July 2012

Z-100 LifeLine
Since 1989

#121

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

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

******* Reminder: Past Z-100 LifeLines are now available on CD-ROM! *******

HOWGOZIT

As you can see, I've decided to continue publishing the "*Z-100 Lifeline*", at least for six more issues. One surprise was that most of you returned. As there had been some long lapses between issues, I thought for sure that only a handful of you would wish to continue, especially with the increased rates. In any case, thanks for your continued support.

As you may recall, Myra successfully underwent a double knee replacement two years ago. In her continuing goal to become the bionic woman, she had to have her right hip replaced this April 2nd. Thankfully, the replacement was successful and, amazingly, she had no pain at all from the replacement or surgery site. Her only pain was the stiffness from her thigh muscles after the strenuous exercises her therapist had her doing.

From the first day, she was pleased with her ability to walk straight and tall again. Her three months of recovery (vacation?) ends and she'll return to work on July 9th.

For those who have been watching my solar heater project, I'm now into version 5.

Briefly, as I reported in January, the thin wall, black irrigation tubing that I had used successfully last year melted when I shut down the system for the season and left the plexiglass on the heater boxes!

I waited for a warm day in the spring to investigate the reason the tubing had melted. Then I measured the box temperature without the system running and found that the temperature exceeded the maximum temperature of my digital thermometer at 175 degrees while the temperature outside was only 75 degrees! Wow, if I just replaced the tubing, every time we had a power failure in the middle of the summer, I'd have to replace all the tubing! NOT!

So, this year I replaced all the tubing with CPVC water pipe. I chose the CPVC because I was concerned that the thicker black water piping might also melt and PVC has a history of not taking heat well (reportedly becoming brittle and subject to cracking). CPVC was made for hot water systems.

I had serious doubts, however, that CPVC would be successful. It had much thicker pipe walls than the tubing and plastic was an insulator, therefore decreasing efficiency tremendously. But I could not find an alternative and had to try it.

I painted all the new piping black - I used 52 spray cans of black primer! To further boost efficiency, I needed to increase the time the water was in the solar box. So I increased the system from 9 lines to 10 lines of 1/2" piping and increased the number of passes of pipe in the 40' solar box from four to six. This made a system of just short of 1/2 mile of piping!!

Measured on a 83 degree day in June at noon, the pool heater increased the temperature from 80 degrees at the input to 83.3 degrees at the output. Given the rate of water flow through the system with our pump, this would increase the pool temperature about 1/2 to 1 degree each day.

I used a thermostat in the solar box to control the pump so it only runs when the temperature in the box exceeds 90 degrees.

We are pleased with the result - the pool temperature the other day was a warm 87, though some may doubt the value of the cost for the extra few degrees of pool water.

If you are contemplating constructing a similar system, please contact me for some advice. The system must be considerably larger than you might think and I may save you a bundle on failed initial versions.

Now, let's get on to business.

This issue's insert has the second part of "Zenith ZVM-13x Series Color Monitors". As you may recall, the first part described the general characteristics of the monitors, giving cleaning recommendations, specifications, a description of the cables that were available, and general troubleshooting tips. This second part provides specific maintenance and troubleshooting procedures. I hope you find it interesting and useful.

And I have interesting news to pass on...

New Source of Delay Lines

As most of you probably don't recall, the delay line in the Z-100, U149 on the motherboard, is necessary to ensure correct timing in the various sections of the computer's RAM memory when we attempt to change the CPU speed. At 5MHz, the delay line was the standard **DL 14CB201**, a 200ns delay line with 5 taps, a tap at each 40ns increase.

Briefly, as I understand it, TAP1 asserts a 40ns delay to place the upper eight bits of the 16-bit address into the RAM's row address latches. Forty nanoseconds after that, TAP2 asserts and causes placement of the addressed data onto pin 14 of each RAM IC. This data is then sent to the CPU. After TAP2 asserts, the delay line continues to assert outputs 60%, 80%, and OUT at 40ns intervals. Forty nanoseconds after all this, TAP1 goes low to generate a clear memory request.

As you can see, it is critical to keep all this memory activity carefully timed. So if the CPU speed is increased, so must these essential delays.

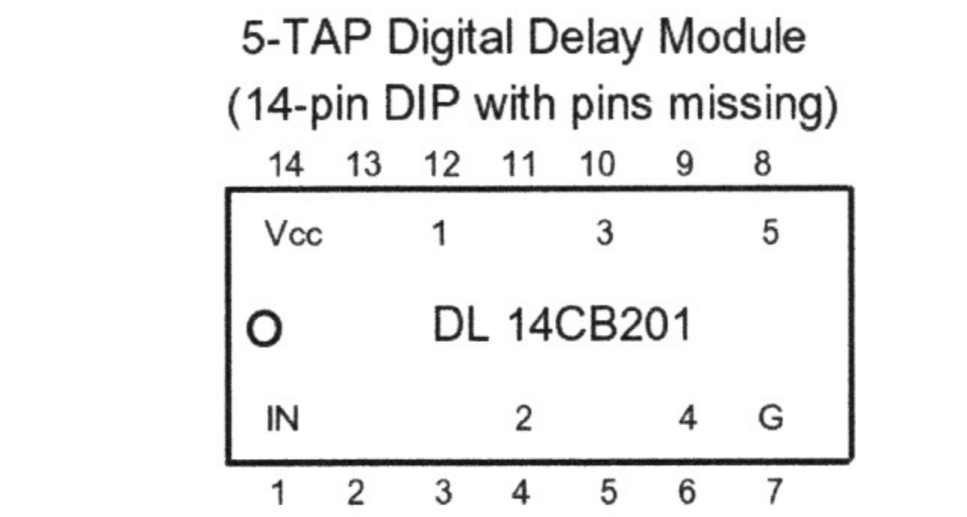
While there is some fudge factor, a 200ns delay line is best at 5 MHz; a 150ns delay line is best at 8 MHz, and a 100ns delay line is best at 10 MHz.

I've found the following range generally works for each:

Delay Line:	Working Range:
200ns	5-7.5 MHz
150ns	5-9.5 MHz
100ns	8-~12 MHz

However, these old delay lines have long gone the way of the dodo and are extremely rare. I've been looking for a suitable replacement for years, and finally located something that works - with easy modifications.

First, we need to review the pinout of the old delay lines:

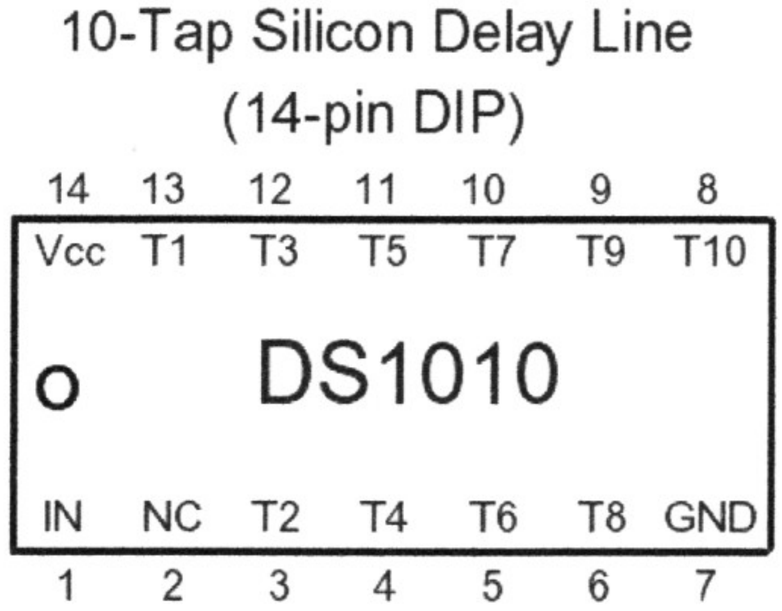


As you can see, the delay line is in a 14-pin DIP configuration with certain pins missing. However, all existing pins are used.

The DS1010 series delay line, however, has ten (10) equally spaced taps. Manufactured by Dallas Semiconductor, the devices are offered in a standard 14-pin DIP, providing delays from 5ns to 500ns. The total fixed delay is specifed by the dash number extension to the part number.

According to the data sheet, since the DS1010 is an all-silicon solution, better economy

and accuracy is achieved when compared to older methods using hybrid techniques and the DS1010 is designed to produce both leading and trailing edge with equal precision. Each tap is capable of driving up to 10 74LS type loads. The pinout is:



Obviously, these two devices don't match. We only want to use the even-numbered taps and ignore the rest. But all the even-numbered taps, except T10 are on the same side.

Looking more closely at the two pinouts, you'll see that only T2 and T6 don't line up, but they are directly opposite where they belong - and these locations are unused in the Z-100's socket, making easy modifications possible.

First, remove pins T3 (pin 12) and T7 (pin 10) on the new DS1010 device. These are unused. I left the other pins attached for better structural integrity. These socket locations are unused in the Z-100's socket.

Next, on the back of the Z-100's motherboard, tack-solder a short piece of wire between pins 3-12 and another between pins 5-10. This transfers our delay line signals to the proper pin locations on the opposing side. As pin 3 and pin 5 are not used in the Z-100's socket, there is no conflict and either the old 200ns delay line or the new, modified 150ns delay line may be plugged directly into the Z-100's modified socket at any time!

The DS1010 comes in a wide variety of ranges, but of particular interest to us are:

DS1010-200	200ns replacement for 5 MHz
DS1010-150	150ns device for 8 MHz
DS1010-100	100ns device for 10 MHz

These DS1010 devices are still available if you search the web, but usually at a ridiculous price. However, www.questcomp.com has the DS1010-150 available for $9.00 ($6.00 in quantities of 2-4) and the DS1010-100 for $5.85 ($3.90 in quantities of 3-6).

They work very well with my oscillator module described in my article **Z-100 Speed Up Options** in issue #78 of the *"Z-100 LifeLine"*.

Is CP/M Capable of Using Our IDE Controller Board?

It appears that everyone with a CP/M capable S-100 bus computer is using an IDE Contoller Board but us. As you know, our LifeLine IDE Controller Board is presently only recognized by Z-DOS v4.06.

Well, it would be fantastic if we could modify at least one of our Z-100 CP/M versions to use our new IDE capability. So with this goal in mind, I ordered two of the generic IDE Controller Boards from www.s100computers.com. These are bare boards with gold-plated S-100 pins for $23.00 each and I was very impressed with the professional quality when they arrived.

Briefly, the board has the capability of connecting two Compact Flash cards and a connector for another IDE drive. Andrew Lynch just ordered his third set of twenty boards, so it must be very popular among S-100 computer users. More information can be found at their website, given above.

I'm hoping that if I can get these basic boards to work with our version of CP/M using the same modifications as the other S-100 computer users, I might have a shot at making our more capable, bootable IDE Controller Board work. That's the plan, anyway.

However, there is a fly in this soup. I have managed to purchase all the parts I need for the two boards, with the exception of the hexidecimal display chips. The above website talks about utsource being a great source of these chips for less than $5.00 each.

However, so far my six requests (over the month of June) for a quote and two e-mails to sales@utsource.net have been completely ignored. The next best price for these units has been Unicorn Electronics which has them for $17.99 each with free shipping and Jameco Electronics which has them for $19.95 each ($17.95 each for 10+) and shipping is extra.

Two other companies have responded to my requests for quotes. 1-Source Components wants just $49.90 each and Quest Components wants $62.75 each for new, or $23.25 each for refurbs (cleaned pulls, when I asked).

Apparently, some companies want to compare these chips to gold?

I said thanks, but no thanks.

Each of these boards use 6 of these displays - more than doubling the entire cost of the rest of the board! Similar decimal (0-9) displays can be obtained for $1.50 each, so I contacted John Monahan, the board's designer and asked why he went with this hexidecimal design to show drive cylinders/sectors. I also asked if these displays were necessary at all and why the information could not just be displayed on the computer's monitor?

John's reply:

- It's disappointing to see **UTsource** are not responding, as I've gotten quite a number of items from them - often at prices well below that here in the U.S.

- You absolutely don't need the Hex display to have a functional ZFDC board. They come under the "nice to have" section.

- The reason I went with these displays is because it is easy to read the bright large display when the board is in the bus and seen from the limited top viewing angle available. The serial driven one/two line LCD displays just don't show up well, also being serial driven there is Z80 overhead/delays.

- Frankly, I have never been one for decimal or octal readouts - I think Hex - personal choice. A Hex output is useful for some boards - particularly for debugging hardware/software. With the exception of the even rarer HP-5082's, other such displays show only the digits 0-9. An alternative approach would be to use a 7 segment LED decoder such as a DM9368 and a simple 7 segment LED display. However, these too are no longer normally stocked.

- Sending the information to the monitor is of course possible. Taking a look at the onboard Z80 code, it would be fairly easy to add an extra status update "command" that would be captured by your BIOS on the other side. The problem with this is its extra data movement overhead. My goal was to keep the handshaking to an absolute minimum.

Anyway, as soon as I can get the display units, or find some alternative, I'll be able to assemble the boards and then concentrate on the software changes, as time permits. Time during the summer is precious and it is really hard to find the time to play with my Z-100s. I'm sure you find it just as hard.

If you have any experience with CP/M on any S-100 computer and would like to help with this needy cause, please call or e-mail me. I could sure use your help.

Closing

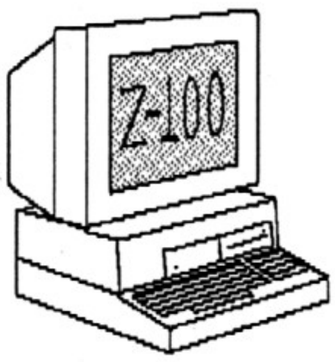
I want to thank all of you who renewed your subscriptions. We even have a few new ones. I hope I'm meeting your expectations.

Remember, I'm no longer on a set publishing schedule, so don't get too excited if you don't get an issue for an extended period. I'm just waiting for something interesting to write about. However, I shall continue to endeavor to make these six issues worth the wait. Feel free to contact me with suggestions on topics to cover.

In the next issue, I'm planning to discuss the intricacies of disassembling machine language code and take on the job of disassembling ZDIR.COM as a working example. Another issue you won't want to miss.

Cheers!!!

'Til next time,
happy computing!



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

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