without any problems.

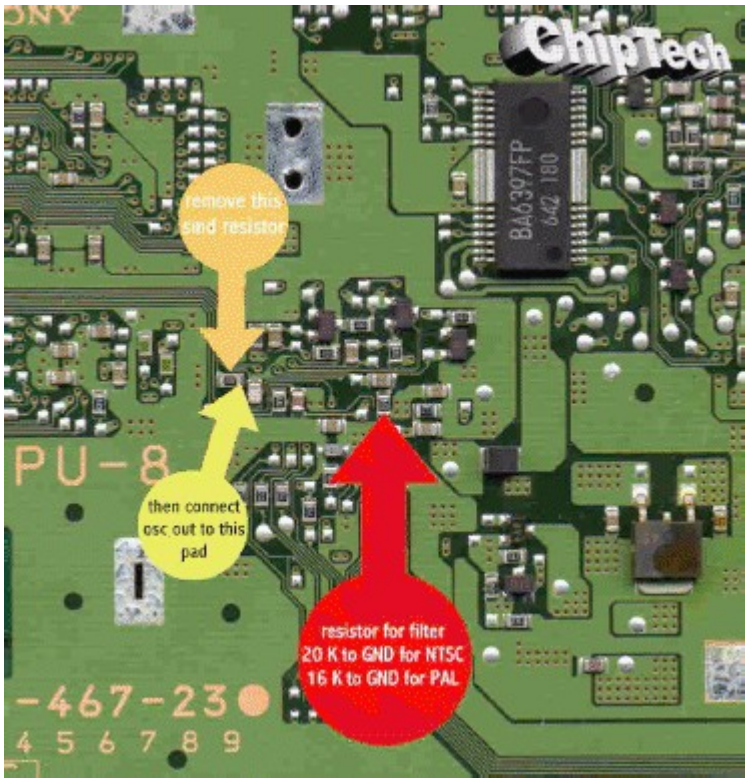
## Mainboard preparation

**CAUTION:** This is where things can get broken. If you are not experienced in hacking on circuit boards, **please** get expert help. To enlarge the image at right, click on it.




The first mainboard modification is to isolate pin 7 on the CXA1645 chip then to connect it to one of two points. **NOTE:** In this example, the color correction modifications are for a **PAL** console. Be sure to make the modification according to the image. The "S"-shaped trace indicated by the red CUT arrow should **carefully** have about 1mm-2mm of the copper removed with a sharp X-acto knife. Pin 7, indicated by the large blue arrow, should be connected to the point labeled **GND1** for a PAL machine. Use a small piece of thin, insulated wire such as the "wire-wrap" wire sold at Radio Shack stores or other electronic shops.

For an **NTSC** machine, pin 7 should be wired to the point labeled **VCC1**.



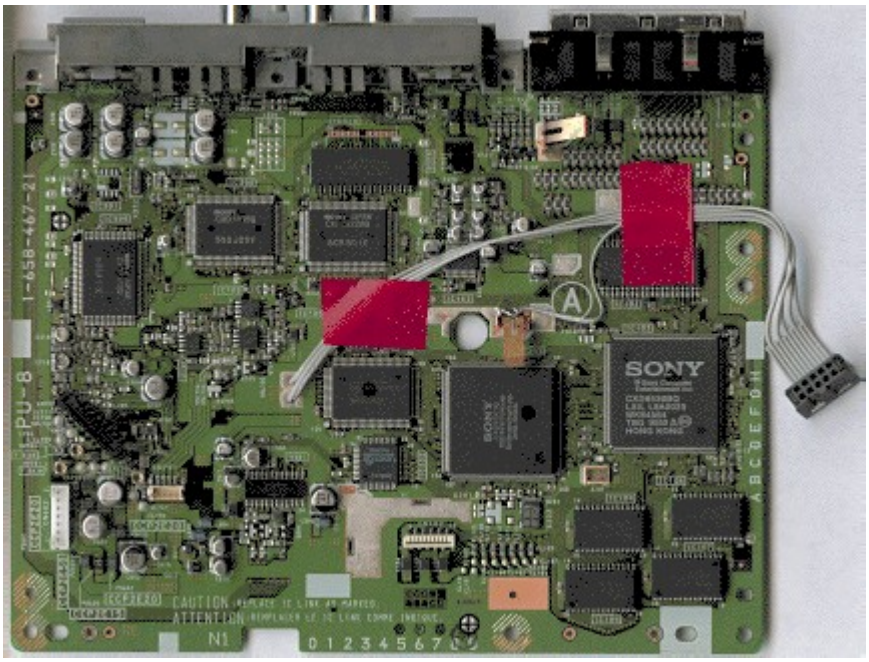

Pin 6 on the CXA1645 (the frequency input) must also be isolated. This is done by **carefully** removing the surface-mount resistor indicated by the orange arrow in the image at left. (Click on image to enlarge). The best way to do this is to use a surface-mount soldering workstation, but it can also be done using two **low** (17W max) wattage soldering irons: apply heat to both ends of the SMD resistor and nudge it free. Don't spend more the a few seconds heating the resistor or you might begin to pull up the solder pads. This procedure is the same for both PAL and NTSC machines.

The right-hand solder pad will be used as a wire connection point for one of the Colormod module's cable leads.

(The resistor indicated by the red arrow does not need to be changed).

(Thanks to Walter Meyer for these two images).

## Wiring to the Mainboard



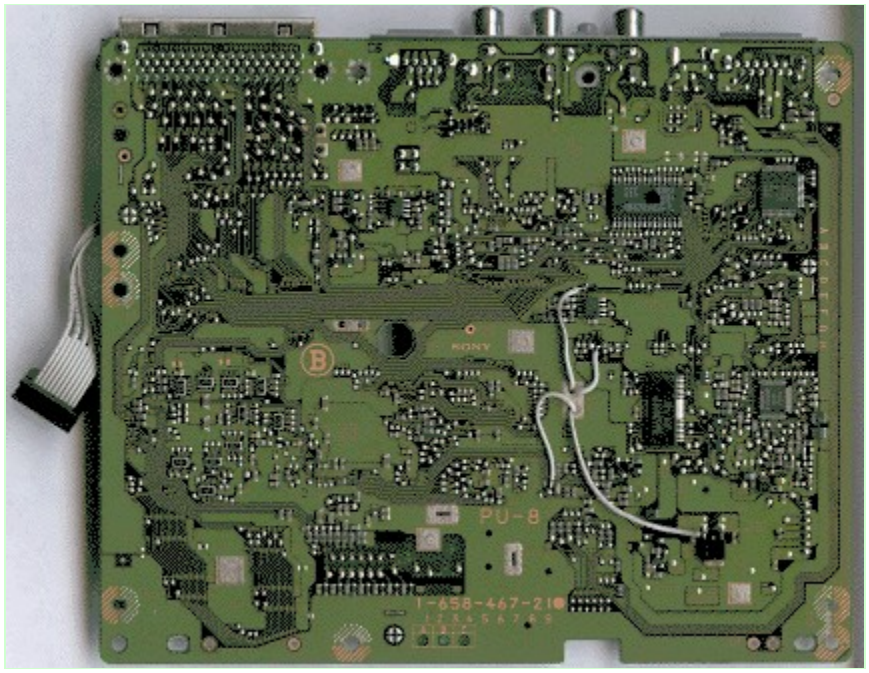
(Detail top view of wire routing--click to enlarge)


The Colormod module is wired to the mainboard using a modified 10-conductor ribbon cable. The detail view of the insulation-displacement connector at right shows how the 10 wires are crimped to the connector, then every other wire is cut off about 1cm from the connector housing. Be sure to align the **marked** end of the ribbon cable (look for the small red dots on the wire furthest to the right as an example) with **pin 1** of the connector. If this is not done properly, you might accidentally clip the wrong wires!

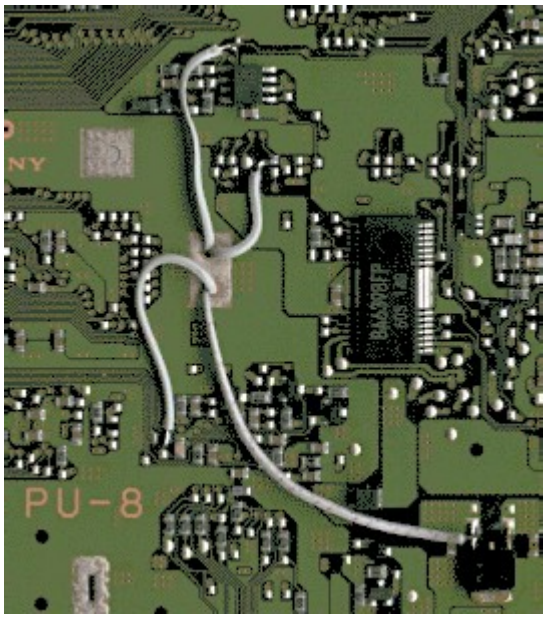
I used about 40cm of ribbon cable initally, then trimmed each wire to appropriate length as I routed them to their locations on the mainboard.

The IDC connector has two rows of 5 socket holes, as can bee seen. Five of these are not used; their wires have been cut away. The remaining five wires connect to the lower row of connector holes. (I know the connector is shown at an angle; use your imagination. ^^)

## Wiring to the Mainboard, Part II



(Detail bottom view of wire connections--click to enlarge)




This chromosome-like detail image at left shows four of the five wire-soldering locations on the mainboard. The fifth wire you may have noticed already, it is soldered to the copper ground spring on the top side of the mainboard. (Look for the big letter **A** in a circle; the copper spring is just to the left of it). PU-7 and PU-8 mainboards have these nice little holes to run wires through, incidentally. Use them ^^.

The topmost wire is the "data" wire for the mod chip function. The wire just below it is the "gate" wire for the mod chip function. If you have worked with mod chips before, these locations should be familiar. See the mod chip wiring instructions (under the SCPH-100x section) for more info.

The wire in the lower right corner is the +5 Volt power supply wire. It is also described in detail in the mod chip wiring instructions.

The remaining wire is what sets this whole project apart from a regular mod chip. This is the **colorburst frequency** signal that connects from the 2k2 resistor on the Colormod board to the right-hand solder pad where that SMD resistor was removed. (see detail image, above).

## Assembly Suggestions

The wires on my ribbon cable look like this:

| Wire number | Signal Name |
|---|---|
| 1 (marked) | +5 Volts |
| 3 | Ground |
| 5 | Mod "Data" |
| 7 | Mod "Gate" |
| 9 | Colorburst |

This corresponds to the header pin order on my Colormod board. Remember that since every other wire is clipped off, only the odd-numbered wires carry signals. Wires 2, 4, 6, 8 and 10 aren't there.

PAL users: you want a 4.433619MHz crystal.
NTSC users: you want a 3.579545MHz crystal.

Oh, and you might want this: The PIC12C508 source for this project.

## In the Future

I have made a commercial version of the Colormod board. It includes a few additional options: a jumper location to allow selection of NTSC/PAL timing mode for the PIC and a two-pin connector location to allow the attachment of a "mod-function disable" switch, which won't affect color-correction.

One final note: this board can also be used for a stock mod chip. It can work with a 4-wire chip by leaving all but the decoupling capacitors off, or work with a 5-wire chip by installing a jumper wire after removing unneeded components. See the Mod Chip Module overview.

I will post an announcement on the REI web site when I have boards available for interested folks.

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**Dedicated to all the Aussies who emailed me asking about color correction...**

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## Access count: 3529

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