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Monitors for the Z-100

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Monitors for the Z-100

A reader had a monitor go out on his low-profile Z-100. The brand is immaterial, but when I sent him a ZVM-135 replacement, it would not work for him.

While researching the problems, it quickly became evident that little had been written on the subject in the past, leaving many in doubt as to what would work, and what would not. So what does one do when his favorite monitor decides to go on vacation?

While I am certainly no expert on the subject, I have picked up on a couple of things, like everything else in the LifeLine, and I would like to pass them on. If any of you have first hand experience with a particular setup, or have something to add, please send me a note.

Everyone probably believes that any Heath/Zenith monitor will work without difficulty, right? Well, not quite.

Though I still do not know for sure, it appears my friend had been using a non-Zenith monitor in the composite mode - using a 75-ohm cable to connect from the Z-100's J14 port to a phono jack on the monitor.

Whoa, I may have jumped into the subject too fast, let's try again.

The Z-100 Video Logic Board

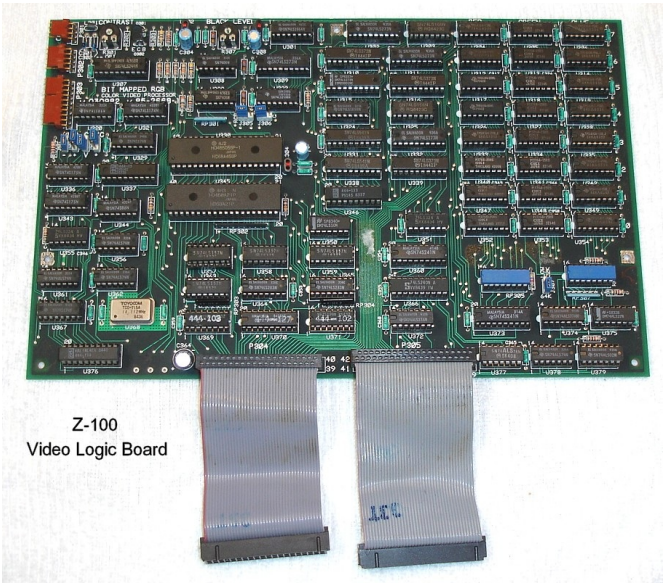


Photo 1.
The Z-100 Video Logic Board

The Video Logic Board is mounted horizontally and upside down over the motherboard.

In the Z-120 All-in-one, it generates the video signals to either the internal monochrome monitor or to a DB-9 connector on the back panel for a color RGB monitor. There is also a brightness control on the back panel at J14.

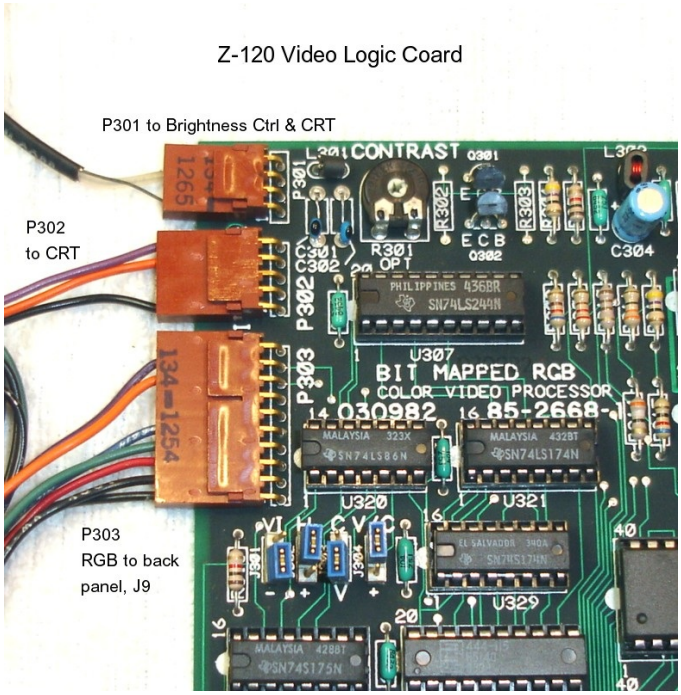


Photo 2.
Connections for the Z-120 All-in-one

Taking a closer look at Photo 2, you can see that in the Z-120, all three connectors are used:

P301 provides Composite signal to the internal monitor via a brightness control on the rear panel at J14.

P302 provides additional synchronization signals to the internal monitor.

P303 provides the RGB signals needed for a color monitor connected to J9 on the rear panel.

While looking at Photo 2, we also have a good view of the jumpers below P303. These are defined as:

J301 - Selects the polarity of the vertical sync signal for the **internal** monitor. Putting the jumper on the **'-'** marked side selects negative polarity. This is the normal position.

J302 - Selects the polarity of the horizontal sync signal for an **external** RGB monitor. Placing the jumper on the **'+'** marked side selects positive polarity. **'H'** is the normal position. Monitors that are set for use with PC-clones generally require positive **'+'** horizontal sync.

J303 - Selects either composite sync or vertical sync for the external RGB monitor. Placing the jumper on the **'V'** marked side selects vertical sync. This is the normal position.

J304 - Selects the polarity of the synchronization signal selected by J303. **'V/C'** is the normal position. **'+'** is generally required for monitors used on a PC-clone.

J305 & **J306** - These jumpers (not visible in this photograph) select color or black and white video. For color, or monochrome monitors that may display 8 shades of green (or amber), both jumpers must be on the side marked **'RGB'**. For monochrome, both jumpers must be on the side marked **'G'**. When you are using color, all three RAM banks are enabled and MUST have RAM chips installed. For monochrome, only the green bank is used.

J307 - This jumper allows for different types of RAM to be used on the video logic board

1. If the jumper is placed on the side marked 'LOW 32K', lower 32K type RAM chips are selected.
2. If the jumper is placed on the side marked '64K', 64K type RAM chips are selected.
3. If no jumper is installed, upper-type 32K RAM chips are selected. (I have no clue what the difference is between upper or lower-type RAM chips - SWV)

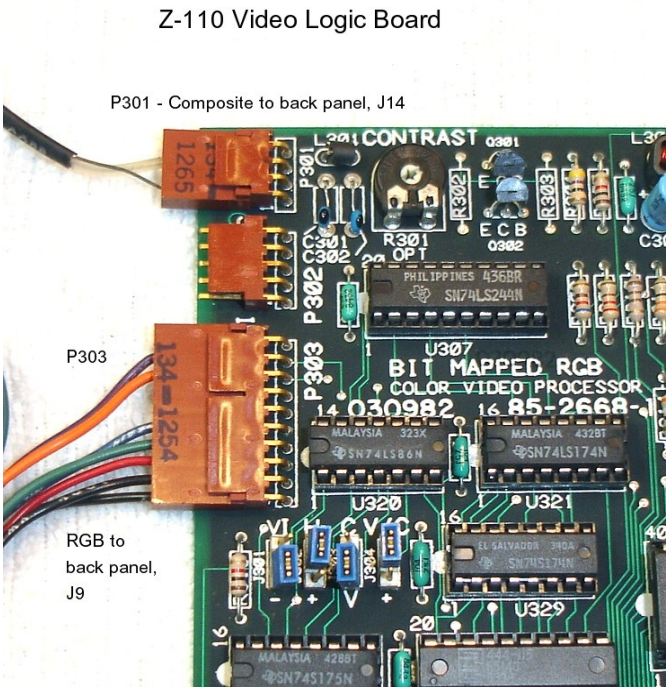


Photo 3.
Connections for the Z-110 Low-profile

Taking a closer look at Photo 3, you can see that in the Z-110, only two connectors are used:

P301 provides Composite signal to a rear panel phono plug at J14.

P303 provides the RGB signals needed for a color monitor connected to J9 on the rear panel.

The Video Logic Boards are identical for both models and have two adjustment controls:

Black Level Control

The Black Level Control (**R307**), located along the top edge of the board, just off camera to the right of Photo 2, should be set initially at the 1 o'clock position, and then adjusted (if necessary) for the desired blackness level.

This control is primarily for use with the Z-120's internal monitor. You do not need to readjust this control if you are using a monitor that has its own black level control.

Contrast Control

Set the Contrast Control (**R301**, not installed on all units) fully counterclockwise. Again, it is primarily for use with the Z-120's internal monitor.

Note: You do not need to remove the Video Logic Board to gain access to these adjustments. While the board is still mounted upside down on the motherboard, you may adjust these controls with a small flat-blade screwdriver through holes on the board's edge closest to you. Contrast is the leftmost hole, the Black Level control is further right.

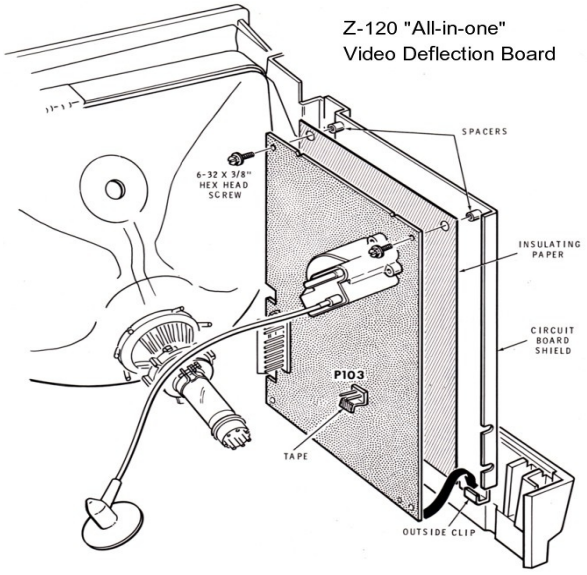


Figure 1.
The Z-120 Video Deflection Board

The Cables

There were two popular methods of connecting a monitor to the Z-100. Both signal methods are provided by the Video Logic Board.

One method uses a composite video connection where the horizontal and vertical synchronization signals are combined with the three color signals forming a single composite video signal that is then sent to the monitor over a two conductor coaxial cable.

The coaxial cable uses a center signal conductor surrounded by a ring of insulation and wrapped with the ground signal conductor, either an aluminum foil conductor, a spiral wrapped stranded conductor, or a combination of both, all covered by a round insulating jacket.

The All-In-One internal green (or amber) monitor uses this method. The coaxial cable is connected from the video logic board at connector P301 to the video brightness control on the rear panel and then to the video deflection board mounted vertically beside the picture tube (Figure 1).

The signal is then broken down into its separate components to control the horizontal and vertical sync signals and the color signals to control the gray scale intensity.

On the low profile Z-100, the composite signal is available at the J14 rear panel phono plug. It works great for the green monitors, such as the ZVM-122. Many color monitors, such as the ZVM-135, have the capability to use either signal method, provided both the computer and the monitor are adjusted to use the composite signal.

So, what about the second method? Well, I'm glad you asked.

The second method keeps the signals separate, using a 9-pin connector, labeled J-9 on the rear panel of both the All-In-One and Low-Profile Models. A seven conductor cable, all separately insulated, is connected inside the computer to connector P303 on the Video Logic Board (See Photo 3).

The cable to the external monitor also has seven, eight, or more conductors, generally wrapped by a heavy, protective jacket. Some monitors have the cable permanently attached inside. Others use a 9-pin, 15-pin or 25-pin DB-connector. Unfortunately, nearly every monitor, even Zenith's, require a special cable.

For the Z-100, the cable pinout follows:

9-pin	25-pin	Signal
2	16	Ground
3	7	Red input
4	5	Green input
5	6	Blue input
6	NC	No connection
7	NC	No connection
8	1	Negative horiz or neg. composite sync*
9	14	Negative vert or neg. composite sync

Note: The ZVM-135-1 cable designed for connecting the Z-100 to the ZVM-134/135/136 families of monitors adds 200 ohm 1/4 watt resistors from each color line to ground. I do not know the purpose or if this may be necessary for other monitors.

Note: Though the Z-100 does not use the remaining pins on the DB 25-pin connector, and the ZVM-135 cable for the Z-100 does not use any other pins, the ZVM-135 itself can still use most of the other pins for other computers:

25-pin	Signal
2	Positive horiz or pos. composite sync*
3	NC
4	Positive vert or pos. composite sync
8	NC
9	NC
10	Green feedthrough
11	Apple X1 input
12	Apple X2 input
13	Apple X3 input
15	IBM intensity
17	NC
18	Audio input
19	Ground
20	Composite video input
21	Red feedthrough
22	Blue feedthrough
23	NC
24	NC
25	Apple X8 input

Note: Composite sync must be supplied to both the horizontal and vertical sync inputs.

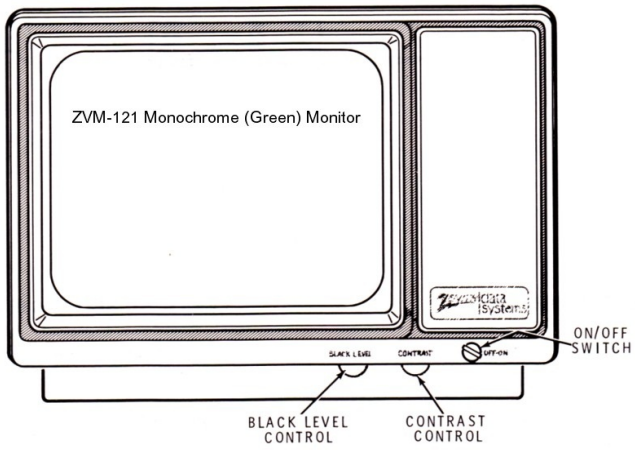
Each computer manufacturer has their own wiring needs. For example, the ZVM-135 manual refers to 4 different cables for their monitor:

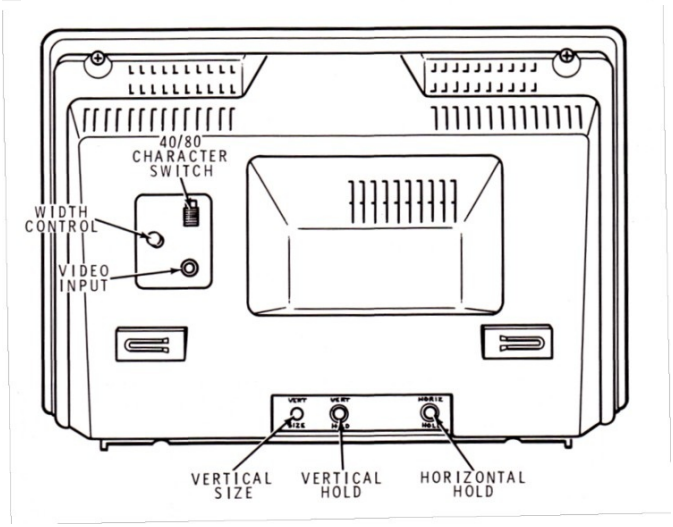
1) Z-100 family of computers
2) IBM
3) Apple
4) TI, Commodore VIC-20 or 64, and Atari 800 or 1200

What does this mean to you? Well, you need to be careful if you are looking for a replacement monitor. The cable that the monitor comes with may not be the proper cable for the Z-100, which was considerably less popular than the other computers listed.

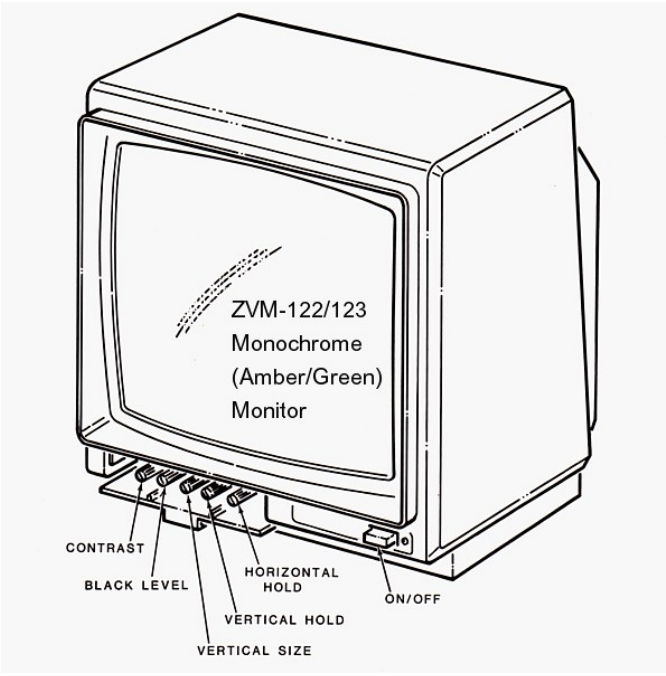
The Monitors

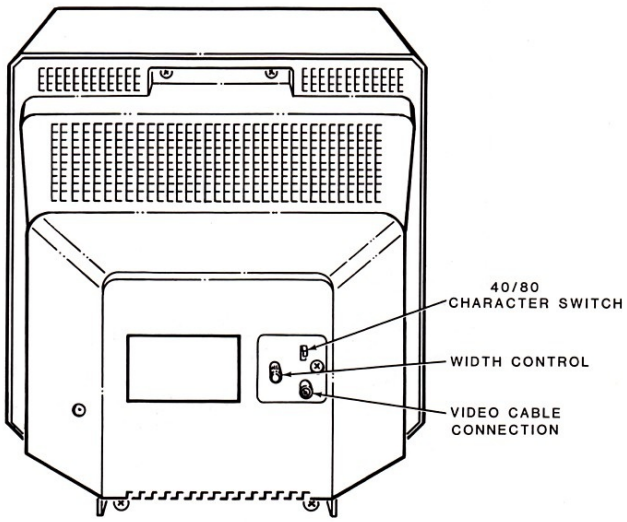
The monitors also have different characteristics and requirements. Let me share the information I have on some of the more popular Zenith models:





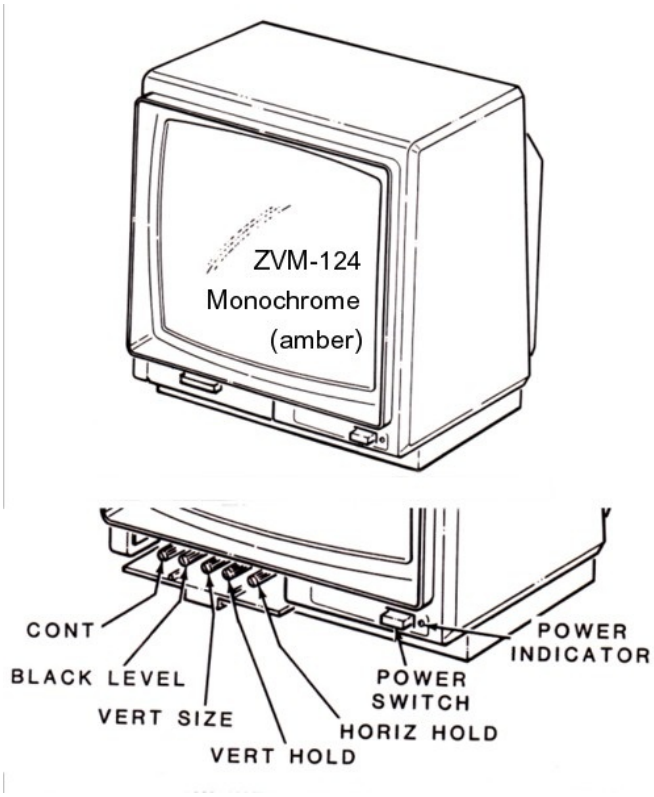
ZVM-121 -- A 12" green monitor that accepts NTSC composite video input via a phono plug to display 25 lines of 40 or 80 chars/line. Front panel controls include black level and contrast. The rear panel controls include width, vertical size, vertical hold, and horizontal hold. The 40/80 char switch is located on the rear panel. This unit works well with the Z-100.

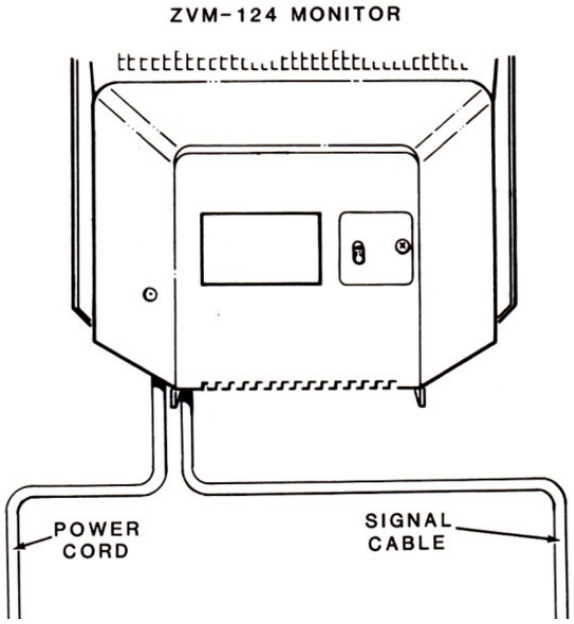




ZVM-122 -- A 12" amber monitor that accepts NTSC composite video via a phono plug to display 25 lines of 40 or 80 chars/line. Front panel controls include brightness, contrast, vertical hold, horizontal hold, and vertical height. The 40/80 char switch is located on the rear panel.

ZVM-123 -- The same as the ZVM-122, but with a green CRT. Both units work well with the Z-100.





ZVM-124 -- A 12" non-glare, amber CRT capable of 25 rows with 80 chars/row made specifically for the IBM PC. I don't know if it will work on the Z-100. The ZVM-124E model uses 220VAC, 50Hz. One model can be converted to the other, if necessary.

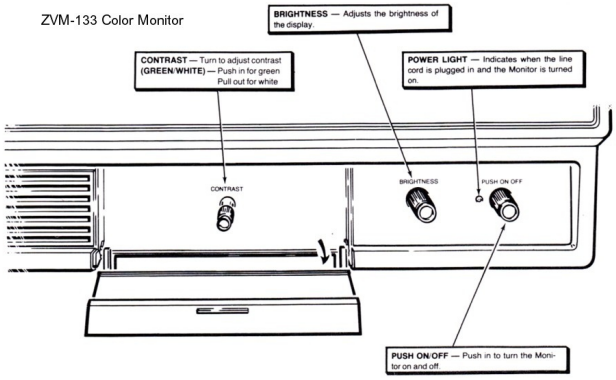
The ZVM-124 uses a 9-pin D-type connector with the following pinout:

Pin	Signal
1	Shield ground
2	Signal ground
3	NC
4	NC
5	NC
6	Highlight input
7	Video input
8	Horiz sync input
9	Vert input

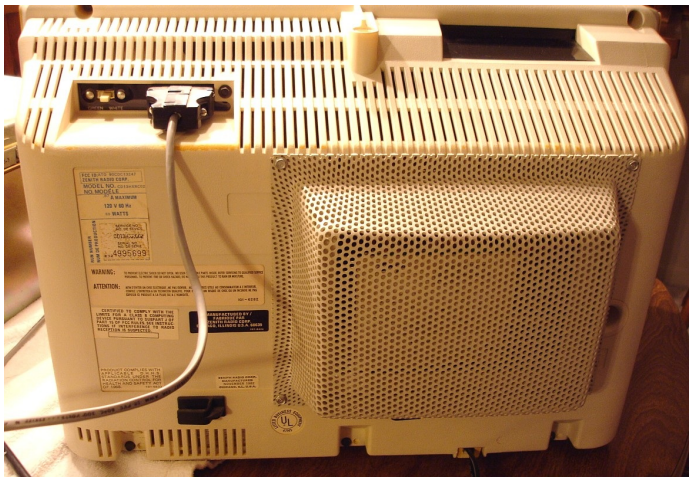
Note: The models, ZVM-130, ZVM-131, ZVM-133, ZVM-135, and ZVM-136 all share similar cases, though the electronics improve considerably over their life. Check the model numbers carefully.

ZVM-130 -- A 13" medium resolution monitor with a 40-character display. I have no further info on this model. Pass on this monitor at a garage sale.

ZVM-131 -- A 13" medium resolution monitor with a 40-character display and includes a speaker, which makes it usable for video games, video recorders or video disc systems. Pass on this monitor at a garage sale.

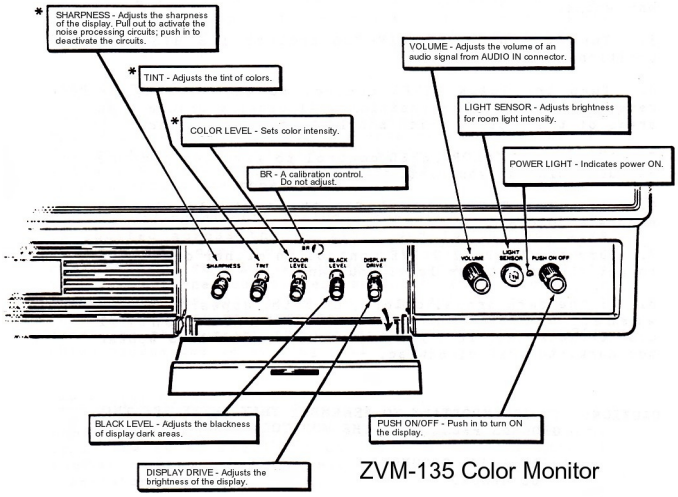


ZVM-133/CVM-133 -- A 13" high resolution RGB monitor with .41mm dot pitch designed for desk-top computers which require an 80 column display and includes Intensity Signal capability (for 16 colors).

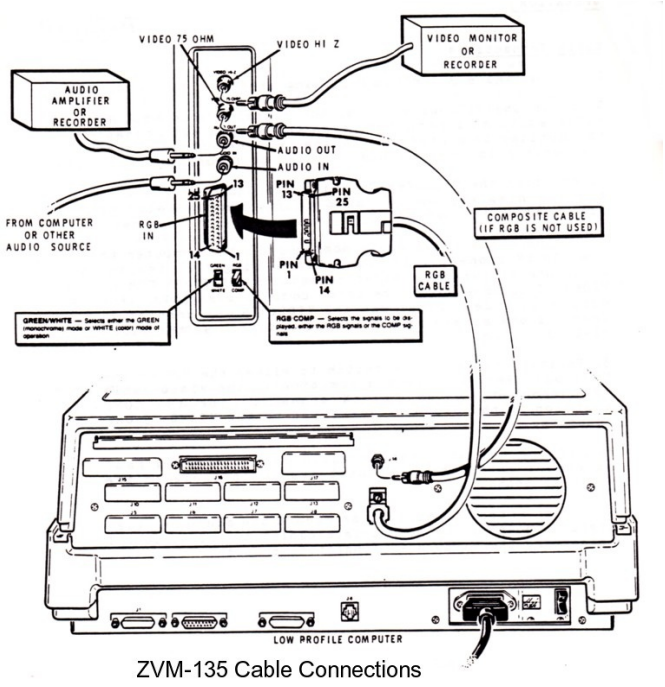


ZVM-134 -- A 13" high resolution RGB monitor with .43mm dot pitch designed for desktop computers which require an 80 column display. It has composite video and RGB inputs and a green switch for easier use when only text is displayed on the screen.

Note: Composite sync can be used; however, negative composite sync must be applied to both pins 1 and 9, or positive composite sync must be applied to both pins 2 and 4. This WILL REQUIRE A MODIFIED CABLE!



ZVM-135 Color Monitor



ZVM-135 Cable Connections

ZVM-135 -- A more capable version of the ZVM-134, this unit has the same features of the above and an audio speaker, automatic light sensor (not on all models) and noise reduction circuitry.

The ZVM-134 & 135 each display up to 640 dots (or pixels) horizontally and 480 vertically when using RGB. Each display 25 lines of 40 characters each using a pixel resolution of 250 dots when using composite video. So, whenever possible, use the RGB mode.

Both units will accept 1 to 5 volts positive or negative horizontal or vertical sync.

Either unit is an excellent choice for any system having a RGB 80 character output, such as the Z-100.

ZVM-136 -- The ZVM-136 is identical to the ZVM-133 RGB-only monitor, but with the added advantage of a long-persistence phosphor CRT.

If you need additional info on any of the above monitors, call. If anyone has information on any Zenith monitor not listed above, and there are plenty of them, I would love a copy for my files.

Video Adaptors

To complicate matters more, there were also three popular modes of color graphics used in PC compatibles in the late 80s (including the PC, PC/XT, AT, and the 386-PC):

CGA	Color Graphics Adaptor
EGA	Enhanced Graphics Adaptor
VGA	Virtual Graphics Array

Monitors manufactured for use with different graphics modes may have different specifications.

For example, the horizontal scan frequency of the monitor has to match the frequency produced by the Z-100 (15.75 KHz). Any fixed frequency monitor MUST work at this same frequency in order to be compatible. Any monitor made for use with the CGA video card has the same horizontal scan frequency as the Z-100.

Also, many more capable & therefore more expensive monitors, such as the NEC Multi-Sync and Logitech Auto-Sync, had the ability to automatically synchronize with the video frequency generated by the host computer. These would work well with the Z-100 and are readily available in the used market.

Another important specification was the dot pitch (size of one single pixel on the display screen) should be as small as possible. The industry standard for the Z-100's resolution was a dot pitch of 0.31 mm. The CGA monitors mentioned above had dot pitches that ranged from 0.38 mm to 0.64 mm. Zenith's popular monitors of the time used 0.43 mm. A good way to assure that the monitor has a decent dot pitch is to get one that supports EGA video modes. These had 0.31 dot pitch or better.

Finally, a major difference between monitors which were used on the Z-100 and those that were used on early IBM-PC compatibles with CGA adaptors was the intensity function. The Z-100 produced 8 colors at one intensity level. The IBM-PC produced 16; 8 at a high intensity and 8 at low intensity.

The Intensity Signal

The intensity line, pin 15 mentioned earlier, is not used by the Z-100. If you connect the Z-100 RGB output to a PC-compatible monitor, and do not make special provisions for the intensity line, the monitor will display the low intensity colors. You will need to turn the monitor's brightness control to almost maximum to achieve normal Z-100 colors.

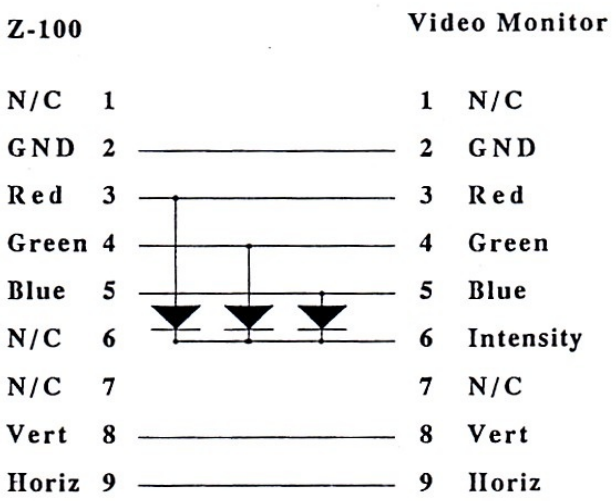
However, as addressed in Issues #1 and #14 of the Z-100 LifeLine, in articles by Travis Barfield and Paul Herman, a quick fix would allow use of the intensity line.

This solution allows you a wider range of adjustment to match room lighting levels. But, it will NOT suddenly permit your Z-100 to use 16 colors! Sorry, since it uses signals from the three color lines to activate the intensity line, all it does is allow better brightness.

In any case, if you are finding that you can't get enough brightness out of your color monitor, and it has the capability of accepting an intensity signal, you may wish to try the following.

You need to construct an adaptor that would plug into one end of the cable, between the monitor and the computer - either 9-pin or 25-pin. A 25-pin RS-232 adaptor, the type that permits changing any signal lines at will, can be easily adapted for use.

The pinout for a 9-pin adaptor follows:



Video Cable Intensity Adaptor

Notes:

- Make sure that the monitor's cable has a wire at pin-6, or it will NOT work!
- For those making a 25-pin adaptor to be placed at the monitor end of the cable, use the cable pinout mentioned earlier, but use pin-15 as the intensity pin.
- For those that have monitors with the cable hard-wired, or connected directly, to the monitor, doing the changes inside the Z-100 or the monitor itself might be a better option. In the Z-100, you can insert a wire with a female socket connector at pin 6 of the Z-100's connector J9, then run the other end of the wire to any convenient location where you can solder the diodes to the red, green, and blue wires.

One final note before moving on. If you have the EasyPC Emulator Board, you already have an intensity signal capability that will give you the 16 colors you desire!

This is simple. Install a female socket pin connector on one end of about 24" of #20 insulated wire. Insert the connector into position 6 of the J9 (RGB) socket on the rear panel of the Z-100. Install a "socket connector" on the other end of the wire which will plug into position 6 of plug P4 for the Easy PC video board (see next page). These "socket connectors" should be available from any of the larger electronics parts dealers.

Next, construct a video cable that contains a signal conductor from pin 6 of the Z-100 to pin 15, or the proper intensity connection, of your particular monitor.

So, now that we know all about cables and monitors and we have shopped very carefully, what if we still bring home a new purchase only to find that it still does not work properly?

If it's a Zenith monitor, odds are, it's the cable. Check the pinout with the above. If it's another manufacturer, such as IBM, I believe that they are actually manufactured to operate off a positive sync signal, horizontal and vertical.

Check out the jumpers on the Z-100's Video Logic Board. Finally, check out the cable. Someone may have changed some wires for one reason or another.

If you still are not satisfied, give me a shout. I may be able to use a similar Z-100/monitor setup and check it out for you.

In closing, I have not tried the various combinations of signals to connectors, but the above information should help you sort through the problem.

The wild card is the monitor. It may have been designed for any one of the computer brands mentioned above, or a number of others. Your odds of success improve if you stay with the Zenith monitors, which were some of the best in their day. Good luck!

If you have any questions or comments, please email me at:

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Cheers,

Steven W. Vagts