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HOWGOZIT

Happy New Year!

Well, Myra and I have been very busy since our last issue. Last year our pool had an obvious leak in our skimmer line somewhere between the skimmer and the pump house about 40 feet away, and underground. We had been needing to add nearly an inch of water a day during the summer, and with that much loss, and no visible water around the pump house or in the lawn, it had to be under the concrete pad around the pool. The pool was over 23 years old, but the liner had been replaced about 14 years ago and while it still looked great, it was nearing the end of its life.

However, as the pool was still usable, we felt that if the repair would be simple enough and a reasonable cost, we should make every effort to keep the pool. So, we called in a pool company to check everything out.

After checking all the lines and even scuba div-ing around the bottom of the pool, the verdict was in. We had leaks in the skimmer line, AND behind the pool light, AND at both water inlets at the pool steps! While the cost to repair was reasonable, the pool liner would not last much longer and we decided to have the pool removed.

Calling around the Hendersonville and Asheville area, we found only two companies that would do the job. Would you believe $45K to remove the pool, or $15K just to crush it in place and bring in additional dirt to fill the hole!

We chose to just crush it and by mid-November, we were the proud owners of bare dirt. The rest of November I spent repairing my brick walkways

and drainage. We also ordered and installed a 10 x 15' stone paver patio.

However, the day after completing the patio construction, it began to rain, creating a muddy mess.

Since work outside had to stop, I decided to tackle a pile of hard drives that I had meant to work on and check for the last several years, but could never find the time, next...

Hard Drive Testing

Over the years I had collected more than a dozen hard drives, most of which still worked, but others of unknown status. Those that no longer had the 'right stuff' were dismantled and recycled as scrap.

In this discussion, I make use of several hard drive utilities that may be familiar to you; PREP, PART, DETECT, and SHIP are examples and were unique to Zenith Data Systems computers, particularly the Z-100. For additional and more detailed explanation about these utilities, please read their respective articles on the "Z-100 LifeLine" Website:
   z100lifeline.swvagts.com.

There are separate articles for the ZDOS v3 utilities and the ZDOS v4 utilities.

My testing was simple. My Z-100 test bed was the bare minimum to accomplish what I needed; a newer motherboard with 192K RAM and ZROM v4.3 running at 5 MHz. It was spread out on our dining room table, with a power supply to the left, the hard drive under test to the immediate right, with the floppy drive to the right of that because it had longer cables, and the data

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separator card sitting flat to the rear of the motherboard.

I connected the system to a small monochrome monitor sitting on a thick book behind the test bed Z-100 computer. Oh, and I left my ZCLK2 attached (optional).

Hard Drive Testing
February 2024

My hard drive stash was from a wide range of old computers, some Zenith, but most were likely from IBM PC clones. For those unfamiliar with preparing hard drives for Zenith computers, they do not use the PC clones' FDISK utility, but must use a sequence of other, special Zenith utilities instead.

The first is the PREP utility which is used to prepare a hard drive for use with a preliminary, low level format. Depending upon the version of DOS used, the drive was partitioned into one or generally two partitions. In Zenith's DOS (ZDOS) v2 or DOS (ZDOS) v3, the initial partitions were named Z-DOS and CP/M, the two most used operating systems of the period, with about 1/3 of the drive set aside for CP/M.

If this division of partitions was satisfactory, you did not need to run PART, the next utility. The PART utility was used to create up to 16 partitions on the hard drive. You can read more about this utility's usefulness in the next article, "Hard Drive With a Split Personality".

Next, you would need to run ASGNPART to assign a drive letter to each partition, then run FORMAT on each partition's drive letter to prepare the partition for data, in the same manner as preparing (formatting) a floppy disk.

So, to test each hard drive, I would install the hard drive on my test bed, boot up to ZDOS v4.06 on a floppy, and check if the drive was usable by running ASGNPART 0:. If the partitions were readable, I would use PART to create the partitions I wanted, run FORMAT on each and install the appropriate operating system (OS) on each partition.

If ASGNPART 0: returns an error instead of a listing of partitions, the drive may be from another computer system - such as a PC clone, and has not been previously PREPped and PARTted. It is not recognizable. Other symptoms may be the motor not running (possibly STICTION), the drive LED not lighting (not set as drive DS0), cables not correctly connected, or other causes that you will need to troubleshoot.

If the LED was lighting correctly, you could try the DETECT utility without disturbing any existing data that may be on the drive. But I generally just assume the worst and go right to using PREP.

Note: To run PREP, you must have the FORMAT ENABLE jumper installed in the upper left corner of the Z-217 Hard Drive Controller. If you forget, you will get an error reporting the lack of that jumper.
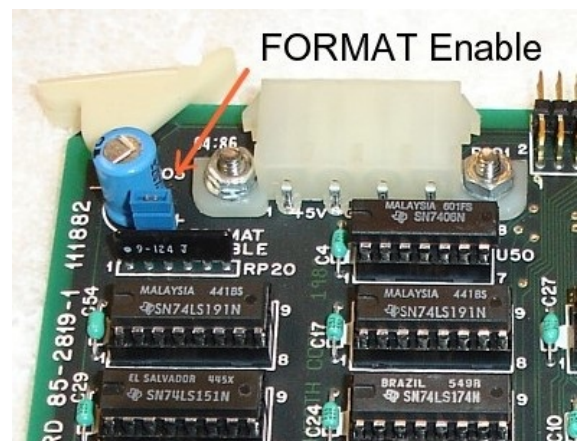
Note: Each hard drive has a set of programming parameters that must be loaded, including number of heads, number of cylinders, step rate, parking cylinder, etc. If PREP cannot find these already stored on the hard disk, it will ask a series of questions to get the information needed. I have published this necessary info for the most common hard drives in the PREP article on the website.

Note: PREP takes FOREVER to run, depending upon the memory size of the hard drive. As I recall, a 10Mb hard drive will take about 20 minutes per pass to complete and there are 7 passes! For a 40Mb hard drive, plan on it running overnight! For this reason, I like the ZDOS v4.x version of PREP because you can select the number of passes to run using the /Tn switch.

Most of my stash of hard drives worked flawlessly, but some failed miserably.

One hard drive of particular note was a Seagate half-height, 42Mb ST-251.

As you may recall, these were the subject of my several articles on STICTION over the years. And as luck would have it, I finally had one that was actually stuck. I had to remove the drive cover and rotate the platters to unfreeze it. The STICTION articles are also available on the website.

Do not be afraid to take the cover off these old drives. If you are concerned that you may damage something, what have you got to lose? Just exercise caution when handling the heads or arms, as they are very fragile.

Seagate ST-251 42Mb Hard Drive
Interior view

Note: When you remove the cover, you will see that the heads are mounted on the end of an arm that extends over the platter at an angle. Always rotate the platters in the direction that would extend the heads from their arms - that is counter clockwise in this case. If you rotate the other way, it may compress the heads into their arms and cause damage to the head as it twists. I have done it, and it turns the drive into a doorstop quite quickly.

I replaced the cover and completed the testing without further difficulty. If the drive is an earlier model, it may not have auto-park on shutdown. In addition to protecting the heads and platters against damage from dropping, use the SHIP utility for a drive with STICTION after every use, as the heads are moved towards the center of the spindle where the platter can exert more torque to break the heads' hold on the surfaces of the platters.

The remainder of this drive's testing was great, a nice quiet drive. I think I will leave this one attached to my test bed after this series of testing is complete. It has plenty of room for

all the operating systems and I can remove the cover on occasion to unstick the heads.

However, this drive, #00530228, became a real puzzle, next...

The Hard Drive With a Split Personality.

As I stated just a moment ago, this drive seemed to work great. I booted to ZDOS v4.06 and ran ASGNPART 0:. There were two existing partitions. In accordance with the ZDOS v4 instructions, I ran PREP /P to load the new recommended PC hard drive parameters.

Note: PREP /P does not affect existing data on the hard drive and the user data and partitions are not changed. The /P switch only updates, non-destructively, old drives with new "PC" style Software Boot Code. All previous data is retained unchanged.

Note: If you neglect to install the FORMAT ENABLE jumper on the hard drive controller, when you attempt to run FORMAT on the new partition, you will get the error:
   *"Error during formatting of the drive.
    Check format enable jumper."*

Note: If you neglect to run PREP /P on the hard drive, when you attempt to run FORMAT on the new partition(s), you will get the error:
   *"This version of FORMAT requires that you
    have run the newest version of PREP with
    the non-destructive /P switch on Winchester
    drives to function properly."*

Still using ZDOS v4.06, I ran PART to create a new set of partitions:

CPM	*CPM*	*3.00%*	*1327 Mb*
GEMINI	*DOS*	*7.00%*	*3095.5Mb*
ZDOS3	*ZDOS3*	*40.0%*	*17687 Mb*
ZDOS4	*ZDOS4*	*50.0%*	*22106.5Mb*

I made the default boot partition ZDOS3 and saved this partition configuration. However, after running ASGNPART 0:ZDOS4 E:, and running FORMAT E:/s/v, I got the message:
   "Insufficient memory for system transfer."

Even just running FORMAT E: without the switches gave the same error message. I also tried formatting the ZDOS3 partition, but got the same message. Running FORMAT on the smaller CPM and GEMINI partitions worked fine.

I thought I would try booting to my floppy ZDOS v3.10, but things got more interesting. When I ran v3.10's ASGNPART 0: it gave me:

CPM	*CPM*	*12%*	*1327 Mb*
GEMINI	*DOS*	*27%*	*3095.5Mb*
ZDOS3	*ZDOS3*	*154%*	*17687 Mb*
ZDOS4	*ZDOS4*	*193%*	*22106.5Mb*

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Look at the percentages?! I had heard that some individuals had experienced problems using ZDOS v4.06 to FORMAT a partition, but this confusion was a first for me.

Background: While I had been doing my Stiction testing on these drives in the past, I had been moving boards around on these drives. It was so long ago, that I had forgotten much of the work back then, but I seem to recall that I found two types of physical ST-251 drives; those with grey stepper motor leads and those with color stepper motor leads.

The stepper motors with grey leads used a controller board without a ROM attached. Their controllers still had a place for a ROM chip, but it was just never needed/installed.

The drives with color stepper motor leads all had ROM chips attached to their controller boards, and there were several different numbered ROMs, but only one number seemed to work - those numbered LSI-L18. I could never get any of the other ROMs to work.
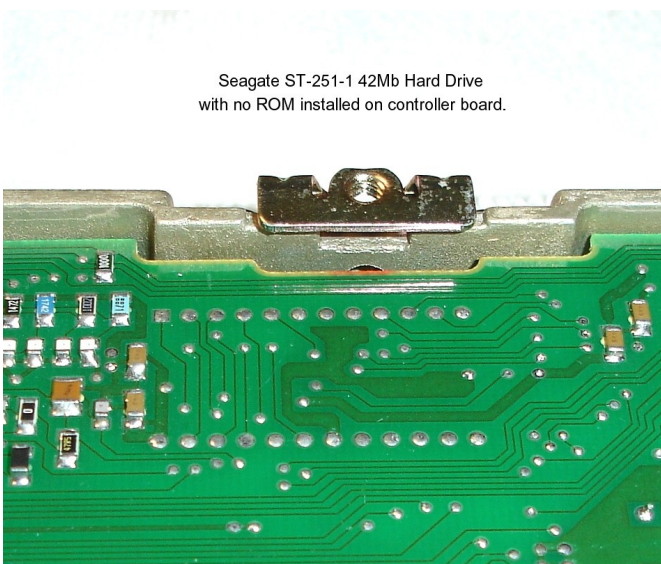

Seagate ST-251-1 42Mb Hard Drive with grey stepper motor leads.
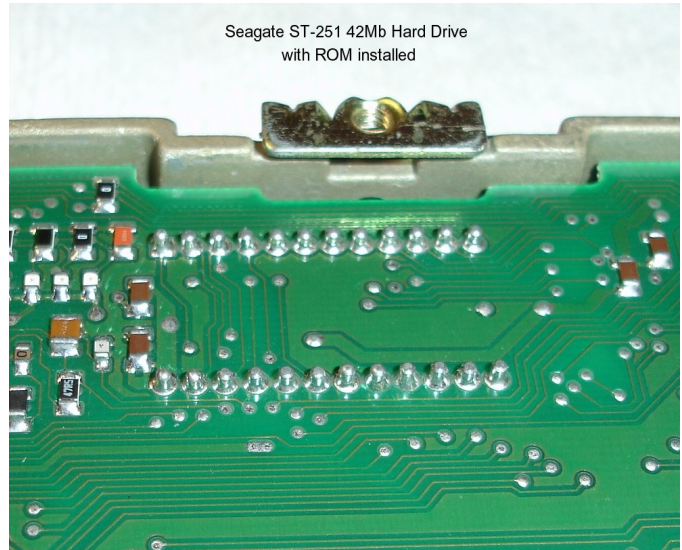

Seagate ST-251 42Mb Hard Drive with colored leads on stepper motor

Seagate ST-251-1 42Mb Hard Drive with no ROM installed on controller board.

Seagate ST-251 42Mb Hard Drive with ROM installed

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I found my notes on one of the ST-251 drives that the difference was:

"The colored stepper motors have a smaller spindle, make two revolutions, not one, and the LSI-L18 ROM sets the stepper motor to correctly stop at track 0."

I do not recall the source of this statement.

During my hard drive ROM experiments, I found great variance between ROMs. For example, in one of the ST-251 controller boards on a drive with **grey** stepper motor leads (ROM not used), I tried a controller board with different ROMs that I had collected at the time:

ROM:	Action:
FA/F18I	Does nothing?
FA/F18F	Does nothing?
FA/F16C	Spins, but no stepper action
/C22	Spins, some step activity, but gives error that we need the Format Enable jumper.
/S18I	Spins, but no stepper activity.
LSI-L18	Causes thumping of stepper motor.

Not only that, but there were differences even between controller boards. For example, if the LSI-L18 ROM was used on one board, it would PREP ok, and even FORMAT ok, but, when it first started, it would cause 4 thumps from the stepper motor hitting the limits. On another board, it would just cause a "device error".

Note: The only ROM that seemed to work reliably on a drive with colored Stepper Motor leads was the **LSI-L18**. If you find some other combination on a working drive, please contact me.

Anyway, back to my testing. While I was running ZDOS v3.10, if I reset the partition sizes using PART back to 3%, 7%, 40% and 50%, the total capacity of the drive was reported as 11Mb!

Further, when I rebooted to ZDOS v4 and ran ASGNPART 0: the percentages were now displayed as 0.78%, 1.81%, 10.36% and 87.05% and the total capacity was correct at 44Mb! Wow, what a mess.

My advice to those who had reported difficulty getting the drive partitions PREPped under ZDOS v4 had been to use an earlier version of DOS to PREP and PART the drive. Then boot to ZDOS v4 and run PREP /P. So, that is what I attempted next.

I rebooted to ZDOS v3.10 and ran **PREP /Q** to make sure I got to reenter all the correct drive parameters. For the 42Mb ST-251 and ST-251-1 drives, they were:

	Total	Reduced	Pre-Comp	Step	Park
Heads:	CYL:	WC Cyl:	Cyl:	Rate:	Cyl:
6	334h	335h	335h	1	38Eh

Initializing the disk... completed
Media test in progress, pass 1
Error - drive capacity >32 (64 if /k) Mbs.

Ok, so next I tried **PREP /K/Q**:

Initializing the disk... completed
Media test in progress, pass X (1-7)
Initializing the disk... completed

Next I ran ZDOS v3.10 **PART** and created:

CPM	CPM	3%	1327 Kb
GEMINI	DOS	7%	3095 Kb
ZDOS3	ZDOS3	40%	17684 Kb
ZDOS4	ZDOS4	50%	22102 Kb

Success! Total drive size was correct.

I rebooted to ZDOS v3.10 to complete the formatting and software installation on the ZDOS3 partition with the following commands:

ASGNPART 0:

Showed the correct partitions.

ASGNPART 0:ZDOS3 E:

FORMAT E:/s/v

Completed great, showed only 2048 bad sectors.

I rebooted to ZDOS v4 to check on our partitions and load the ZDOS4 software:

ASGNPART 0:

Showed the correct partitions and sizes!

ASGNPART 0:ZDOS4 E:
FORMAT E:/s/v

As expected, I got the error:
    "*This version of FORMAT requires that you have run the newest version of PREP with the non-destructive /P switch on Winchester drives to function properly.*"

PREP /P
Winchester drive unit number (0-3): 0
Input Winchester volume label > ST251
Update successful. You need to run ASGNPART to gain access to the drive.

ASGNPART 0:

Still showed the correct partitions and sizes.

ASGNPART 0:ZDOS4 E:
FORMAT E:/s/v

Completed great! I loaded the software without further incident. Yeah! A working drive.

I had had my doubts, and apparently justifiably, as I will find...

About a week later, I continued my hard drive testing, but the drive would not spin. I opened the drive as before, but the disk rotated with just the slightest resistance. I powered up again, but the drive remained silent.

The drive had a controller board attached, that I called board 'D', which has had spin issues previously. I swapped the controller board attached to the drive with another, which I called board 'C', and this time the drive spun-up just fine.

I tried the command **Boot {F3}{CR}** and the drive booted great to ZDOS v4. But the primary boot partition was set to ZDOS3? I thought that I had correctly programmed each ZDOS version to their respective partition names and set the default boot partition to ZDOS3, but maybe I got it wrong?

I ran **ASGNPART 0:** and the partition information and assignments, including the default boot partition were correct. So, I thought I would just do a floppy boot to ZDOS v3.10 and reload the ZDOS v3.10 to the ZDOS partition...

I did a floppy boot to ZDOS v3.10 and ran **ASGNPART 0:** which showed the correct partition information. Next, I ran **ASGNPART 0:ZDOS3 E:**, then **FORMAT E:/s/v**, but the operation stalled! The drive LED blinked initially for awhile, then came on steady for several minutes as the disk was being formatted. You could just make out the faint growling of the drive as the operation was working, but then the drive went silent and the LED went out just when the system was to be loaded.

I floppy booted to ZDOS v2.22 and tried FORMAT again. This time it worked correctly! After entering the label, ZDOS3, the computer reported 16384 bad sectors!

I rebooted to ZDOS v3.10 to try FORMAT again, but the command **ASGNPART 0:ZDOS3 E:** gave the error, "Read error on drive"! What the?

I did not have DETECT on the ZDOS v3.10 floppy disk, but thought I would try running DIAG on the hard drive.

1) The controller test was ok.
2) The Drive test, though gave the errors:

  "Error on drive 0 of Winchester controller 0"
  "Cannot read system boot code on cylinder 0,
    Head 0, Sector 1"
  "Check PREP"
  "Check drive"

Rebooting to floppy ZDOS v3.10 and running **ASGNPART 0:** again gave the error,
  "Read error on drive"

I was running out of options.

I decided to start the entire preparation again. I rebooted to ZDOS v4.06, and ran the following:

   ASGNPART 0: gave all the correct partitions, except the 50% ZDOS4 partition was reported as 49.99% and the total percentages of the drive were 99.99%/0.01%.

   ASGNPART 0:CPM E:
   FORMAT E:/s/v

As expected, I got the error:
   "This version of FORMAT requires that you have run the newest version of PREP with the non-destructive /P switch on Winchester drives to function properly."

   PREP /P
   Winchester drive unit number (0-3): 0
   Input Winchester volume label > ST251
   Update successful. You need to run ASGNPART to gain access to the drive.

   ASGNPART 0:

Still showed the correct partitions and sizes.

   ASGNPART 0:CPM E:
   FORMAT E:/s/v

   "New sector 251 is being marked as bad, from BST"
   "New sector 305 is being marked as bad, from BST"
   "New sector 1007 is being marked as bad, from BST"
   "Sector 251 is being marked as bad, already in BST"
   "Sector 305 is being marked as bad, already in BST"
   "Sector 1007 is being marked as bad, already in BST"
   "Verifying CYLINDER 0-23"
   "System transferred"

After entering a label, the computer reported 6144 bad sectors and 1.2M bytes available.

   ASGNPART 0:GEMINI F:
   FORMAT F:/s/v

   "Verifying CYLINDER 0-56"
   "System transferred"

After entering a label, the computer reported no bad sectors and 3.01M bytes available.

   ASGNPART 0:ZDOS3 G:
   FORMAT G:/s/v

   "New sector 3051 is being marked as bad, from BST"
   "Sector 3051 is being marked as bad, already in BST"
   "Sector 1007 is being marked as bad, already in BST"
   "Verifying CYLINDER 0-326"
   "System transferred"

After entering a label, the computer reported 8192 bad sectors and 17.9M bytes available.

   ASGNPART 0:ZDOS4 H:
   FORMAT H:/s/v

"New sector 7048 is being marked as bad, from BST"
"Verifying CYLINDER 0-408"
   "Disk unsuitable for system disk"

After entering a label, the computer reported 2048 bad sectors and 22.6M bytes available.

This 'disk unsuitable' message generally means that there is a bad sector where the partition information needs to be stored. What if all my issues were happening at a partition boundary?

I decided to try changing the partition table, but I still want the Gemini and CPM partitions early because of the size of this disk.

Another problem could be that we need to use the PREP /K switch, even with ZDOS v4.06. (Try later)

Using ZDOS v4.06 version of PART, I tried this partition arrangement:

GEMINI	DOS	7%	3096 Kb
CPM	CPM	3%	1327 Kb
ZDOS4	ZDOS4	50%	22108 Kb
ZDOS3	ZDOS3	40%	17684 Kb
Totals:		100%	44215 Kb

I ran ZDOS v4.06 ASGNPART and FORMAT on each partition, and loaded ZDOS v4.06 in each partition without incident.

I booted to floppy ZDOS v3.10, and ASGNPART 0: showed the same data. Could the problems all have been from the partition division on this drive?

Well, many of you have probably figured out what I was doing wrong, and the computer even gave a hint earlier. The PREP command's /K switch!

In simple terms, our operating systems are limited to hard drives in sizes less than 32Mb because of addressing limitations. These drives used sector sizes of 512 bytes.

The /K switch in later DOS versions, including ZDOS v4 allows us to use hard drives up to 64Mb by using 1024-byte sector sizes. And I believe that ZDOS v4.06 fixed the addressing issues such that even larger drives can now be used, but I could be mistaken.

However, IF YOU USE THE /K SWITCH, the only operating systems that can be used are ZDOS v3 and ZDOS v4! All the older operating systems will NOT RUN correctly, if at all. ALL of my hard drive issues shown above (these were drives >32Mb) were being caused by not using the PREP /K switch!

When I used the command PREP /K/T1, on my ST-251 hard drive, all the drive issues (obviously it will not solve STICTION) went away. However, when I tried loading CPM-85, the ASSIGN command would not list the partitions correctly, and I suspect that if I tried to load PC-DOS on the GEMINI partition, it would also choke. I'll leave that as an exercise for the curious.

However, do not give up on these 42Mb drives. You can still have your cake and eat it too. It just does not have to be such a big cake...

Instead of using PREP /K, use PREP /Q/Tn and when the number of heads is asked, use 4 instead of 6 heads. The result will be a 29Mb drive instead of 42Mb, but all the partitions should work just fine on the slightly smaller drive.

Note: The reason for the /Q switch is to force PREP to ask for the drive parameters, so you can specify 4 heads.

I hope you found this article useful. Let me know if you have any difficulties.

DIAG "Head Load Timing Error"

I recently received two Z-207 Floppy Controller Boards for repair. I thought you might like to follow along with my troubleshooting efforts.

One board was marked 85-2807-2, 072883. The other was marked 85-2807-3, 121484. Neither board came with any explanation as to what was wrong, but both were in excellent condition. As my stock of Z-207 Floppy Controllers was getting low, I really wanted to repair these two. As always, I began with a visual inspection of each board:

Visual inspection of the 85-2807-2, 072883 board showed:
   + Controller chip, FD1797-02, labeled 'BAD'.
   + I removed the paper label commonly found on all Zenith manufactured boards.
   + I noted that the C26 capacitor was recently replaced; the original black axial 1uF capacitor had a bad history of shorting out upon power up, with an accompanying pop, smoke, and strong odor, after long periods of non-use. I have also found them open in the past.
   + R3 and R4 (pre-compensation setting) appear undisturbed.
   + Another black axial 1uF capacitor is installed below U15 and have been replaced on the newer -3 boards. I made a note to check this one after I begin testing the board.
   + PS1, PS2, PS3, and Q2, Q3 appear replaced (that is, they had been soldered after the original manufacturing, leaving flux residue).

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Visual Inspection of the 85-2807-3, 121484 board showed:
   + Controller chip, FD1797, labeled 'GOOD'.
   + I removed the paper label.
   + The C26 capacitor had been replaced.
   + R3 and R4 (pre-compensation setting) appear undisturbed.
   + ALL 2807-3 boards have a WRONG (reversed) silkscreen position at C30! I wrote an article in Z-100 LifeLine issue #81 addressing this problem. As a result, during manufacturing C30 is installed reversed and causes the floppy motor to run continuously! I made a note to remove C30, check it, and reinstall it correctly.
   + I made another note to check the capacitor below U15 even though it had been replaced on this newer -3 board.
   + PS1 and PS2 appear replaced.

Testing board 85-2807-2, 072883:
   + C26 capacitor tested fine.
   + All the voltages around the Voltage Regulators, PS1, PS2, PS3, were fine.
   + I booted to ZDOS v3 and ran the DIAG Controller Test. I immediately got the error **"Head Load Timing Error"**, check U33, and U15. I replaced U33, U15, and the 'bad' controller, U22, but got the same error.
   + I removed and checked the capacitor below U15, **C48, found it was open**; I replaced it.
   + DIAG now worked fine. I adjusted the CP2 voltage & CP1 frequency and performed the Z-207 calibration checks, adjusting Pre-Compensation R3 & R4 using the Z-207 Calibration circuit - all good.
   + I also found that the controller chip, FD1797-02, previously labeled 'BAD', was ok.
   + I installed the Barfield Mod and tested using ZDOS v4 at 8 MHz by FORMATting 3.5" drive.
   + I replaced a missing ejector lever.

Testing board 85-2807-3, 121484:
   + C26 capacitor tested fine.
   + As mentioned earlier, ALL 2807-3 boards have a WRONG (reversed) silkscreen position at C30! I removed and tested C30, 47uF, and found it to be ok. I removed the incorrect silkscreen markings and reinstalled C30 correctly. Floppy Drive Motor now stops after about 15 seconds.
   + All the voltages around the Voltage Regulators, PS1, PS2, PS3, were fine.
   + I booted to ZDOS v3, ran the DIAG Controller Test. I immediately got the error **"Head Load Timing Error"**, check U33, and U15. I replaced U33, U15, and controller, U22, but got the same error.
   + I checked the newer capacitor below U15, C48, found it ok, but replaced it anyway, thinking it may be just a polarity problem.
   + I rebooted and ran DIAG again, but still got same error.
   + I did resistance checks of all components associated with U15, and found that **R18, a 150K ohm resistor was open**. I have found these bad before on -3 boards. I replaced it with a 120K resistor used on earlier boards and listed in the schematics.
   + I tried to FORMAT a floppy disk, but all the tracks above track 23 were bad, indicating a pre-compensation problem. Also, I could not get the LED to light on my Z-207 pre-compensation calibration circuit! After replacing U1 and U3, I found that **U3 was bad** and replaced it. FORMAT now worked properly on higher tracks.
   + DIAG now worked fine. After adjusting the CP2 voltage & CP1 frequency, I adjusted Pre-Compensation R3 & R4 using my Calibration circuit and all was now good.
   + I installed the Barfield Mod and tested using ZDOS v4 at 8 MHz by FORMATting 3.5" drive.
   + I replaced a missing ejector lever.

If you have a Z-207 Floppy Controller Board sitting on a shelf because of a problem, these boards are now getting very scarce. I only have one or two spare boards left. Any donations of these boards, working or not, would be greatly appreciated.

GBS-8200 CGA to VGA Video Adapter Update

While I was helping someone with his early Z-100 video research, I found that information on the Z-100's video system was sorely lacking. So I published a new article for the website, **"Z-100 Video System"**. This article attempted to combine information from the Z-100 User's Manual, Technical Manual, and the Service Manual.

Also through additional research, it was suggested that the video signals may be better coming from a different connector than Charles Hett and I had been using for our VGA monitor testing. You can review these efforts in the two articles **"GBS-82xx CGA to VGA Converter"** and **"GBS-8219 RGB to VGA Converter"** on the website.

So, while I had my test bed Z-100 spread about the dining room table for the hard drive tests, I decided to revisit our efforts that we had made attempting to get the GBS-8200 & GBS-8220 CGA to VGA Video adapters to work satisfactorily on our Z-100s.

I relocated my GBS-8200 video adapter and retrieved my spare Sceptre X7G-Komodo II VGA flat screen monitor from the garage.

The adapter and cable were still wired for use with Composite Sync (pin 9 on connector P303 of the Z-100's Video Logic Board), the RGB color wires and a ground wire. I configured the Video Logic Board J301 to J304 video jumpers to the down, down, up, down positions (ignore the jumper positions in this generic photo), to provide positive synchronization signals to the external monitor.

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GBS-8200 CGA to VGA Video Adapter

Z-120 Video Logic Board

As you may recall, these jumpers are described in the manuals as:

J301 - Selects VSync polarity for the INTERNAL Z-120 All-in-one display, P302, pin 5. The '-' position (down) produces negative VSync. HSync is ALWAYS positive (+) and cannot be changed, P302, pin 4.

Note: Jumpers J302 to J304 only affect an EXTERNAL monitor.

J302 - Selects HSync polarity for the RGB connector, P303, pin 8. The '+' position (down) produces HSync positive(+) signal. The 'H' or unmarked position (up) produces HSync negative(-) signal.

J303 - Selects the type signal for the RGB connector, P303, pin 9. The 'C' position (up) selects composite (combined HSync & VSync). The 'V' position (down) selects the vertical sync signal.

J304 - Selects the polarity of the signal selected by J303 (V or C). The 'V/C' position (up) selects Sync negative(-) signal. The '+' position (down) selects Sync positive(+) signal.

Note: The normal jumper, J301 to J304, positions for a Z-100 with an external Zenith RGB monitor are: (down)(up)(down)(up), for negative sync.

Note: Jumper J301 ONLY affects the INTERNAL display of the Z-120 All-in-one computer, while Jumpers J302 to J304 ONLY affect an EXTERNAL monitor.

The Video Logic Board has three connectors for video output:

P301 - Provides composite video & sync to an EXTERNAL composite monitor. It is located at connector J14 on the Z-110 low-profile computer only.

P302 - Provides HSync and VSync signals to the INTERNAL monitor of the Z-120 all-in-one computer. HSync is always positive(+); VSync polarity is selected by J301.

P303 - Provides color & sync signals for an EXTERNAL CGA RGB monitor.

As expected, when I turned the computer ON, the VGA monitor worked, but the picture was jittery, pretty much as it was when I finished the tests many years ago.

However, during those intervening years, it seems at least one person found a solution.

Searching on the internet, I found an excellent YouTube video on line from Mike's Amateur Arcade Monitor Repair entitled "GBS-8200 CGA/EGA to VGA Converter - Tips and Tricks" dated August 5, 2022 and located at:

https://www.bing.com/videos/riverview/relatedvideo?q=GBS-8200+sync+issues+Youtube&mid=9EB4DD16733CC40B2C689EB4DD16733CC40B2C68&FORM=VIRE

I used much of the material from this video and others to create the following Q&A:

Q: Image shakes or has the jitters
A: Place an 8-10 Kohm resistor in the composite sync wire.

Q: Brightness & contrast adjustment ranges are too low on the monitor
A: Turn up the three color potentiometers on the GBS-8200 to a higher setting.

Q: "No Signal" message
A: There are three display types; RGBS, RGSHV, and YPBPR inputs:
   RGBS uses each color wire, a composite sync wire, and ground wires.
   RGBHV uses each color wire, individual HSync and VSync wires, and ground.
   YPBPR uses the individual video signals from a video source & the phono plug input.

Be sure to use the right input connector for your configuration.

Q: Image is frozen, or has the jitters
A: In the GBS-8200 Display Settings, check 'V Position'. It may be set too low. Try increasing the setting until unfrozen. This will be the minimum setting that you can use.

Q: Color is wrong or gets worse while playing older games over time, color washes out
A: Adjust Clamp Settings; generally "Clamp st" set to 3 and "Clamp sp" set to 4 will be optimal.

Q: Color artifacts (interference) in full blocks of color
A: Try adding insulated copper tape over the signal traces on the board's underside.

Q: White pixels on screen, especially in broad color areas
A: 1. RAM too fast? Solder a resistor & capacitor to the SDRAM clock line.
   2. Connect a second VGA monitor cable (without the monitor) to the second output, if equipped. It will provide the extra signal loading needed.

Q: Sync issues
A: Add a LM1881 sync separator circuit to separate the composite sync components.

Encouraged by this YouTube video, I began experimenting again with the VGA adapter's connections and our Video Logic Board's settings.

As you may recall, however, one of the functions of the adapter's down button, is to reset the adapter's settings and force it to retry detecting the source video.

So, I pressed the down button for 5-6 seconds and I quickly regretted my action.
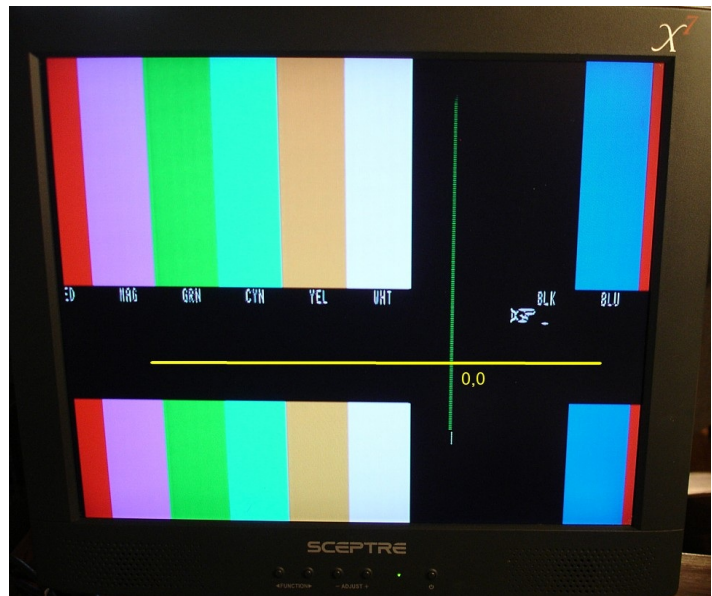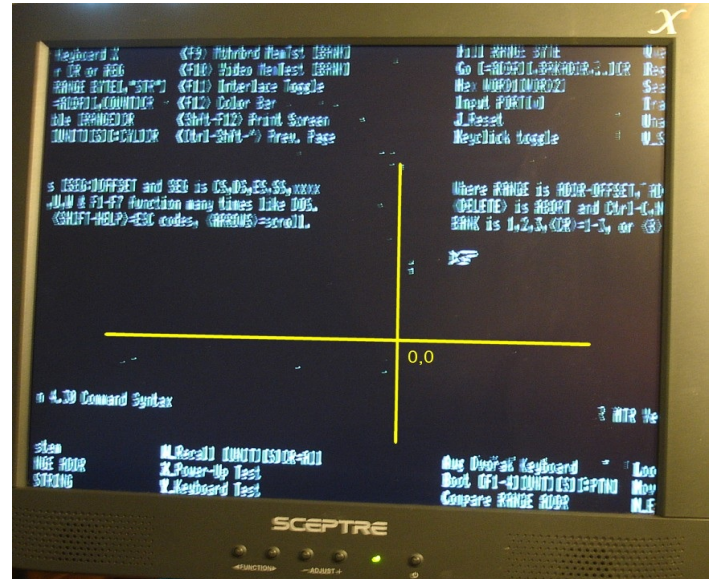
The video display suddenly broke into four quarters and froze. It would update every 30 to 60 seconds, redisplay the screen, with the four quarters split in a different location on the screen and freeze again.

I drew in the vertical and horizontal lines to make the effect easier to see, and, of course, the jitter was still there.

To make a long period of frustration fit in this article, I recalled the fix on the video for a frozen screen.

I pushed the menu button on the VGA adapter, located the 'Display' setting, and adjusted the V-position setting slightly higher.
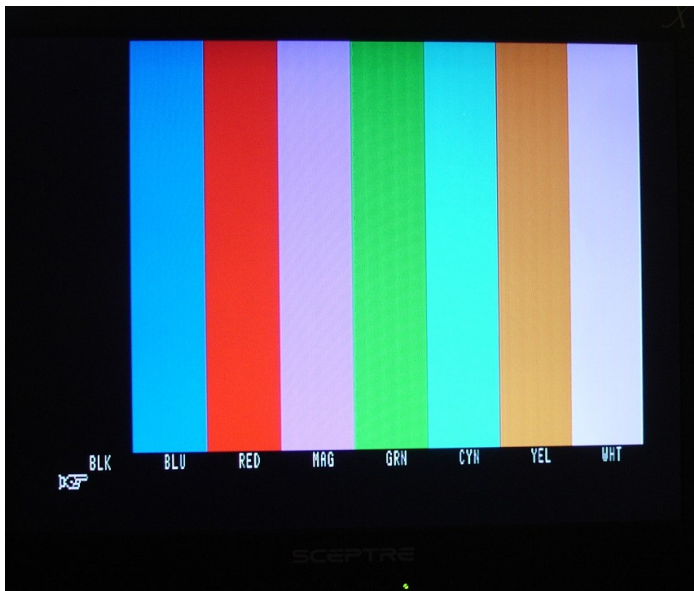
Sure enough, everything cleared up, no jitters, no odd video effects, no frozen video screen! A perfectly stable video screen with great colors...

I never did try the resistor in the sync line or the other possible fixes. I was quite happy with the display just as it was. The saying, "Don't touch a thing!", came to mind.

However, now the rest of the story. Charles and I were curious about the other signals on the Video Logic Board; would the P302 connector provide a better signal?

I was still using the P303, pin 9, composite sync signal as input to the VGA adapter. I considered the picture perfect, at least for my use. But curiosity caused me to press on...

Next, I tried utilizing the separate, individual sync signals, using both pins 8 (HSync) and pin 9 (VSync) of P303. I changed the jumper setting on the Video Logic Board to down, down, down, down. This would change the composite sync signal to straight vertical sync (J303 was moved from 'C' to the 'V' position), but J304 was still left with positive sync.

After adding the pin 8 (HSync) signal to the connector cable of the VGA Adapter, I was ready.

After power up, the display showed "No Signal".

I went into the VGA Adapter's menu, changed RGBS to RGBHV, and the display of the color bars came up perfect. I could not see any difference from the previous, composite sync display.

As a double check, I disconnected the HSync signal, and sure enough, the display changed back to "No Signal". Perfect!

I attached the sync lines to P302, still using separate sync lines and the RGBHV display mode. I could NOT get anything except the "No Signal" display. I tried every setting of the Video Logic Board jumpers, but could not get video.

I compared oscilloscope traces using my portable scope, but did not find any difference.

Following a day of very confusing oscilloscope readings and spotty success with a display on a VGA flat screen monitor, I spent most of a month taking a full suite of Z-100 video logic board waveforms on my portable oscilloscope.

With no load attached to any of the three video logic board connector outputs, all signals worked as they should. When sync was supposed to be positive or negative or combined according to the J301 thru J304 jumper settings, they were as to be expected. Even with the jumper J302 set for composite sync, the waveforms showed both the horizontal and vertical syncs present in each waveform. I confirmed the readings and waveforms on two video logic boards and they were both working flawlessly.

The only interesting and totally unexpected waveform found was the Horizontal Sync, which at the longer timebases on the scope appeared to be multiple waveforms with a rather sinusoidal amplitude. This was found to be from "aliasing", caused from the inadequate sampling rate of my inexpensive portable scope. I have addressed "aliasing" in great detail in a new article "Digital Oscilloscope Sampling Rate" under Repair Articles, now available on the "Z-100 LifeLine" website.

However, the really odd symptoms occurred only when the CGA to VGA adapter was connected.

Note: As the jumpers, J301 through J304, on the video logic board all have different functions and definitions, throughout this article, I am reporting the Video Logic Board jumper positions as X, up, or down; with the board standing upright in its socket. 'X' can be either up or down, as it is not applicable in most cases.

I thought that when I initially began experimenting with the CGA to VGA adapter again this spring, everything worked as it should and when I adjusted the V. Position settings in the adapter, there was a point when the jittering display became stable above a certain setting.

However, after all the experimenting over the past month, I could no longer get a stable

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display again, AND I could no longer get any
display at all using the jumpers that I had been
using earlier to get the display to work. It is
possible that I had damaged the adapter in some
manner while fiddling with the jumpers and scope
probes (The actual cause was eventually found
and is given below, but stay with me).

After looking at some of the waveforms on my
portable oscilloscope, I wanted to thoroughly
check that the two video logic boards I was
using were actually displaying the outputs as
they should (they were), and that the weird
waveforms that I was seeing while the VGA
adapter was installed, was indeed coming from
the Adapter and not from loading down my video
logic boards.

Some notes to keep in mind:
*   There are no jumpers that affect the P301
connector. Pin 3 of that connector provides the
Composite signal (both sync signals + video
signals together) for any external composite
monitor that may be attached to the Z-110 Low-
profile computer at location J14 on the rear
panel. The Z-120 All-in-one computer has a
brightness control for the internal display at
this location.

Note: Do not confuse this Composite Video with
the Composite Sync mentioned later. The
Composite Video signal uses one signal that
includes the two sync signals, Horizontal Sync
(HSync) and Vertical Sync (VSync), AND the other
video signals, RGB, needed by any Composite
Monitor. The two sync signals are both negative
while the other video signals are positive in
the waveform. Composite Sync is just the
combination of the two sync signals, either of
which could be positive or negative.

*   Jumper J301 only sets the polarity of the
VSync signal at connector P302, the sync signal
for the internal Z-120 All-in-one monitor. The
HSync signal at pin 4 of the P302 connector is
always positive and is not changeable.

*   When jumper J303 is in the 'C' position, both
HSync and VSync are present in the same signal,
Composite Sync, and the jumper J304 sets the
polarity of both sync signals. Both are either
Positive or Negative. The setting of J302 for
HSync has no affect. Further, when the VGA
Adapter is connected, both pins 8 and 9 on
connector P303 have identical waveforms. The
composite waveform is still only the two sync
signals; there is no video signal in this
composite sync signal.

*   While adjusting the V.Position setting in my
VGA adapter, there was a momentary glitch in the
display video going through 20 to 21 or 20 to 19
(your VGA adapter may not have the same affect).
While I had initially seen the jitters go away
while initially adjusting the adapter, my later
testing showed adjusting the V.Position values
had no affect on jitters.

However, **additional investigation showed that my
jitters were because I had left the two separate
wires to use both sync inputs to the VGA adapter
while in RGBS mode**. I had kept the two wires for
use during the VGA adapter's RGBHV mode testing.
Disconnecting the (unused) HSync wire stabilized
the display. The extra signal line was probably
causing a feedback interference.

*   I get my power for the VGA adapter from the
+5Vdc connectors on the motherboard. When I
placed my Scope on the +5Vdc line, there was a
minor ripple of about 30 mV. With an 8.5uF
capacitor to ground, the ripple was reduced to
about 15 mV, but it had no affect on the display
jitters. I also tried other values from 1 uF to
35 uF, but that first value was best. As there
was minimal affect, I permanently removed the
capacitor.

*   There are three video modes for the CGA to
VGA Adapter:
   + RGBS mode uses the three video signals
      (RGB), one Composite Sync signal, and
      ground connection.
   + RGBHV mode uses the three video signals
      (RGB), two separate HSync & VSync signals,
      and a ground connection. This requires two
      separate sync wires.
   + YPbPr mode for those display systems using
      component signals (Not used on the Z-100).

With the CGA to VGA adapter connected as
described in each of the following scenarios,
some of these signals change dramatically:

*   With the video board's jumpers set X, up, up,
and down, which would set negative HSync (J302),
select CSync (J303) and positive CSync (J304),
pins 8 and 9 of connector P303 should give the
same HSync and VSync signals together in each
waveform of pins 8 & 9.

BUT, while the signals were indeed both the same
on the two pins, the HSync pulses were the full
4 volts for three pulses only during (or within)
the VSync pulse! The VSync pulse and the HSync
pulses were otherwise only about 0.04 volts in
amplitude!! This could be from a damaged VGA
adapter.

*   With the VGA adapter in RGBS mode, but with
both sync lines connected to the adapter from
P303, and the jumpers are set to X, up, up, up,
which would set negative HSync (J302), select
CSync (J303) and negative CSync (J304), then the
display works, but with the display having the
jitters if the scope is attached at pin 9.

If the scope were attached at pin 8, the display
was stable! However, if pin 8 is disconnected
from the adapter, the display becomes stable
again. I assume there is some oscillation or
interference set between the two separate sync
lines?

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* With the VGA adapter still in RGBS mode, setting the jumpers to X, up, down, up, which would set negative HSync (J302), select VSync (J303) and negative VSync (J304), with the scope probe on pin 8, I got a stable display.

But as soon as I moved the probe to pin 9 again, the display acted as if the horizontal hold went out and the screen became unreadable! Moving the probe back to pin 8, all was stable. Yet, if I disconnect pin 8 from the adapter, I lost the HSync on either pin 8 or pin 9! So, while J303 will work with just VSync - the pin 8 HSync line is still required to provide the HSync signal!

I would appreciate it if someone would confirm the circumstances and findings above, or found some other means of acquiring a clear, stable signal for your VGA monitor.

I finally set my CGA to VGA Adapter as follows.

Set the RGBS mode on the Adapter. Set the four Video Logic Board jumpers J301 through J304 as X, X, up, up, where X can be either position; J301 and J302 are not used. J303 is setting Composite Sync and J304 is selecting a negative sync signal.

The result is stable and very usable, but different from my initial findings. However, please recognize that my Adapter has been used in several non-standard circumstances during all this experimentation and may have experienced some damage as a result. Your Adapter may not work the same, and may require some special jumper configuration different from mine.

Also, most VGA displays now recognize the polarity of sync signals and adapt automatically. So, the setting of J304 may be immaterial.

However, one situation is clear. When I used the RGBHV mode, the video result was NO better than the RGBS mode. So, use the RGBS video mode and use just the one HSync signal, pin 9, from the P303 connector.

Conclusion. The composite signal from P303 works just fine in the VGA Adapter's RGBS video mode. If you have difficulty, or would prefer to use the RGBHV video mode, remember to add the additional Hsync wire to the cable and change the Video Logic Board's jumpers to up, down, up, down, for positive composite sync. It may also be subject to interference between the two sync lines.

Good luck.

Gotek Floppy Emulator Update

Darrell Pelan sent me an email with the latest news on Gotek Floppy Emulator developments that may be of interest.

"The Gotek units were updated to a new setup on eBay. As far I know, you can not get these on Amazon (they have the less desirable F415 MCU)."

"I just finished two versions of a 3D printed faceplate mount for the Z100. One for the older units that use an 128x64 OLED from Amazon and a second for the eBay units (the OLED is a different physical size). I will post them on Thingiverse later today."
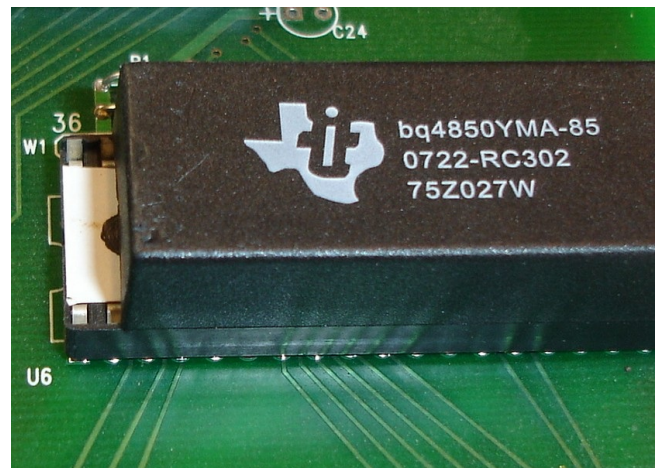
The link to these updated mounting frames is:
https://www.thingiverse.com/thing:6517855

"The Disk Image Utility was updated several times in the last year. It is on Github."
The current version of Disk Image Utility is at:
https://github.com/DarrellH89/DiskImageUtility/blob/master/DiskUtility/Zip%20Files/DIskImageUtility%20ver%201.2c.zip

The repository can be found at:
https://github.com/DarrellH89/DiskImageUtility

For further information, you may contact Darrell Pelan at: pelandc@gmail.com

IDE NVsRAM Internal Battery Died!

We have known for years that these battery-backed NVsRAM units would not last, and now Charles Hett has reported the first inoperative unit.

The symptoms are fairly simple:
   * The clock will not keep time, cannot be set, or the DOS system clock is not updated.
   * The NVsRAM is reported as corrupt and/or cannot be reprogrammed.

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I have a stock of about 12 spare BQ4850YMA NVsRAM units that I bought back in January. While these are no longer manufactured, these are new units purchased through Digikey Electronics and have not been used, so they should last their advertised 10 year life.

A newer 'N' model is also discontinued, but Digikey reports they have in excess of 2000 available, but for $70+ each. However, when I checked in January, they reported more than 5000 available! So they are apparently in high demand.

My current price is $65.00, shipping included, reserved **only** for known "Z-100 LifeLine" IDE Controller owners. This price includes programming to your Z-100 configuration and shipping. I will watch the market.

Closing

On September 26th, after several days of soaking rain, all hell broke loose around here in the form of Hurricane Helene. You probably heard all about it on the news. The already saturated soils, steep slopes, hard rain, and high winds all combined to knock down trees and cause fast flowing flood waters that sucked away structures of all kinds.

While Myra and I only lost a tree and we had power back after only 5 days, our neighbors lost several trees and power was out for weeks... Fortunately, in our neighborhood, we had no home damage nor injuries.

But, just a few miles away, whole communities were washed away in the severe flooding that some were calling a "once in a thousand years storm". In Asheville, the river peaked nearly 30 FEET above normal flood stage, severely busting old records! We cannot even imagine what that must have been like!

Now, three months have passed, and some homes and businesses are just now being repaired, rivers moved back to their normal beds and roads and bridges getting repaired. Some roads, such as Interstate I-40 west bound into Tennessee, will remain completely closed, with no idea when it will open, even for just one lane traffic. Full recovery for many will take several years.

Please keep these communities and the lives lost in your thoughts and prayers.

I was recently contacted by a Clarkson College graduate, Glenn Faini, who had a Z-100 roommate and he passed me some pictures that I found interesting. The first was a Clarkson advertisement from the mid-80s, when Clarkson gave all their incoming freshmen Z-100 roommates...

Meet Dean Bray and the roommate he picked for all of Clarkson's incoming freshmen.

Clarkson College has just become the first major academic institution to issue a desktop computer to every student, starting with incoming freshmen. They picked the Zenith Z100.

"Clarkson offers programs in engineering, management, science and liberal studies. Computer literacy is now vital to each of these fields, and our present mainframe-based system wasn't keeping up with demands—even with 200 terminals.

"When we started looking into desktop computers, we wanted one that all of our students could use. The Zenith Z100 with its two microprocessors and outstanding graphics capabilities was simply the most versatile system for the price.

"Our management students can use it for all their accounting and planning. Our science and engineering students can use it for testing and modeling. And all of our students can use it for everything from financial budgeting to organizing their term papers.

"That, plus the Z100's expansion capabilities which allow it to grow with our students' needs on into their careers made our decision an easy one."

ZENITH | data systems
The quality goes in before the name goes on.

For more information about the Zenith desktop computer and its applications for education, call (800) 323-5924. In Illinois, call collect (312) 391-8961.

Now, that was a roommate that I would have liked when I went to Villanova. All we had was an IBM-360 monster in a computer hall that used punch cards and you had to wait your turn for the opportunity to run your program, but I am dating myself. At least it did not run on tubes.

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And Clarkson had its own Z-100 faceplate placed on them...

Thanks Glenn, for a look back at history.

Finally, after two years, I have updated the Z-100 Parts Price List for the website. As you can probably see, the costs have risen quite a bit because postage as increased considerably during the past several years.

However, after seeing some of the Z-100 parts being offered on-line for what I consider ridiculous prices, with the new year, I have also decided to offer something new, **a Z-100 Parts Buyback Offer:**

The basic, but most important, part assemblies for the standard Z-100 computer series are becoming quite scarce, and my supply of spare parts has become depleted. Therefore, beginning in 2025, I am instituting a new buy back program, where you can sell off your spare Z-100 parts & manuals.

I am offering to buy back the parts listed in the new 2025 price list published on the website for 50% of the sale price listed. If you wish to sell a part, board, assembly or manual, please email me for a quote. The part need not necessarily work, but must be **undamaged** and capable of repair.

This offer does NOT apply to software, ZROM versions, NVsRAM chips, SmartWatch, floppy or MFM hard drives, whole computers, CRT and yoke assemblies, ZDOS User Manuals, and Z-100 Life-Line CDs. You are responsible for shipping costs & insurance.

Of course, **donations are always welcome.**

Note: As fast as technology, hardware and software changes, the links given in the above articles will probably not remain active for long. They still worked as of the new year. However, if you find them inoperative, let me know and I will try to find the most recent information for you.

I hope that you found this issue useful.

Myra and I wish all of you the very best for a healthy and prosperous New Year.

'Til next time,
happy computing!

Cheers!!!

Z-100 LIFELINE
Supporting the H/Z-100 Community Since 1989

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