

# Using APPLE II AppleColor TTL RGB Card with an Apple Analog Monitor

*Or... the 'Marcorlandi' Modification*



the Apple IIE Extended 80col/RGB

Anyone knows about virtual incompatibility between the old TTL 'CGA' standards and the newer analog signal color monitors. Old TTL display monitors usually require a two state TTL Level at the RGB inputs and separate composite sync.

The TTL RGB inputs can thus provide a way of displaying a maximum of eight colors, from the three bits available at monitor's input.

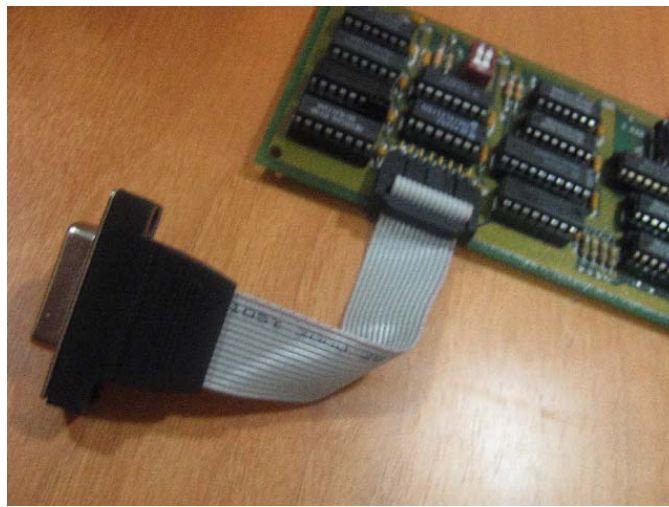
The Extended 80 Column/Text Apple Color RGB Card is capable of displaying up to 16 colors, using an additional 'bit' output, named intensity, which is present also in the standard PC/CGA old card signals, and gives an extended bit used as intensity modulator, as you all know 4 bits equals 16 possible combinations of colors... here's explained how TTL monitors can display more than just 8 colors !

## The Apple IIe Extended RGB Color Card

If you own an Apple II Extended 64k/RAM RGB Color Card (possibly bought on ebay for few \$\$ as I did) you might probably want to use it with a standard analog monitor such as the Apple II GS RGB Color Monitor, and as I experienced, attaching the card you won't see anything else than a black screen...

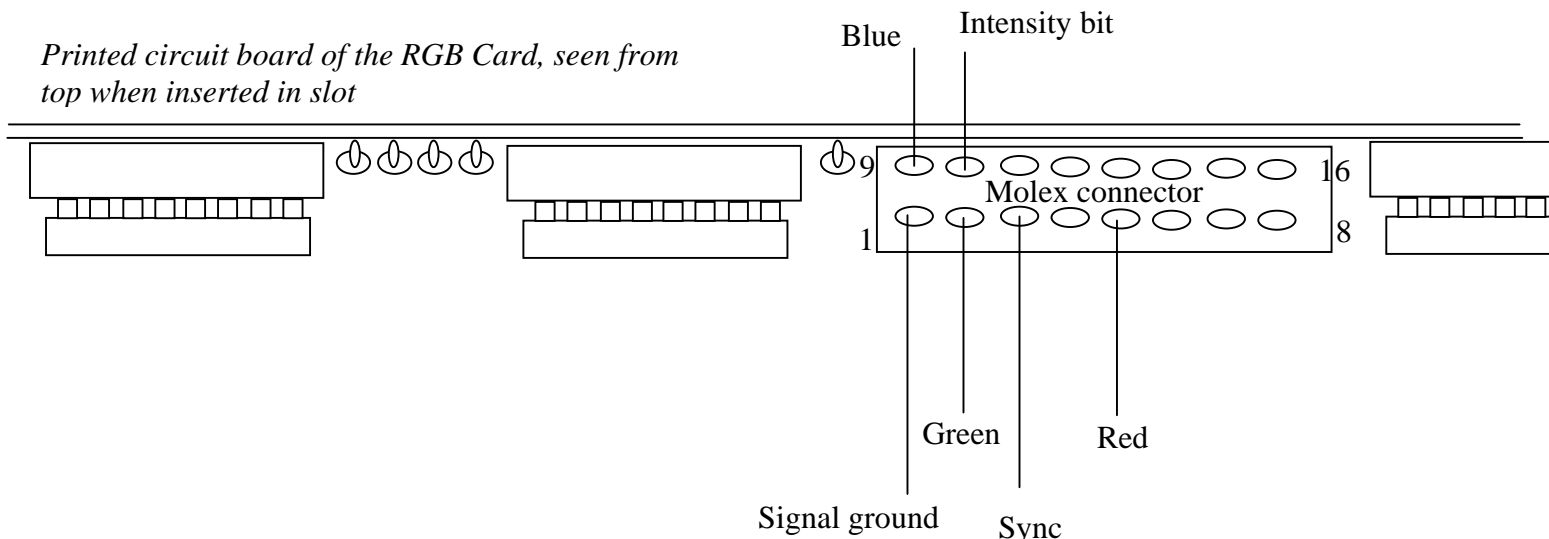
### The Molex connector

I bought my card, together with the manual (which is a very useful source of information for programming with the card, contains soft switches, double hi-res memory map, documentation of Applesoft "&" extension graphic commands usable after loading the 'Hires' driver...) but I did not have the 'molex' connector, so I managed to get one from a PC Game Card (those with game port), which has the same type of molex 16 to db-15 pin connections, it's shown here...



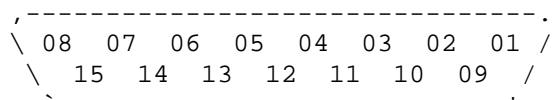
If you can't find a molex to db15 connector, here's the pinout I traced down by helping myself with an oscilloscope, by the way, looking at the output levels I found out why the card didn't work at all with analog monitors...

These are the Molex pinouts for the signals at the 16 pins end of the connector, looking with the connector in front of you and while the card is seen from the top when inserted in the slot.



Here's is the DB-15 Connector if attached to the molex via a flat cable :

Dsub-15 (male) socket seen from the back (soldering) pins



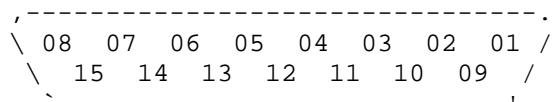
pin #	signal
shell	system ground
1	ground
2	<b>GREEN TTL BIT</b>
3	<b>COMPOSITE SYNC</b>
4	(not used)
5	<b>RED TTL BIT</b>
6	ground
7	-5 V (not used)
8	+12 V (not used)
9	<b>BLUE TTL BIT</b>
10	<b>INTENSITY BIT</b>
11	(not used)
12	(not used)
13	ground
14	(not used)
15	(not used)

A few things you should be concerned for, RED and GREEN outputs differ from the corresponding ANALOG RGB inputs at the back of the Apple Analog RGB Color, thus if you use a standard cable to connect the DB15 output to the RGB socket you'll end up with a 'RED LEAF' Apple if you run the demo programs (!)... so, remember to cross the R and G pins !

For your reference, here are the pins at the RGB input socket of an II GS analog monitor :

IIGS RGB Connector

Dsub-15 (female) socket at back of IIgs

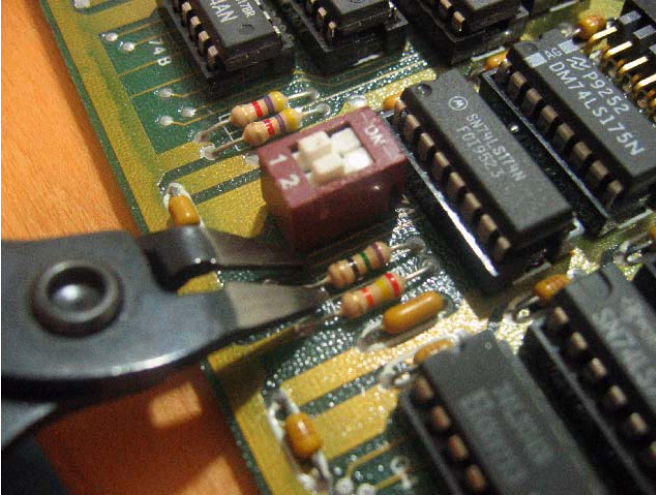


pin #	signal
shell	system ground
1	ground (for red)
2	red analog video
3	composite sync
4	(not used)
5	green analog video
6	ground (for green)
7	-5 V (not used)
8	+12 V (not used)
9	blue analog video
10	(not used)
11	audio output (not used)
12	composite video (not used)
13	ground (for blue)
14	(not used)
15	(not used)

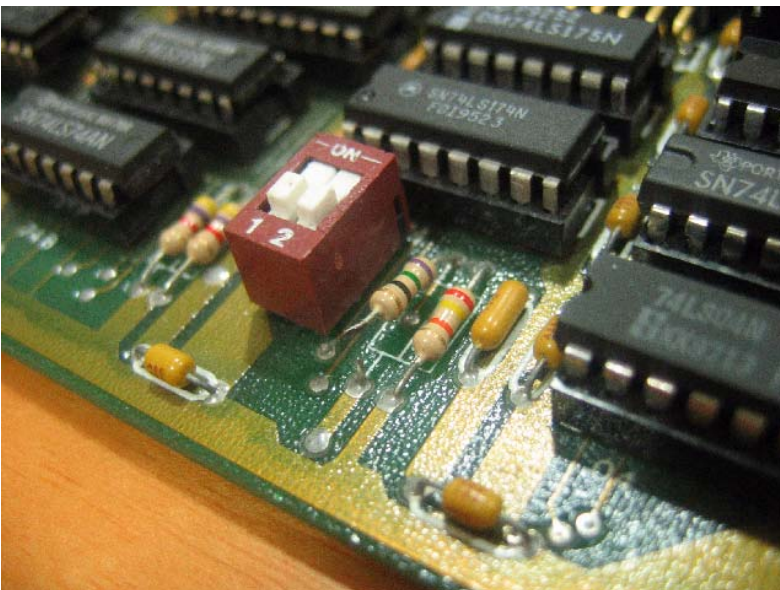
## The Marcorlandi modification

Now, what to do first to make my RGB card work with the analog monitor ?

If you just want to display 8 Colors, that's really simple, just cut the 75 Ohm resistor beside the switch on the card, as seen here :



After the mod you'll end up with a floating resistor on the card, that's fine, we don't need this connection to make the card work with analog monitors.



If you wonder why you should do it, here's the reason : this resistor is a pull-down that lowers the sync level to 1 V, while the RGB monitor needs TTL levels. I found this watching the signal at the oscilloscope, and since all of the components on the card are TTLs I suspected that the signal was lowered down... and so was it..

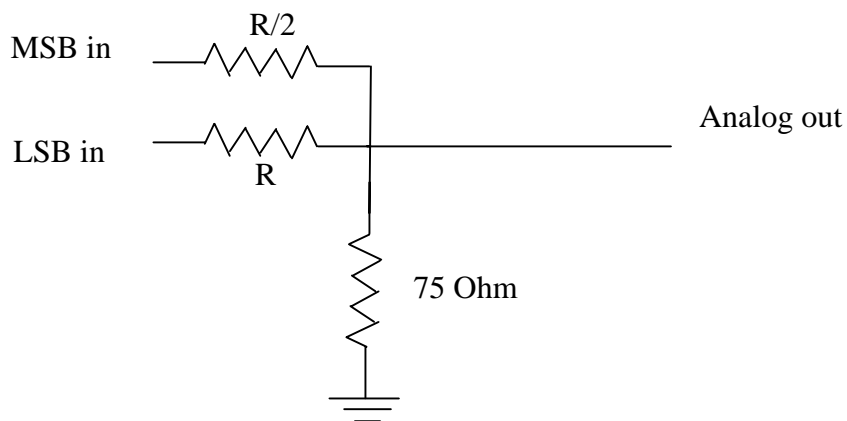
If you connect the monitor (remember to swap RED and GREEN connections) now it should work correctly, run the demo disk supplied with the card (an image of it can also be found on the net at [asimov ftp archive...](#))

## What... only 8 Colors ??

You'll see that with the simple modification you'll end up with a screen showing up only 8 Colors, that is, color numbers from 1 to 8 will be the same as 9 to 16... We need to set up something more to show them all..

The RGB Card is capable of displaying 16 colors, but the analog monitor obviously doesn't know about the fourth 'INTENSITY' bit, so we need to vary the R,G,B levels according to the Intensity TTL bit. We do this by using a simple resistor network.

The Resistor Ladder Network is the simplest D to A converter, and is basically made like this :

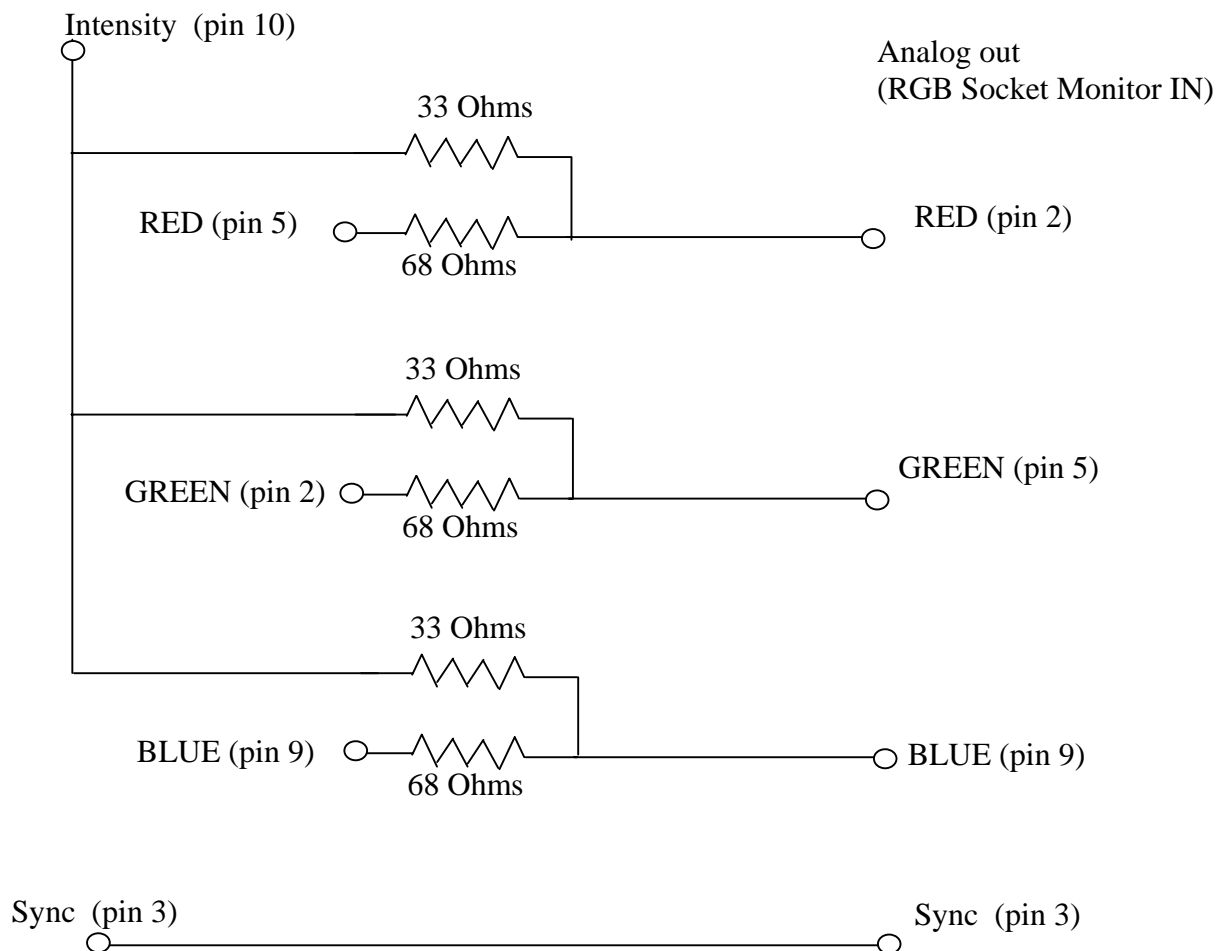


the MSB is the most significant bit, while LSB is the least significant.

In our case MSB will correspond to the Intensity Bit input, while LSB will be one of the Red/Green/Blue TTL inputs. The Resistor is R Ohms (here, R is not for Red, obviously) and the value should be chosen for best results, since it defines the intensity and color saturation for the output.

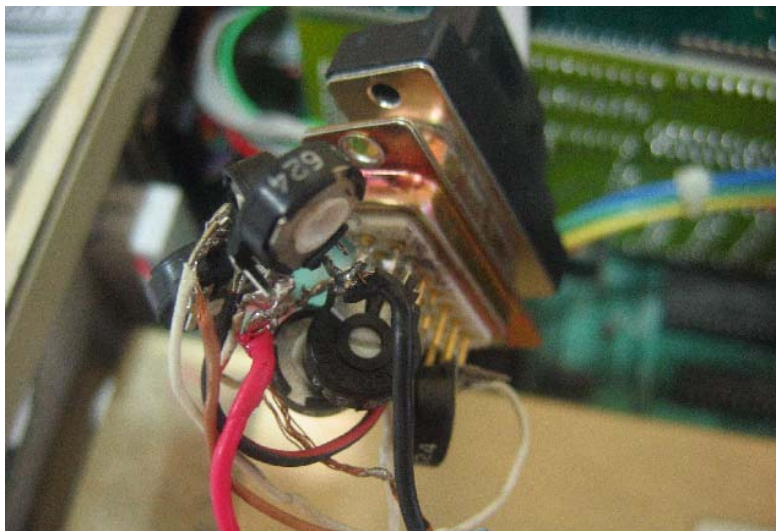
Here's the complete schematic for the D/A converter, with these values colors should be fine, but in my final setup I chose to use 100 Ohm trimmer resistors instead of the values shown here, it allowed me to tune the colors for best results, since I wanted complete control over them.

Please note that the 75 Ohm resistor connected to ground is not needed (as in the simple DA schematic shown before) because the monitor itself provides grounding resistors.



Note : For best result use 100 Ohm resistive trimmers in place of the resistors shown, you'll be able to calibrate colors adjusting both intensity and saturation.

Here are is my setup for the resistor ladder using resistive trimmers, quite crowded but functional for experimenting...





...And here's the brilliant 16 colors output as a final result...  
You can enjoy your TTL RGB Card with Analog Monitor !!



You may contact me at [orlandi.marco@libero.it](mailto:orlandi.marco@libero.it) for any info or suggestion..  
Have fun with your monitor and RGB Card....

Marco Orlandi