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Z-100 LifeLine
Since 1989

#126

A Professional Journal Exclusively for the Heath/Zenith Z-100 Computer

Z-100 LifeLine Web Site: **https://z100lifeline.swvagts.com (new effective September 2019)**

HOWGOZIT

Life here is doing well, though I have not been able to begin some other pressing projects. It seems that I got waylaid by a very important Z-100 upgrade and this issue is the result. I call it the Z-100 LCD Monitor issue and it's a very important step into the 21st Century for the Z-100. Our current CGA monitors are going away, whether we want them to or not. They are nearly impossible to find and even more difficult to get parts for. Well, thanks to the fortitude and persistence of Charles Hett, he has found an affordable replacement. But, more on that in a minute.

My Z-100 LifeLine website and e-mail remains busy. New people are still interested in repairing their Z-100's and those who just obtained one are very interested in getting their's to run and to even do some upgrades. However, some of these new people have obtained Z-100's using older mother boards and ask for help.

So, I've had to do some work with these older boards (never messed with them before now) for a new user and ran into a problem I haven't had before...

RAM Tests on an Older 768k Motherboard

While playing with an older motherboard for a user experiencing problems booting, I found a strange problem that I could use some help with.

I've actually got two older boards, #85-2653-1, that still operate and are configured to 768K RAM. One uses point-to-point wiring to create the memory upgrade, the second uses the ZMF-100 modification by FBE, that used two small circuit boards. A third modification was also available, the ZMF-100a, also by FBE, that used one circuit board, but I don't have this installed anywhere.

The problem arises when I attempt to use the Heath/Zenith Disk-based Diagnostics Disk to do the RAM diagnostic tests on these boards. I'm wondering if this is a design problem with the 768K RAM modification to the older motherboards or if it has always been a problem?

I'm running the Disk-based Diagnostics Rev. R1.4 under Z-DOS v3.10. As you may recall, the Ram Diagnostics - R1.2(A) gives the menu:

01. Parity Generator/Checker Test(A)
02. Mapping Test(A)
03. System Memory Test(A)
04. Video Memory Test(A)

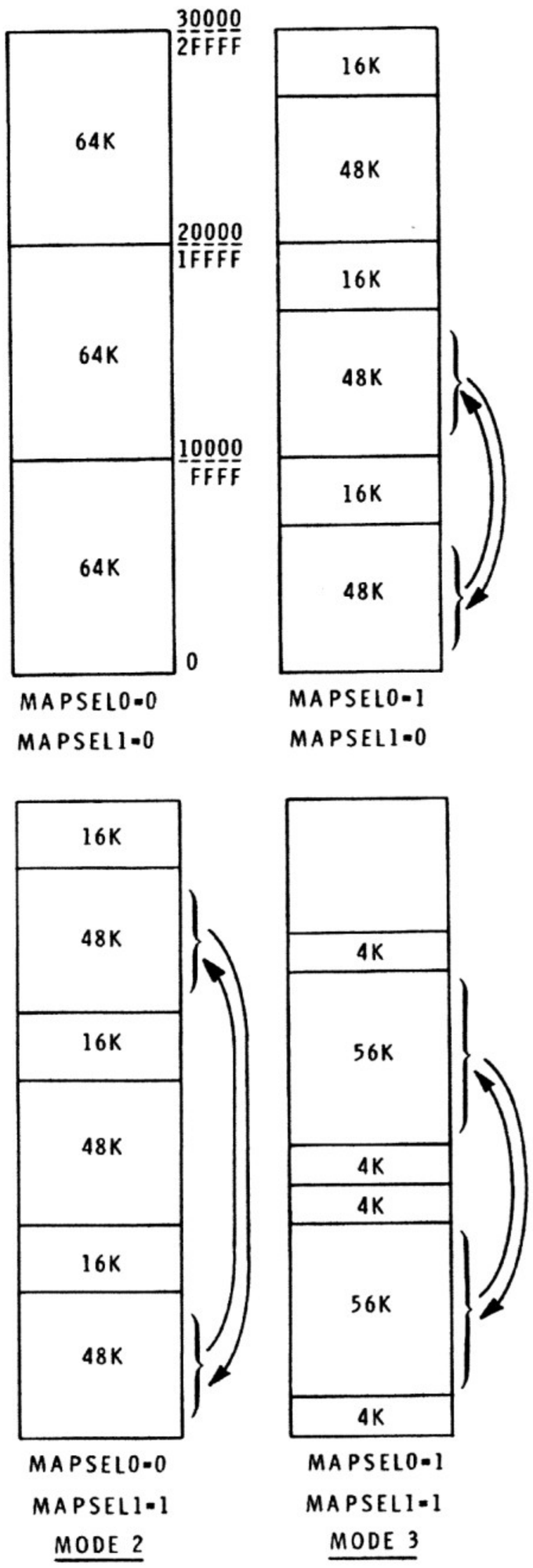
Pressing **{F0}{Return}** will run all the (A)utomatic tests, or pressing **{2}{Return}** for just the Mapping Test, gives me the error:

Error Detected
Mapping Mode Two Error
Replace Motherboard Chip U159, U179
Replace Motherboard Chip U110, U111
Replace Motherboard Chip U176
Replace Motherboard
(& Register Data)

I've swapped out all 5 chips mentioned on both boards with no luck. The two motherboards are being run on two separate computer systems. The diagnostics manual is of no help.

The service manual has a section on Map Selection on Page 2.61 in my manual. It states:

Map selection takes place at pins 1 and 5 of U111. These two lines, MAPSEL0 and MAPSEL1, also go to pins 7 and 8 of U173, but currently are not used by this IC. Depending on the logic state of pins 1 and 5 of U111, plus the address on lines BA12-BA15, the memory map enters one of the four configurations or modes, shown in Pictorial 2-11, shown next:



Mode 0 is the default configuration, in which memory is contiguous from 0 to 192K.

In mode 1, the first 48k of bank 0 appears to be swapped with the first 48k of bank 1. The two 16k areas, and the rest of RAM, are unchanged. This configuration may be used for MP/M while running the 8085 CPU.*

In mode 2, the first 48k of bank 0 appears to be swapped with the first 48k of bank 2. The two 16k areas, and the middle 64k of RAM, are unchanged. This configuration may also be used for MP/M while running the 8085 CPU.

In mode 3, 56k in bank 0 appears to be swapped with 56k in bank 1. Four kilobyte buffers above and below each 56k area remain unchanged, as does the top 64k bank. This configuration would permit using an extended BIOS when running CP/M-2.2 (8-bit operating system software).*

Note that, in all cases, the memory only appears to be swapped from the memory's point of view. When the CPU addresses the swapped memory, the memory map decoder merely asserts a different RAS line than it normally would.

For example, assume that the Computer is operating in configuration #4. If the CPU should write to the byte at the 6k location, U111 would assert REN1 instead of REN0. The memory at the 70k location will be written to. Bear in mind, however, that as far as the CPU (and the programmer) is concerned, the byte at 6k was written to.

Address lines BA12-BA15 allow the memory map decoder to keep some sections of memory in place down to 4k increments.

Keep in mind that this documentation was written for 64k memory chips and 192K total RAM on the motherboard. With 768k RAM total, we are using 256k chips rather than 64k chips, but the theory is all the same.

Ok, now referring to the **ZMF100a Installation Guide** (I don't have the earlier guides, but they should be somewhat similar), the circuit board alters the wiring to the existing high address decoder PAL(U173) and memory mapping PROM (U111) so that 768k of motherboard memory is enabled and 256k memory banks are decoded instead of 64k banks.

Further, address bits 16 and 17 are multiplexed by a special PAL (U1) on the ZMF100a circuit board and output to the memory chip pin-1's via a cable and the bus bar. This PAL also handles the address rearrangements required by the Z-100 "bank swapping" Memory Maps 1, 2, and 3 which are used by some 8-bit operating systems, such as Barry Watzman's CP/M-Plus.

With the ZMF100 installed, memory installed on the S-100 bus in the address range of 3000:0000 through B000:FFFF can no longer be accessed. This is because all this memory is now "on the motherboard". This is true regardless of how many banks of 256k memory chips are installed.

The installation guide recommends the Heath/Zenith Disk-based Diagnostics program and reminds us to configure the program for the proper memory size in 64k banks (0-11 for 768k RAM) and type of memory chips (256k). Finally, it states that ALL of the RAM DIAGNOSTIC tests will work.

So, before I delve further into this error situation, I was hoping that some of you who might remember the memory tests on the older motherboards may recall if the tests did indeed all work. Specifically, I'd like to know whether there were any problems with performing the RAM tests on old motherboards:

- **Without** the RAM upgrade to 256k chips?

- **When** using one or more of the S-100 buss **256k RAM Boards**?

- **With the RAM upgrades** (ZMF or other system upgrades) to 768k RAM on the motherboard?

Please let me know what you experienced by e-mail to swvaqts@earthlink.net or regular mail to **211 Sean Way, Hendersonville, NC 28792**. Of course I'll let everyone know what I find out in a future *Z-100 LifeLine* issue.

The impact of this error situation is relatively minor as we don't do memory swapping very much. In fact, unless you are using CP/M which relies heavily upon a properly working memory swapping system, the only other instance of memory swapping I'm aware of is during the use of RAM drives. Here, 256k RAM boards are used like floppy drives and swapped in and out with active computer memory during use. Unlike floppy drives, the RAM drive is all volatile memory, meaning that whatever is stored on the RAM drive is lost at power shutdown. I can think of no other application that needs memory swapping.

Nevertheless, this needs further investigation, so your help is greatly appreciated. Thanks.

An LCD Monitor for the Z-100!!

I have the pleasure of announcing one of the greatest upgrades to the Z-100 since the IDE Controller. How about using one of those nice LCD flat screen monitors with your Z-100?

As I mentioned at the start, the old CGA monitors are on their last legs and are very difficult to find and/or repair. Charles Hett (one of the IDE controller developers) has been experimenting with using CGA to VGA converters and has had great success! Check out his articles in this issue.

When he first mentioned his project, I was a bit skeptical, I had heard of others out there in web world and they had no success, but thankfully Charles had the gumption to continue. First, he tried one of the less expensive units, then brought the big guns into play with a device meant for industrial applications, figuring he had a better chance getting that to work. The first article briefly describes this effort.

However, with his success, I happened to notice that the much less expensive VGA converters were by the same manufacturer and I figured that some of the same theory might apply. Now that we knew it could be done, it was worth our time to investigate these less expensive options more thoroughly.

So, I talked to Charles again and we agreed to buy both options, Charles got the dual output GBS-8220 and I purchased the GBS-8200, both going for less than $20.00 each.

While waiting for my unit to arrive, I researched the web regarding its usage by the old gamers that were looking to replace the CRT's in the old arcade machines with LCD monitors and these boards that Charles and I bought were designed specifically for these uses.

However, there was also much information about some users having difficulty adapting the boards for other uses, such as for the Atari computers. It seems that they had problems with the TTL signal strength from a computer using TTL technology. TTL technology uses 5vdc signal levels to represent a high signal and the GBS-82xx series converter uses a maximum of a 3.3vpp (peak to peak) signal. Any signals that exceeded 3.3vpp were clipped to protect the device from damage. So, they tried using a series resistance in the Sync lines to bring the signal strength down.

This provided a solution to many, but others still had problems. I expected to be one of these, and probably set myself up for failure. See the article on the GBS-82xx series VGA Converters, for more explanation.

Anyway, to make weeks of my signal processing using a Heath Digital Scope, nearly worthless, Charles let me know that he had solved the puzzle. It worked great, with NO external hardware! It was a simple solution of using the on-board menu to adjust the settings!

The result? **WE ARE ABLE TO NOW RUN THE Z-100 WITH A VGA MONITOR!!**

Please read the articles, they are well worth your time. And my sincere thanks to Charles for putting my misery to rest. Who would have guessed that a simple adjustment would provide such a beautiful display to the Z-100!!

Video Logic Board Repair

While I was messing with the new CGA to VGA Converter, I had to try several video logic boards to compare results. We wanted to ensure that our success was not just a fluke. And while I was using several of the boards, I found two, not so common, display problems:

The first board showed vertical black bars going vertically through the Color Bar Display. They were evenly spaced with about 3 black bars dropping down through each color. I found this to be caused by a bad 74LS32 chip at U355.

On the second board, all I got was a green and black monochrome system, even though the board had full color capability with all 3 banks of **32K** chips. The Color Bar Display showed the left four colors being black and the right four being green, a typical monochrome display. After many hours of swapping chips and taking resistance readings, I found this to be a normal situation with ZROM v4.3.

It seems that the J305 and J306 jumpers are ignored for external monitors. Further, ZROMs version 2.9 and earlier allow color with 32K RAM chips **or** 64K chips on the video logic board, no matter how J305 & J306 are configured. However, ZROM v4.3 apparently checks the J307 jumper and if it is set to 32K, the computer defaults to monochrome. If J307 is set to 64K, the monitor will always be color, no matter what is selected by J305/J306. Further experimentation is needed.

Finally, in the past I have had other strange display symptoms that you should also note.

For a full color checkerboard pattern on the Color Bar Display, with colored rectangles in different colors, try changing the RAM Map IC, U357, U358, or U359, and visually check their sockets. I found one of the ICs had a bad pin 14 in its socket. Also, if you get blue/green only, check U361, which changes the color mix.

Another was a problem during bootup or a memory test. I got a RAM error requesting to replace U124 or U125. Replacing these, however, did not help. I found U221, a 74LS32 IC, intermittent or bad. Remember to visually check the socket.

If you have a Z-100 Technical Manual, you might want to list these repairs with the others on the troubleshooting sheet, page 4.69. Others may wish to add a page to their User's Manual. Thanks.

Closing

This is the last issue of the *Z-100 LifeLine* requiring a paid subscription. Those of you who had paid for additional issues have received a refund check with issue #125. This does not mean the end of the *Z-100 LifeLine,* however. As topics come up, I'll still publish additional (but obviously much smaller) issues, but I'll cover the expenses myself.

Topics that I still wish to cover, as time permits, include my work on CP/M and changes to the IDE Controller, the ZROM programming, and other Z-DOS v4 software issues. My workbench is also still covered in Seagate drive parts. While I am convinced that the non-spin problems of Seagate drives is hardware related and not from 'stiction', as reported by some, this is old news and our IDE capability makes these drives no longer needed. I'm suspending my work on these and getting my workbench back.

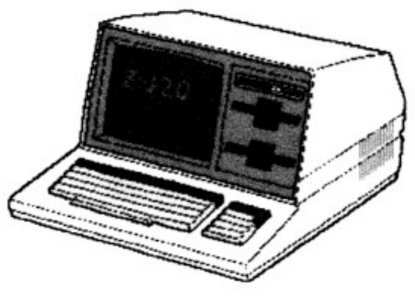
My website and e-mail will all remain active, so don't hesitate to contact me with issues. I will still maintain my entire stock of spare parts, books, magazines, and software. The Z-100 is still my second love (after Myra, of course) and I hope to remain active in making changes and keeping interest high in the Z-100 community.

Cheers!!!

'Til next time,
happy computing!

Z-100 LIFELINE

Supporting the H/Z-100 Community Since 1989



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GBS-8219 RGB to VGA Converter

by Charles Hett, January 2016

For a long time I have been seeking a suitable scan converter to allow the display of Z-100 RGB video on a more modern VGA capable display. The old CRT RGB digital interface monitors for the Z-100 are becoming unreliable and unavailable. LCD displays are readily available, cheap used, and use less power and have less weight.

A scan converter is needed because the Z-100 horizontal scan rate is about 15.2 kHz where the VGA rate is about 31kHz. Analog and Digital interfaces also come into play. I think I have found a suitable converter at an acceptable (but not exactly cheap) price. It is the GBS-8219 VGA scan converter.

Search

I searched for any DIY articles about building scan converters, but all I found used obsolete parts in their design and would probably be difficult to build and get to work. So I abandoned the idea of building my own.

I found the Ambery 15KHz RGB CGA to VGA RGBHV Converter Scaler, AV-1M, at www.ambery.com for $89.00 (+ $10.50 for cable) (Prices still good as of January 2016). There was no specification for TTL digital input voltages (only 0.7v 75 ohm) so I thought that it might not work with Z100.

I also found a few of the cheap (about $30) adapters that were available on eBay. However, they did not advertise a TTL interface either.

In 2014 I found the GBS-8219 converter. The internet information on this unit said all the right things – separate H/V or composite H/V sync, 15 kHz frequency, digital TTL input, could handle interlace, and could adjust horizontal and vertical height.

It was available on Amazon.com for $225, but several different vendors on eBay had it for much less. So I paid about $150 for one and received it less than two weeks after ordering – shipped from China. The price varied considerably depending on the seller and time.

The package arrived in excellent condition and included:

- The converter
- 1 each 9 pin D male and female connector
- Cable with 9 pin D male connector attached (for connecting the computer to the adapter). You have to add the appropriate sex 9 pin D connector on the other end.
- 12VDC power adapter
- Instruction manual

Installation

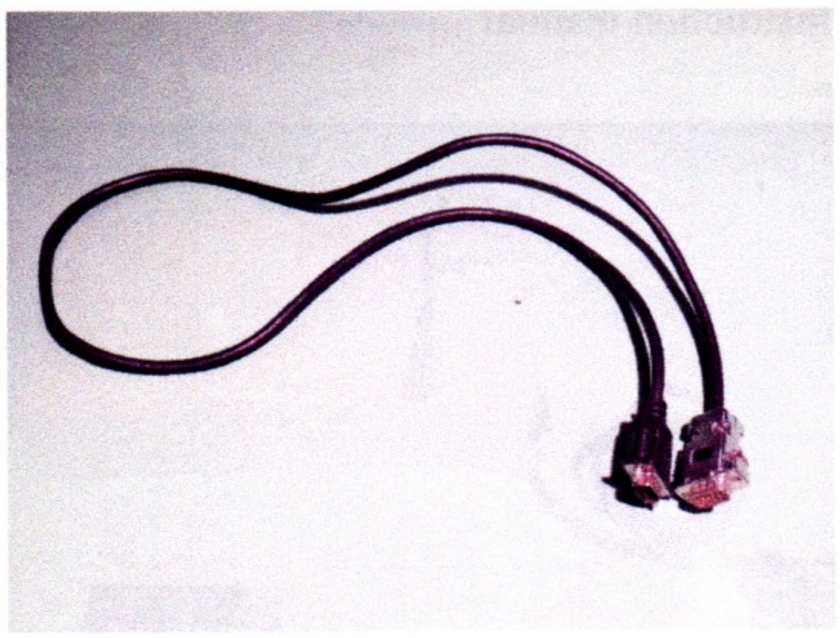
The GBS-2819 has a row of BNC connectors and a RUN light on the right side and female 9-pin and 15-pin connectors, power socket, and three menu buttons on the left side.

Note: BNC connectors are not used with the Z-100.

After checking the Z-100 color monitor jack pin assignments, I determined that a straight through 9-pin D connector cable was required with male pins on both ends. I attempted to install the male connector on the provided 9-pin cable, but this did not go well.

The insulation on the cable wires was very thin and melted easily when soldered. The connector insulation melted at a very low temperature. Also, the shield of the provided cable was aluminum and not solderable.

After a couple of attempts, I was able to complete the cable assembly. I tucked the shield under the backshell strain relief to make that connection.



If you don't have good tools and a steady hand, I recommend that you use a commercially made 9-pin to 15-pin cable. What you would need is a male-to-male cable wired pin-for-pin for this application.

From there it is a simple matter of connecting the 9-pin cable from the Z-100 video connector to the adapter.

I tried the 9-pin cable that I had been using with my CRT color monitor. But, I had to use a gender changer adapter to end up with a cable that had male connectors on both ends. The cable is wired pin-for-pin and end-to-end, so this arrangement worked fine also.

Choice of VGA monitor

My first system turn on was with a 17" Dell E171FPb LCD SVGA monitor with 4:3 aspect ratio and a resolution of 1280 x 1024.

I also tried a 15.1" Zenith L15V26C LCD 4:3 aspect ratio television that had a PC input. The resolution was stated as 1024 x 768. It worked with the converter, but not quite as well as the Dell monitor, possibly because of the lower resolution.

I also tried it on my Toshiba 32" 16:9 high defination television, but could not find a suitable combination of settings that gave a totally acceptable picture. The converter horizontal and vertical menu settings were not adequate to do the job. It did "work", however, with this big display and was quite impressive in some respects. Maybe with more time, I could have found a good setting.

Go with what you have or can get cheaply, but I don't recommend going larger than 17". While a high definition monitor or TV with a VGA interface would work, it isn't necessary and probably won't visibly improve things.

Because of the relatively low resolution of the Z-100 video system, I think this is a case of smaller is better for the monitor.

I also recommend trying to locate an LCD monitor. In addition to the smaller space used, using an LCD monitor with the converter, you don't see the raster lines between rows of pixels in graphics mode like you do on a CRT. It is just a solid field of color. Very cool.

To connect the VGA monitor just plug it in to the 15-pin output connector on the adapter. No VGA cable is provided with the adapter.

Power

The product comes with a wall wart style power supply rated at 12vdc, 1a. I believe it is a switching type. It connects to the adapter with a standard connector.

I suggest plugging the Z-100, the monitor and the adapter into a power strip and simultaneously powering all three devices simultaneously. I found that extraneous pixels would be displayed beyond the desired display area if the computer were turned on first before the converter and there was no way to clear them short of re-powering the adapter. Even that did not always work.

While turning on the converter first is OK, because the converter does not have its own power switch, it is easier to use the power strip to turn on everything. Also, while some say that power strip on/off switches aren't meant to be switched with a load applied, power strips are easier to replace than on/off switches in the Z-100s and monitors.

Setup and menu

Configuring the Z-100 Video Logic Board Jumpers

First, I suggest trying the setup without changing any jumpers. It turns out that the jumper settings I ended up with was the default shown in Pictorial 4-1 in the Video Logic Board section of the Z-100 Technical Manual. The jumpers of concern are:

J301	Sets '-' polarity of vertical sync (The converter works either way)
J302	**H** polarity of horizontal sync for external RGB (converter works either way)
J303	**V** (The converter requires this)
J304	**VC** polarity of sync selected by J303 (converter works either way)

Adapter setup

Menu operation

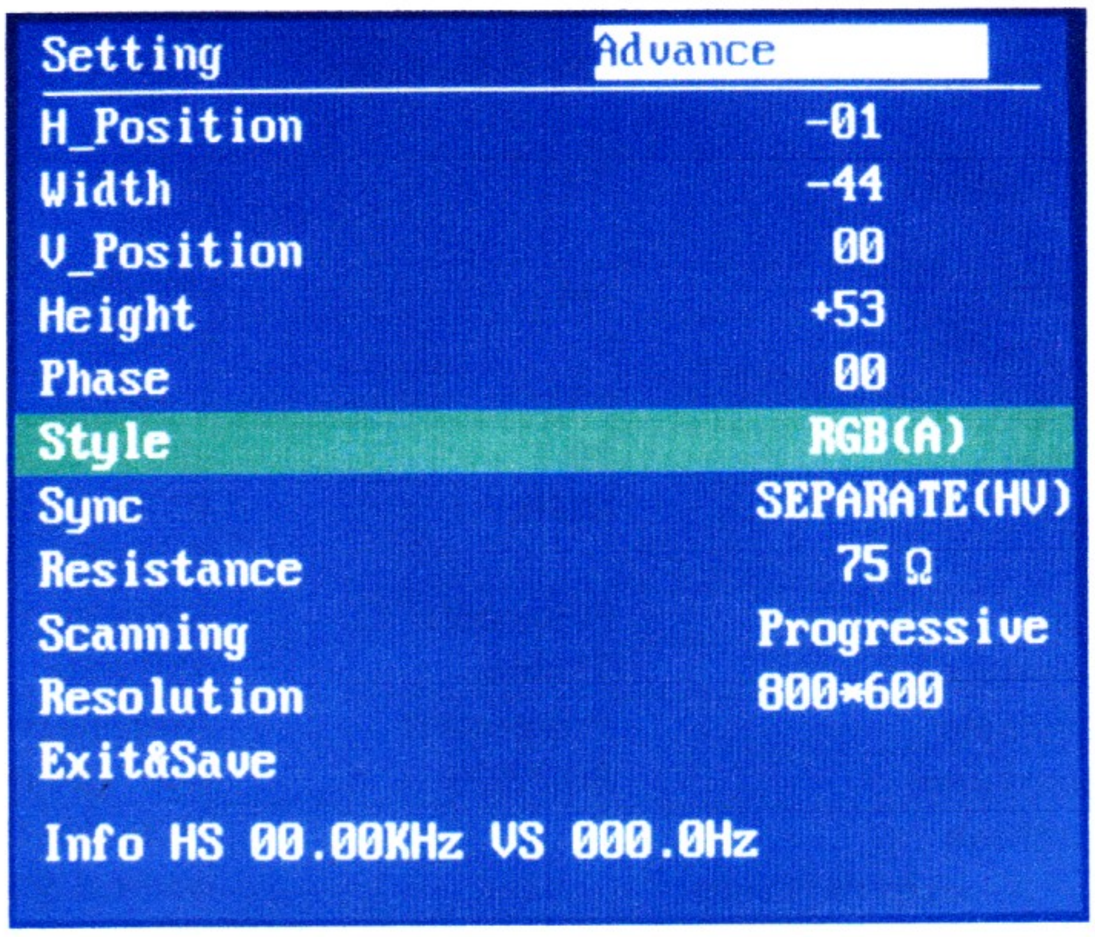
To access the menu, press the Menu button. The menu will be displayed with the H_Position line selected and the value displayed in white. To access a different line, press the Up or Down buttons to advance to the desired line.

To change the selected value, press the Menu button while on that line and the selected value will be displayed in red. Then press the Up or Down buttons to select the desired value. When the value has been selected, press the Menu button again. The selected value will now be displayed in white and you can go to the next value for selection.

When all values are selected, you can go down to the Exit&Save line and press the Menu button to exit and save the selections. If no buttons are pressed for about 15 seconds, the selections will be saved automatically and the menu will be exited and extinguished.

Menu settings

The values I have chosen are displayed in the table on the next page. These settings yield a horizontal width of about 10.5" and a vertical height of about 8.0" on my Dell monitor which is pretty close to an aspect ratio of 4:3. The top margin is about 0.8" and the display is approximately centered horizontally with left and right margins of about 1.4".



I tried interlaced operation, setting the Z100 and the converter for interlaced mode but the results were not satisfactory – too much flicker and poor looking characters.

How I Chose the Values

To start with, just boot the Z100 and use the basic boot screen to get things working. You can also use the Color Bar entry to test that the colors are wired correctly.

Now you can begin the serious adjustment of the display.

It turns out that, due to aliasing effects, selections are fairly critical and some iteration may be needed to get the best looking characters. Some trade-off may also be needed between an exact aspect ratio for properly displayed graphics objects such as circles and crisp characters.

I chose to optimize for good looking characters. If proper aspect graphics is important, you could temporarily re-adjust vertical and/or horizontal height to get what you want at the expense of slightly poorer characters.

I found that I obtained the best displayed characters if I selected values somewhat less than the maximum available on the display.

Menu Line	My selections	Range
H_Position	-01	-99 +99
Width	-44	-99 +99
V_Position	0	0 +99
Height	+53	0 +99
Phase	00	-16 +15
Style	RGB(A)	RGB(A), RGB(D), YUV It seems odd that RGB(D) doesn't work*
Sync	Separate(HV)	Separate, Composite, SOG (Sync on Green)
Resistance	75ohm	750 ohm
Scanning	Progressive	Progressive or Interlaced
Resolution	800*600	640*480 or 800*600
ExitSave exits the menu		Note that the menu also displays the horizontal and vertical scan input frequencies.

*Selecting RGB(A) forces resistance to 75 ohm. Can be overridden.
Selecting RGB(D) forces resistance to 750 ohm. Can be overridden.

To aid in making the selections, you can use a program such as the crosshatch BASIC program described in Z100 Lifeline #42. I added four lines to draw a CIRCLE the height of, and centered on, the crosshatch.

```
10 'crosshatch
20 CLS
25 X=315
26 Y=112
27 Z=225
28 CIRCLE (X,Y),Z
30 FOR I=0 TO 640 STEP 30
40 LINE (I,0)-(I,240),7
50 NEXT I
60 FOR I=0 TO 250 STEP 15
70 LINE (0,I)-(630,I),7
80 NEXT I
90 GOTO 90
100 END
```

When run, you should get a circle display. Then adjust the display height and width to get a perfectly round circle.

After making that adjustment, exit BASIC and simply type a string of upper case 'M's and lower case 'm's that span the entire display and repeat over several lines, filling a large portion of the display with characters.

Using the converter menu again, adjust the display settings for optimum character appearance keeping in mind that you will be affecting the graphic geometry if you change the height or width. A difference of one number on horizontal or vertical size or position can make a difference in the quality of the characters but it can also goof up the graphics geometry. Play with it until you are satisfied that you have obtained the best overall performance.

I close with a photo of the Jayhawk from my school to show you how he looks on an LCD screen. Good luck!

GBS-82xx CGA to VGA Converter

by Charles Hett, April 2016

Introduction

In a quest to find a replacement for the CGA Monitor to my Zenith Z-100, I began looking at CGA to VGA converters a few years ago.

A CGA to VGA converter is necessary because the horizontal scan frequency of a VGA interface is about 31kHz whereas the frequency of the CGA interface is about 15.5kHz or about one half that of VGA. This requires some pretty fancy circuitry.

I finally found and bought a GBS-8200 unit about a year ago and tried many times to get this to work with the Z-100 but was unsuccessful.

I then found the GBS-8219 but it was a lot more expensive than the GBS-8200. However, I thought it might have a better chance of working because it was specifically advertised to work with the digital RGB video and synchronization signals as provided by the Z-100.

I watched this item and as the price declined to the $150 range, I finally purchased one. I was able to get it to work without difficulty and produced a satisfactory but not perfect display of the output of the Z-100 on an LCD VGA monitor.

I wrote a description of the GBS-8219 for publication in the *"Z-100 Lifeline"*. Steven Vagts liked the article but he and I both thought the price of the GBS-8219 was high and he thought we should try again to get one or both of its sisters, the GBS-8200 and GBS-8220 to work. As all three units were from the same manufacturer, we thought that there should be a good chance of getting at least one of these to work.

We shortened the original article considerably, but because there is so little information on the web regarding this unit, because I had spent so much time documenting my work with this unit, and because the flexibility of the added capability of this unit proved that it was possible to get a CGA to VGA Converter to work on the Z-100, we decided to continue publishing that article, also (see previous insert).

Besides, you may find an excellent bargain on one of these units in the future. They do work great. However, we do feel that the cheaper units work equally well, if not better.

Comparing the GBS-82xx Units

Steve purchased a GBS-8200 and I purchased a GBS-8220 for a second attempt. The next page shows a comparison table of specifications for the three units.

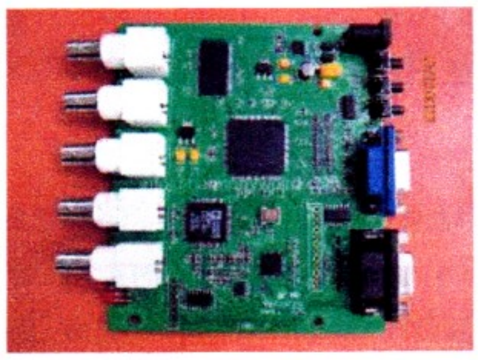
The only significant difference between the two cheaper units was that the GBS-8220 had the capability to drive two VGA monitors. While the more expensive unit, the GBS-8219, was designed for industrial applications, these two cheaper units were specifically designed to replace gaming arcade CGA monitors. The reason for the GBS-8220 may have been for special situations where two monitors displaying the same picture were required.

We obtained all these units from eBay or Amazon. We had no difficulty getting them from China but we make no recommendations for any vendor or country of origin. Watch the shipping costs when choosing a source, however.

With either the GBS-8200 or GBS-8220, henceforth referred to as the GBX-82xx, you receive the GBS-82xx board, an 8-pin inline connector with seven wires installed, and a white two-pin connector with black & red wires installed for the power supply. A standard circular power connector is installed on the board if you prefer to use that.

Neither unit came with a manual but the information is readily available on the internet, although much of that information isn't really helpful. Hopefully, what is described here will be sufficient to get you going.

Comparing the GBS-82xx Units

	  **GBS-8219**	 **GBS-8200**	 **GBS-8220**
Price Range	$150-$200+	$15-$20	$20-$40
Sync	12-40KHz horiz freq auto detected. Requires separate H and V sync BNC connectors not required	15, 24, 31KHz horiz freq detected. Digital: Requires composite sync, except at 31KHz	15, 24, 31KHz horiz freq detected. Digital: Requires composite sync, except at 31KHz
RGB	Digital: no adjustment required BNC connectors not required	Analog: 0.7V adjustable	Analog: 0.7V adjustable
Input Signals	RGB/MDA/CGA/EGA/YUV	CGA / EGA / YUV	CGA / EGA / YUV
Enclosure	Nice black aluminum case	None	None
Size	5.8"w x 4"d x 1.1"t (Base w/flanges)	4.6"w x 4.4"d x 0.85"t	4.6"w x 4.4"d x 0.85"t
VGA Outputs	1	1	2 available
Power Supply	12vdc 2amp supplied	5-12vdc 2* amp not supplied. Cable w/connector supplied.	5vdc 2* amp not supplied. Cable w/connector supplied.
CGA Cable	Poor quality cable supplied with a male 9-pin Dsub CGA connector on one end, 9-pin Dsub male & female connectors for your installation on other end. You need male for Z100.	Supplied with a white in-line plastic 8-pin connector with 7 wires installed. You provide the male 9-pin Dsub connector on other end. Strain relief recommended.	Supplied with a white in line plastic 8-pin connector with 7 wires installed. You provide the male 9-pin Dsub connector on the other end. Strain relief recommended.
Notes:		* Draws only about 0.65amps.	* Draws only about 0.65amps.

There are three potentiometers used for adjusting the RGB input voltages. Note these are in reverse order relative to the input signal positions on P11. They are clearly labeled on the board silk screen.

RP1	Red
RP2	Green
RP3	Blue

Connectors and Switches

The connectors and jumpers are clearly labeled on the board silk screen.

8200/8220	
P1	(GBS-8220 only)
P2	Y, Pb, Pr phono plug inputs
P3	5-pin CGA input - probably won't use but nice test points for R, G, B, Gnd & S
P4	15-pin Dsub VGA output 1
P5	4-pin connector - not used
P6	4-pin connector - factory - do not use
P7	circular dc power input
P8	2-pin factory jumper - do not use
P9	2-pin inline DC power input (cable/connector supplied for this)
P10	15-pin Dsub connector VGA IN (Says for VGA input but this doesn't seem to work.)
P11	8-pin inline CGA input (cable/connector supplied for this)
P12	12-pin VGA output 1 inline optional - probably won't use but nice test points
P13	15-pin Dsub VGA output 2 (GBS-8220 only)
P14	VGA output 2 inline optional probably won't use but nice test points (GBS-8220 only)

There are four push button switches on these boards, clearly labeled on the silk screen. They are:

Up	Used to navigate the menu up/down.
Dn/Auto	When menu is not displayed this button automatically selects input configuration after held for five seconds and used to navigate the menu up/down.
SW	Selects the input signal type RGBS, RGBHV, YPbPr when menu is not displayed and used to navigate the menu left/right
Menu	Turns on the on-screen menu and is used to navigate the menu left/right

Getting the Converters to Work

Getting something like this to work with so little information was a bit difficult given the limited information we had. Steve researched the web and found that there were some suggestions to try for modifying the signal requirements.

First, it seems that signals that are the result of TTL signal levels, such as found in the Z-100, are zero and 5vdc. However, the CGA/VGA Converter is limited to 3.3vdc signal levels. If signals increase above 3.3vdc, then the circuit is designed to limit the signal strength to 3.3vdc and signal information is lost. To lower the signal levels, the website suggested using 680 ohm resistors in the sync lines. So Steve constructed voltage dividers using potentiometers to cut signal strength. With no significant luck, he then tried tracing the signals through the video logic board using a digital scope.

Still having no luck, we tried various synchronization combinations on the Z-100 video logic board jumpers, modified the RGB input signals and messed with the menu settings with little success. Steve reported that he had some success with composite sync selected and wired but still only had a screen that looked fair

but shaky, and most of the time the screen was frozen unless he opened or shorted the sync line.

Steve's work was encouraging though because it seemed to indicate we might be close to having a working system.

While Steve continued his work, I took off all of my extraneous RGB input circuitry. Then I measured the RGB pots and calculated the resistance setting that should be needed to give about 0.7v peak at the 66 ohm resistor across the interface chip input to ground. This setting is about 230 ohms when measured as described below which is about mid range on the pot.

I set the Z-100 and CGA cabling for composite sync. I had read that a menu setting for a parameter called Clamp Sp should be 3 and Clamp St should be 4 so I set those. Then I started playing with vertical and horizontal size and position settings. All of a sudden the display came alive and snapped into sync. Yippie!

From there on it was a matter of tweaking these settings and the LCD monitor settings for what I thought was the best picture obtainable.

We have since found out from another website that the GBS-82xx boards are only capable of using separate sync signals if the system is a 31KHz system! With our 15KHz Z-100's we must use Composite Sync! Further, we have since found that the Composite Sync must be set for negative!

The Final Setup

8200/8220 Pot Settings

I mentioned the pot settings above. This is pretty important to at least get a picture to start with. If you set the pots to either extreme end you won't get a picture. The easiest way to set them to a starting point is to ensure that they are set to mid-range. The Red pot is RP1; the Green is RP2 and the Blue is RP3.

After bringing up the color bar test on the Z-100, you can adjust these as needed for get the white bar's color correct. Finally, set them as needed for the best color.

DC Power Supply

While the GBS-82xx converter on-line manuals say 5 volts and the GBS-8220 silk screen is labeled **5v DC IN**, the GBS-8200 power silk screen label actually says **5-12Vdc IN** (the GBS-8200 and GBS-8220 use different regulators). So, while the Z-100 has +5 volts DC available, Steve picked up 8vdc inside the Z-100 for providing power. He was concerned about loading on the Z-100 because the recommended power supply on-line was 2.0 amps and not all that much used the 8 volt power supply in the Z-100.

We have since found out that the converter units only draw about 0.65 amps. As there is an onboard three terminal regulator that regulates the input down to 3.3 volts for the board power, it would be best to use the +5 volt source within the Z-100. For Steve's installation, he attached spring clips on the power cable and attached them directly to the motherboard's power connectors.

I used 5 volts available on an unused hard drive connector inside the Z-100. Use the power cable provided with the board. You will likely have to extend the wires if you pick up power from the Z-100 for an external installation, perhaps through a power connector mounted on the back panel.

Of course you could always use a wall wart type supply. We don't recommend using anything greater than +8vdc because it would cause unnecessary power dissipation in the converter's three terminal regulator.

VGA Cables

No VGA cable from the converter to monitor is provided. Most monitors should be equipped with a cable and the proper 15-pin Dsub connector to connect to the converter.

If you intend to run a cable from the back of the Z-100 to an externally mounted VGA converter as I have, you will have to construct a connector to the unused end of the video cable provided.

CGA Cable wiring

Male 9-pin Dsub from Z100	Signal Name / Color	8 pin single inline connector to converter
1	Ground / black	left end
2	Ground / nc	nc
3	Red video / red	R right end
4	Green video / green	G
5	Blue video / blue	B
6		
7		
8	Horizontal sync / yellow nc	
9	Vertical sync / gray	S

nc=not connected

Here again, Steve proposed a different setup. He placed a 10-pin in-line connector on the empty end of the video cable to plug directly into the Z-100 Video Logic Board. He found that he could mount the VGA converter over one of the internal 5-1/4" floppy drives. Then notch the side of the metal back plane to allow the cable from the monitor to pass through the back plane to attach directly to the converter. For more on installing the converter internally in the Z-100, see Steve's article attached next.

Composite Sync Jumper on the Z-100

The Z-100 video logic board jumper settings needed for the GBS-82xx are as follows:

J302 - (up), J303 C, (up), J304 VC (up). The J301 setting is not related to the CGA output. Do not change it.

Note: Because I need to switch back and forth between composite and separate horizontal sync, I wired an external SPDT toggle switch to J303 to provide this function.

Initial turn on

Once everything is connected, apply power. You should immediately see a red LED on the board and some blue Chinese characters at the top of the monitor screen. You may not see any Z-100 intelligence yet. You might see just a full green screen, with or without areas of black interspersed.

Press and hold the AUTO button for five seconds to attempt to get the Z100 video setup to be automatically detected. The red LED may flash for a few seconds while this is being done.

GBS-82xx Menu Settings

Before proceeding further, with or without a picture, the GBS-82xx menu settings should be configured:

Pressing the MENU button causes the menu to appear with its four main sub-menus listed:

1. Picture >
2. Geometry >
3. Display >
4. Language >

. . Exit

The very first thing you want to do is select the **Language Menu** if you see Chinese characters:

- Go up to the bottom item (fourth from the top) using the UP button.
- Press the right (MENU) button selecting the Language Menu.
- Press the UP button to the first row which should be English.
- Press the right (MENU) button again to select English.
- The display should then switch to English.
- Push the DN/AUTO button to the Exit row
- Press the Menu button to return to the main menu.
- You can then exit from there or just wait about five seconds for the menu to be exited automatically.

The button usage is fairly intuitive and now that you can read what is happening, we'll discuss the rest of the menu settings.

The next sub-menu to configure is the **Display Menu.** There are four choices here which refer to the monitor resolution, **not** the Z-100:

1. 640 x 480
2. 800 x 600 (Steve uses this)
3. 1024 x 768 (I use this one)
4. 1360 x 768
. . Return

As you proceed through the setup you may want to return here to see if other settings work better with your monitor.

After setting the display resolution move on to the **Geometry Menu.**

At this point you should have the Z-100 turned on, connected to the converter and the converter connected to the monitor. You may or may not be seeing any information yet on the monitor from the Z-100.

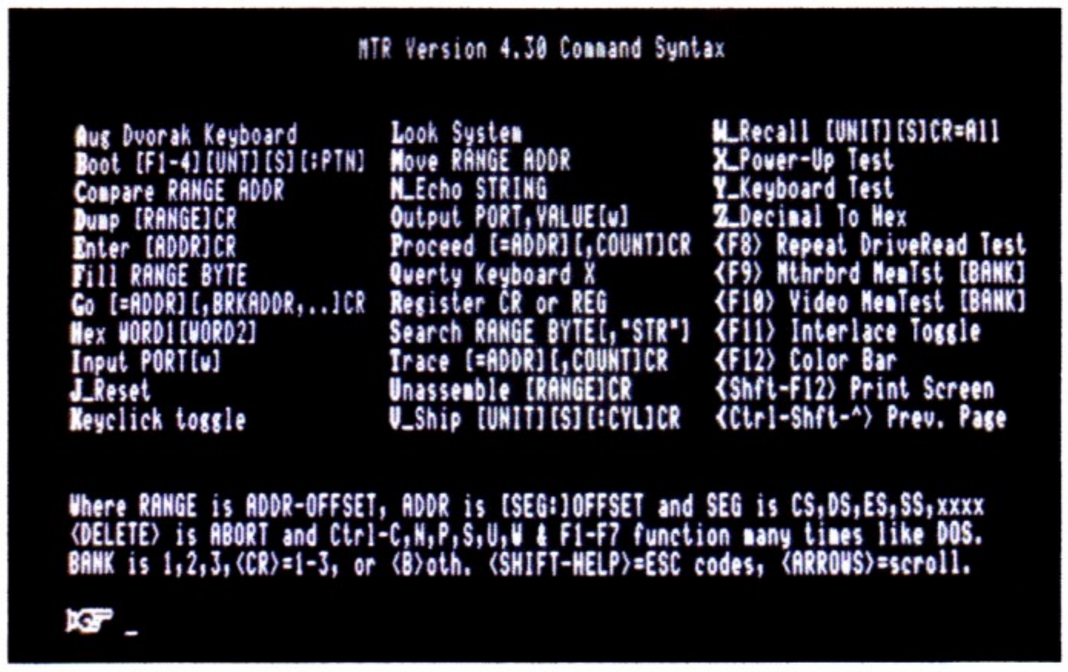
The **Geometry Menu** has six setting choices. The first value of each is the default, the second value is the setting I am using, as best for my monitor:

1. H(orizontal) Posit	50	52
2. V(ertical) Posit	20	35
3. H(orizontal) Size	50	48
4. V(ertical) Size	50	41
5. Clamp St	90	03*
6. Clamp Sp	95	04*
7. Default		
. . Return		

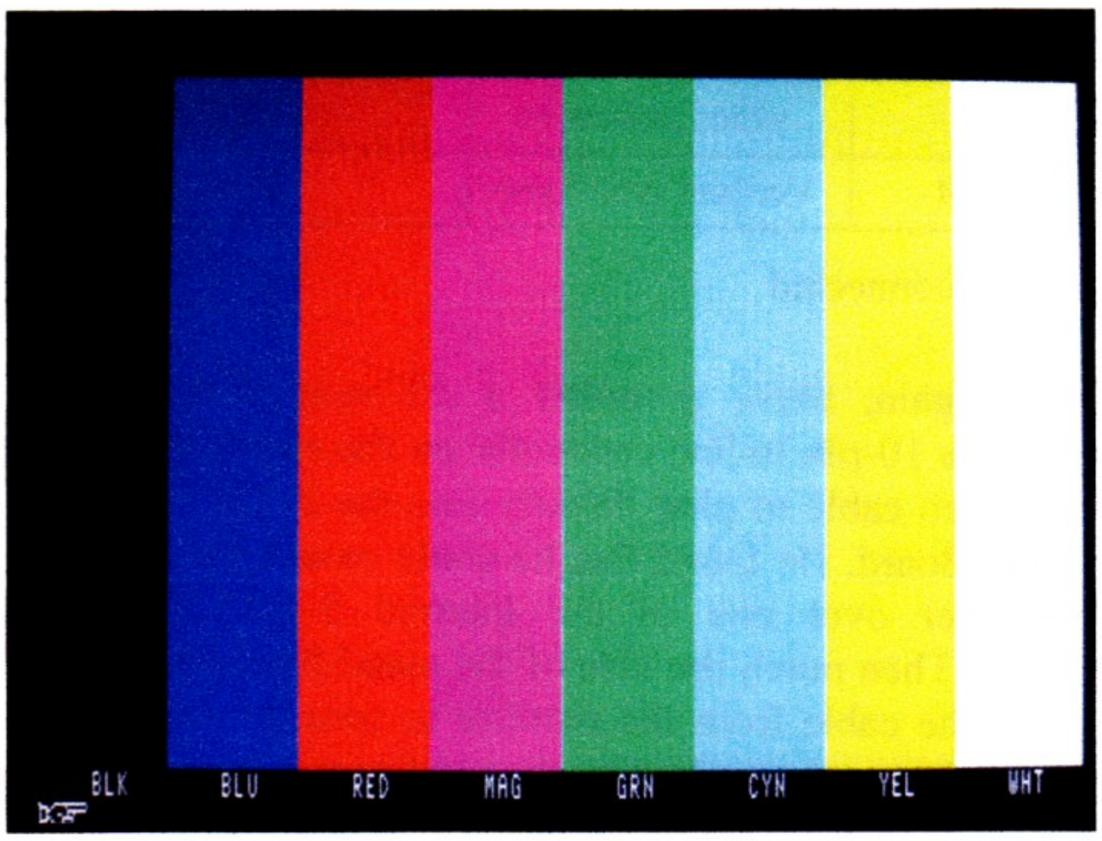
* I don't fully understand Clamp St and Clamp Sp. If you increase them you can get to a situation where the right part of the screen is blanked and the size of this blanked area depends on the Clamp values. If you decrease the numbers slowly from 99 by changing the first value a few numbers, then the second value, the blanked area walks slowly across the screen to the left edge. Perhaps it is to mask parts of the display from undesired artifacts or remove color misconvergence from the edges of the monitor. Who knows?

In any case, the values 90 to 95 blank at the right edge and values 01 to 05 blank the left edge. Either setting should work for you.

Now you should have a nice display that represents the output of the Z-100, such as the Boot screen...



Shown is the MTR ROM version 4.30 boot screen. I suggest you turn on the Z-100 color bar display using the F12 key or the Color Bar menu of the earlier ROMs.

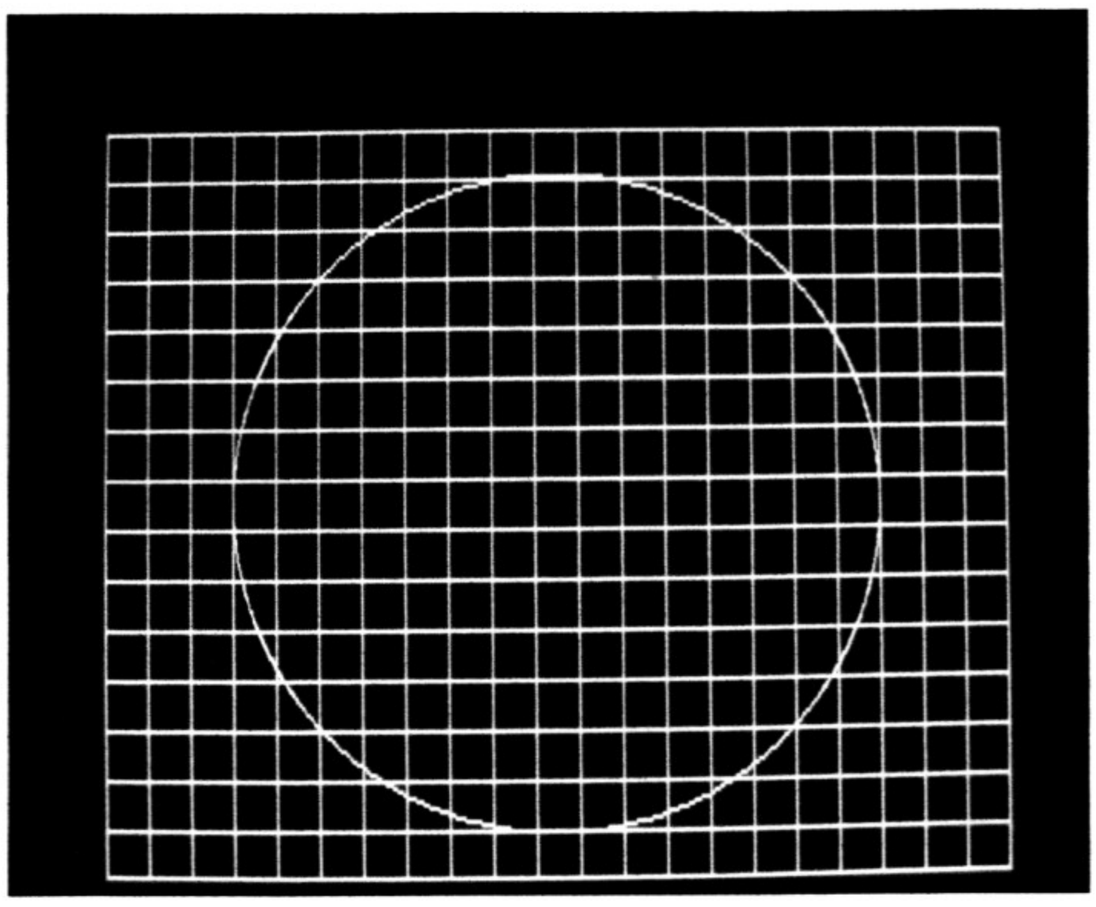


Verify that the proper colors are displayed and in the correct sequence. If the colors are wrong, check and correct the Z-100 to converter cable.

If the color white has some red, green, or blue tint, adjust the RGB potentiometers on the VGA converter until you get pure white. You may also want to try fine tuning the RGB potentiometers for an even better picture. Be careful, however, the pots don't look very rugged.

You can write a very simple BASIC program to draw a large circle on the screen which will enable to you to get the horizontal and vertical size to approximately the correct settings for an accurate circle...

```
10 'crosshatch
20 CLS
25 X=315
26 Y=112
27 Z=225
28 CIRCLE (X,Y),Z
30 FOR I=0 TO 640 STEP 30
40 LINE (I,0)-(I,240),7
50 NEXT I
60 FOR I=0 TO 250 STEP 15
70 LINE (0,I)-(630,I),7
80 NEXT I
90 GOTO 90
100 END
```



I found when setting the vertical size, I would see undesired lines at the bottom of the screen if I went too small. The value given earlier works for me.

You may have to compromise on the settings between a perfect circle and a good looking display.

The final sub-menu is the **Picture Menu**. It has five items and return. Again, the first value it the default setting, the second is the setting that I am using, as best on my monitor:

1.	Brightness	50	69
2.	Contrast	50	99
3.	Saturation	50	99
4.	Sharpness	05	10
5.	Default		
. .	Return		

Note: Some displays were subject to burn-in, and excessive contrast or brightness for a length of time would create a permanent shadow burned into the phosphors of the CRT. I don't believe that LCD displays suffer from this problem, however.

What to do About Jitter

Once we got everything working pretty well, we both noticed that under some conditions we would see jittering on the top and/or bottom rows of the display. We don't know what causes this, but it is likely some setting that is on the edge of stability.

We have been able to fix it by pressing the AUTO/DN button (menu should be off) for five seconds and releasing. The red LED on the converter board should flash several times and the flickering should go away.

You might have to try this several times. If the red LED only flashes once, the flicker will likely remain. If this happens, try adjusting the horizontal and vertical width and position slightly and try again.

Make sure the menu is off each time you try the AUTO /DN switch. For some reason, I had the best luck doing this while the Z-100 was displaying the color bars using the boot up monitor (F12 key). Eventually, you should see the flickering clean up.

Monitor Suggestions and
Fine Tuning Monitor Settings

We suggest LCD monitors no larger than 17" diagonal and 4:3 aspect ratios. A resolution of at least 1024 x 768 is suggested. This will match up best with the resolution settings available on the converter menu. High definition monitors with VGA inputs should work but they are not necessary and you may see some strange aliasing effects.

We have successfully tried the following monitors:

- 17" Dell E171FPb LCD SVGA monitor with 4:3 aspect ratio and a resolution of 1280*1024.
- 17" Dell E176FPb LCD SVGA monitor with 4:3 aspect r atio and a resolution of 1280*1024.
- 15" Zenith L15V26C LCD 4:3 aspect ratio television, that has a PC input with a resolution of 1024 x 768
- 15" Dell E771a CRT monitor with a resolution of 800*600

- 17" HP HSTND-2L05 LCD SVGA monitor with 4:3 aspect ratio and a resolution of 800*600
- 19" ViewSonic VA912b, model #VS10931 LCD SVGA monitor with 4:3 aspect ratio and a resolution of 800*600
- 20" HP widescreen W2071d with 19:6 aspect ratio and a resolution of 800*600

Note: On the widescreen HP monitor, the picture is not shrunken like the televisions do with added black on each side, but the Z-100 screen is stretched across the screen, making really wide characters.

Remember that monitors have their own horizontal size and position controls as well as brightness, contrast, and maybe sharpness. Play with these as you like to get the best possible picture. Iteration between these settings and the converter settings may be necessary.

Final Recommendations

Unless you like the idea of a nice enclosure for your converter or want a pretty much turnkey installation regarding power supply, etc. buy a GBS-8200. If you really need to display output on two monitors simultaneously, then buy a GBS-8220.

Internal mounting of the adapter might have the disadvantage of one having to remove the cover to make changes in the adapter settings. However, once the converter is set, minor changes could be made with the monitor's own settings.

If you have a working CRT CGA monitor and are happy with it, I suggest you hang on to it, even if you want to buy one of these inexpensive adapters for an LCD monitor you may already have. You should not expect a perfect rendition of what you are familiar with on a CGA CRT monitor. With a color CGA CRT you will see the individual dots of a character. With the LCD the dots tend to blur together.

I don't like that as much but the tradeoff of having a less bulky, less power consuming, cheaper and more available display going forward makes this approach attractive to me. It won't cost you much to determine if you like it. I have talked only about an LCD VGA monitor. A CRT VGA monitor may be more appealing. Try both if you have them.

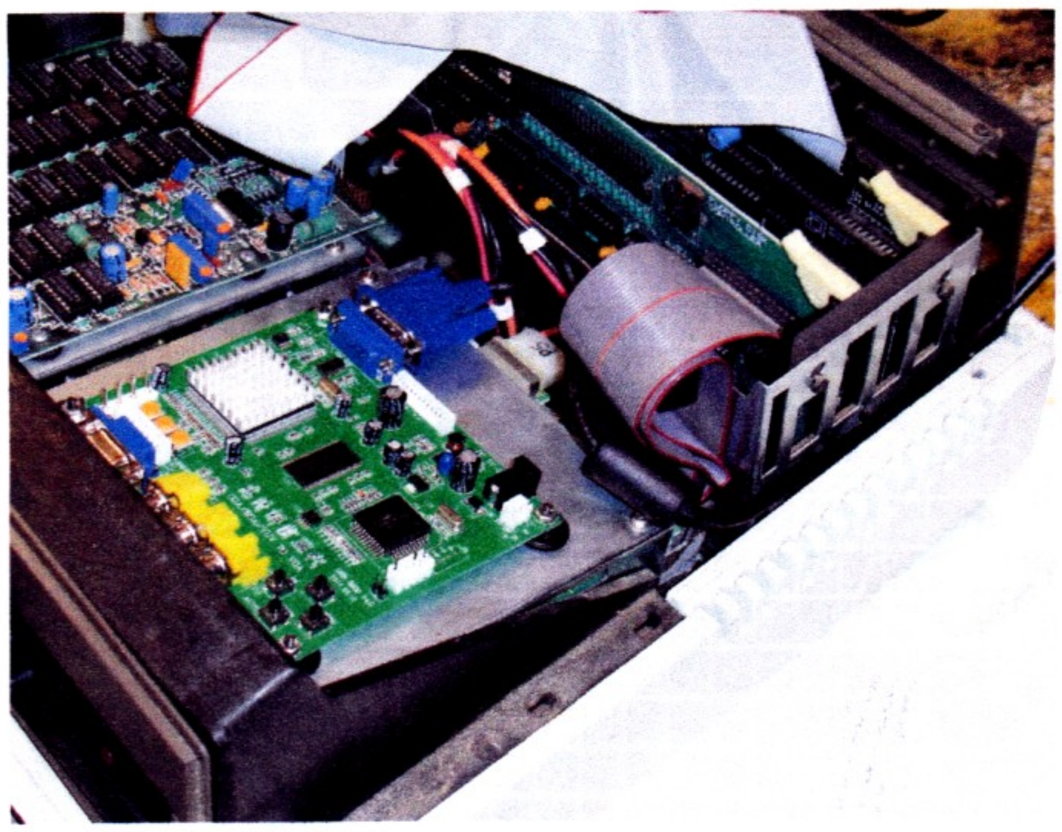
Mounting the VGA Converter Within the Z-100 Series Computer

by Steven Vagts

If you desire to mount this new capability within your Z-100 series computer, there seems to be several options available. First, I'll discuss two possible options for the H/Z-110 low-profile computer. Then, I'll show an option for the H/Z-120 all-in-one.

Mounting Within the Low Profile Z-110

As I mentioned, there are two options that I have looked into. The first is easy...

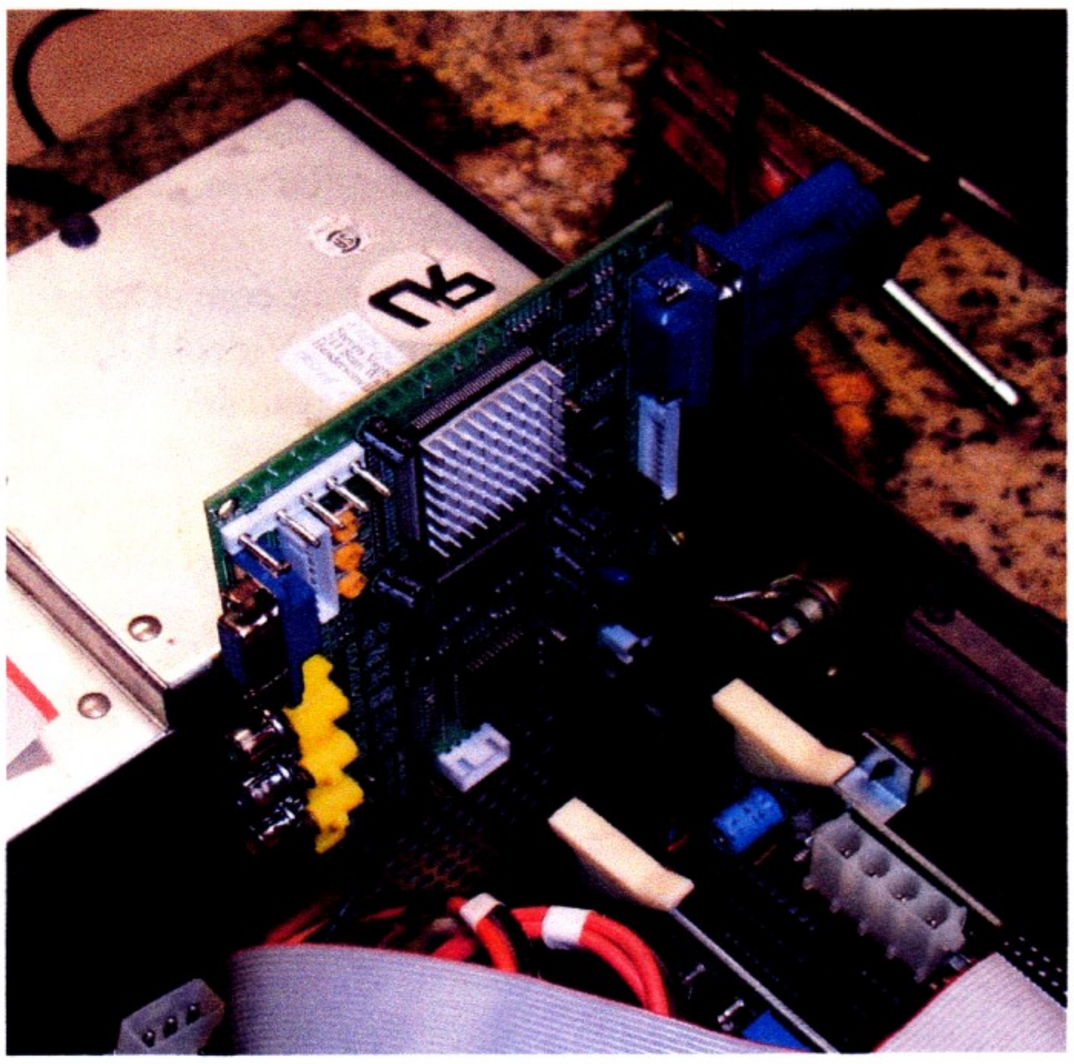


Mounting the converter onto the floppy drive cover is always the easiest. I've used the same approach to adding the 3.5" floppy drive and even adding the IDE Compact Flash card adapters (with modification to the front bezel).

In this case, I simply mounted the converter onto the upper shield of one of the floppy drives (the right one in this computer). I used grommet spacers and #4 screws to fasten the unit securely. Leave ½" space to the left and right side to avoid the floppy drive's side mounting brackets.

You can see the monitor cable is routed around the card cage to the right side where a notch is ground into the right side of the rear panel with a grinder. Smooth the edges carefully so as not to leave any burrs.

If space is not available here because, like I mentioned, you already have this space occupied by IDE drive, 3.5" drive, etc., there is a second option.



This one is more difficult and isn't for the faint hearted. If you look beside the right side of the power supply of the low profile computer, you will find what appears to be just enough space to mount the converter on the right rear corner of the power supply, though obviously not in this position. This picture was just meant to show the relative sizes. You would need to lower the converter so the top edge is about level with the top of the power supply.

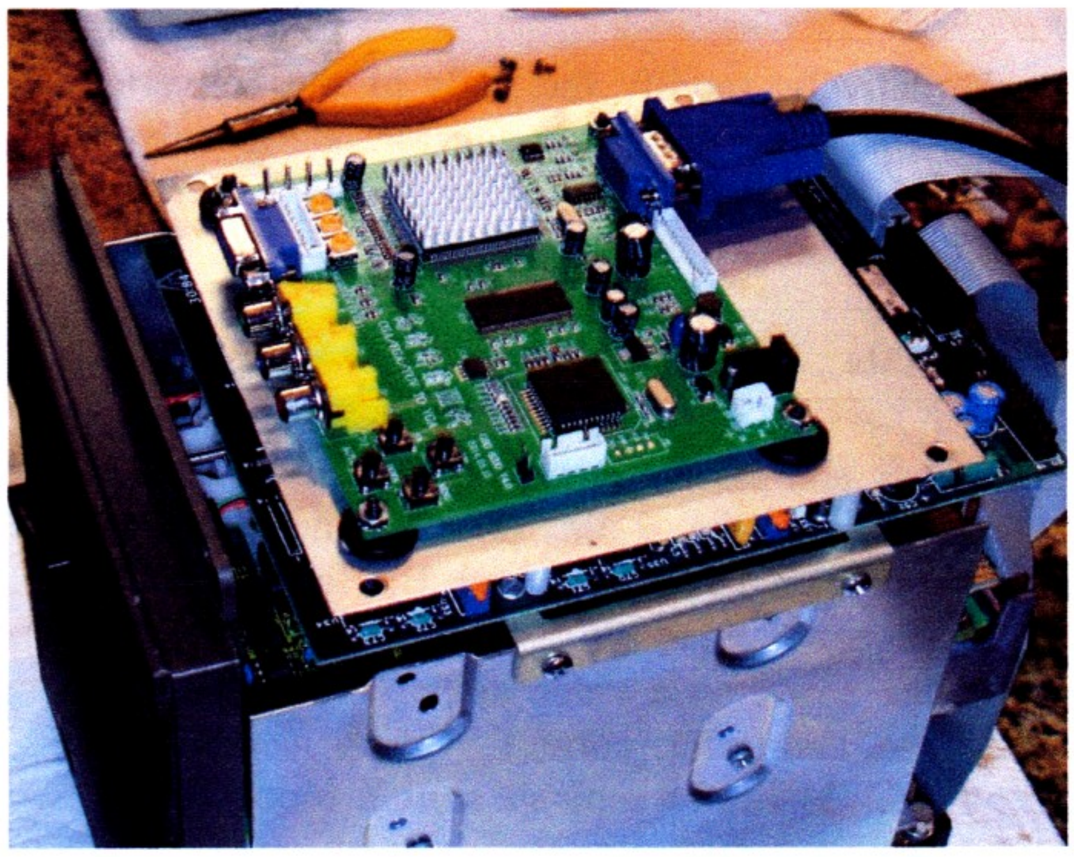
Use ½" plastic spacers at all four corners of the converter to leave an adequate gap for air to enter the power supply. These plastic spacers can easily be cut from old 'Bic' pen cases (I always keep a supply of these on hand). You can see where the converter would otherwise cover the air vents.

Drill a hole similar to the existing CGA connector mount in the back panel and adequate to mount the converter board with the rear VGA connector exposed outside the rear panel. If done carefully, you could mount the rear of the board flush against the rear panel and only use two other screws and ½" spacers to hold the front edge of the converter.

I have not done this installation, but it looks promising. Please let me know if you try this method, with any problems and solutions that you may have encountered. I'll pass on the results. Include pictures, if you can.

Mounting Within the All-in-One Z-120

Finally, within the all-in-one Z-120 you have only one good option: The top of the drive bay is an excellent, usually open area of sufficient size and accessibility.



Mount the converter in a manner similar to the first option for the Z-110 - on top of the floppy drive shield, if a dual floppy installation.

If an MFM hard drive is installed, this is where the Data Separator Card is installed. But not to worry, there is still room to mount the converter atop this Data Separator Card. You can use another metal shield similar to the above, or make a similar bracket out of plexiglass plastic, aluminum sheet, or even thin plywood. Just use plastic standoffs to raise the new converter platform above the Data Separator Card.

I have not done this installation, but it looks promising. Also, I did not actually install the spacers shown above. I just used them to support the card platform and give you the idea of what they would look like. I would change the screws mounting the Data Separator card to the brackets, install the spacers there, and drill holes in whatever converter platform you decide upon. Using longer screws, attach the brackets through the Data Separator card, through the spacers, and to the new platform holding the converter board.

Please let me know if you try this method, with any problems and solutions that you may have encountered. I'll pass on the results. Include pictures, if you can.

Power Requirements

In all instances, power is by equipping the power cable leads with spring clips and clipping the leads directly to the motherboard's power connectors. As discussed in Charles' article, use the +5vdc power point.

Or, alternatively, modify the ends of the converter's power cable with a drive connector, using only the +5vdc and ground leads and plug the converter in as you would a standard drive.

Signal Cable

Charles has addressed the modification of the Signal Cable for using the 9-pin Dsub connector already installed on the Z-100's rear panel. But for internal use, it is much better to attach a 10-pin connector to the ends of the converter's video cable. You could either modify the connector currently being used on the Video Logic Board or a separate similar connector.

As I had several extras, I attached a separate connector by:

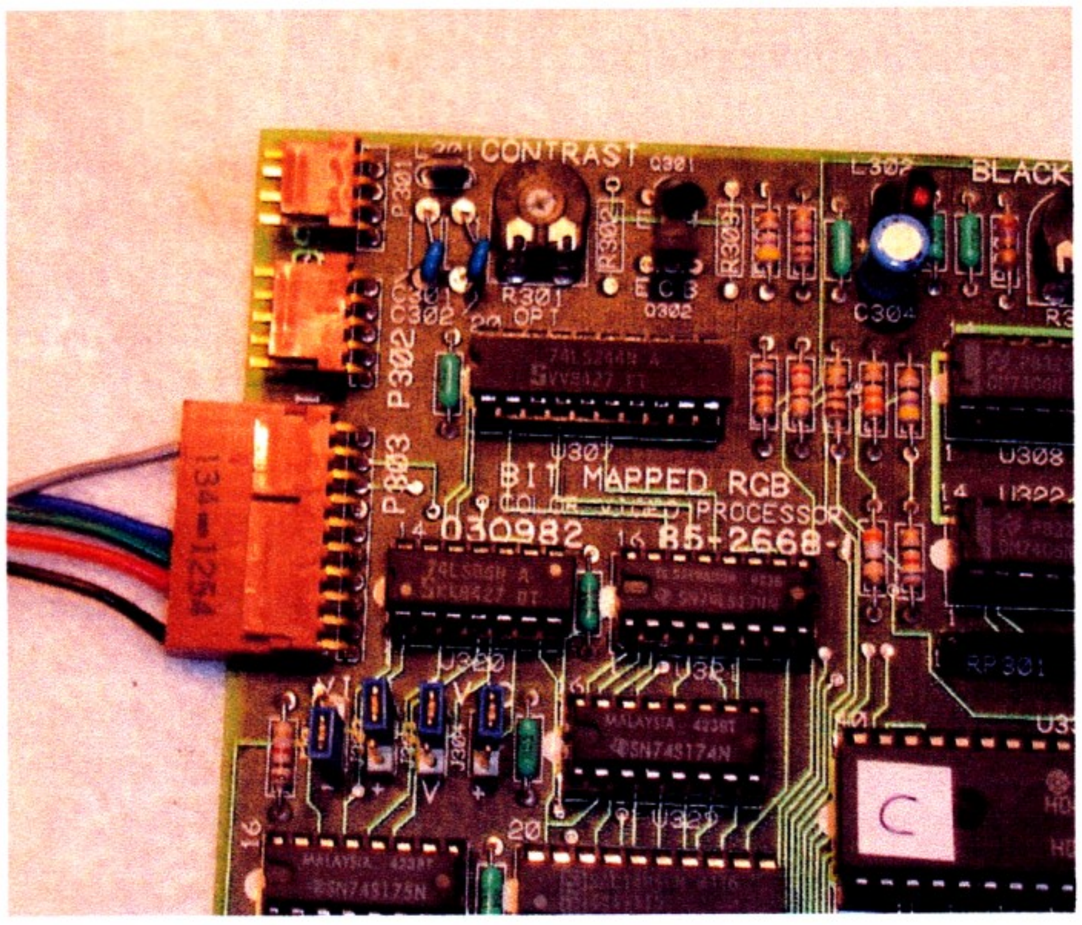
- Unclipping each of the existing wires by pressing the small tab accessible through a window on the back of the connector while pulling on the wire. Carefully pry open the tabs holding the insulation part of the wire to each spring clip
- Cut off the old wire where the uninsulated part is crimped to the spring clip
- Remove the yellow wire from the converter's signal cable. It can be removed from the converter's connector in the same manner that you removed the old leads from the video logic board's connector.
- Remove about 1/8" of insulation on each of the converter's signal cable.
- Fold the tabs around the new, dressed leads and solder each wire to the spring clip.
- Gently open the small tab that you had previously compressed to remove the wire from the connector with the edge of a knife or razor blade. Don't overdo, as these are fragile. Open just a slight bit to insure that it will catch in the connector.
- Insert each wire into its proper slot in the connector. Make sure you don't reverse the wires in the connector. As the small tabs are very fragile, they won't last repeated use.

If you would rather not reuse your existing connector, I have found what appears to be similar Video Logic Board 10-position in-line connectors available from Mouser Electronics. The CST-100 connector shell is white, however. It is Mouser #571-1-770602-0 for $0.35 each. The pin contacts are Mouser #571-770666-2 (gold plated) for $0.62 each with a minimum order of 20.

Notice: Mouser has a note that these connectors are scheduled for obsolescence and will be discontinued by the manufacturer. In fact, the tin version of the pin contacts are already no longer available.

An alternative connector that would work is also available from Mouser Electronics, a non-polarized, in-line connector shell, Mouser #571-1874997 for $1.97 each and the contact pins, Mouser #571-875236 for $0.21 each.

See the following picture for the completed cable attached to the Video Logic Board.



Finally, set the jumpers as shown in the above picture. These are J301 on the left through J304 on the right. From left to right, they should appear to be down, up, up, and up.

Good luck.