Laboratory 17 Supplement:
How to Use the HP Logic Analyzers in the Lab

Prepared By:
Theodore Deden

Submitted By:
Theodore Deden and Jason Matalka

To:
Icaro dos Santos

For:
EE345m
Real Time Microcontroller Interfacing Laboratory
University of Texas at Austin

On:
5 March 2003

Purpose:

The purpose of this report is to act as a guide for use of the lab logic analyzers. The machines are old, but they function well, and provide a great diagnostic tool for students working in the lab. It took me all of a couple of hours to dig up the manual and find out enough to use the equipment for my own debugging. I have no doubt that any motivated ECE student, being a resourceful engineering major, would easily find this information for himself, but it would likely take a couple of hours to become comfortable with it, which is no small sacrifice to make in light of the time pressures already imposed by the lab. Therefore, I am preparing this supplement to Laboratory 17 in order that future students might be able to make use of the hardware available to them in less time, and with less effort, and hopefully receive some benefit from it.

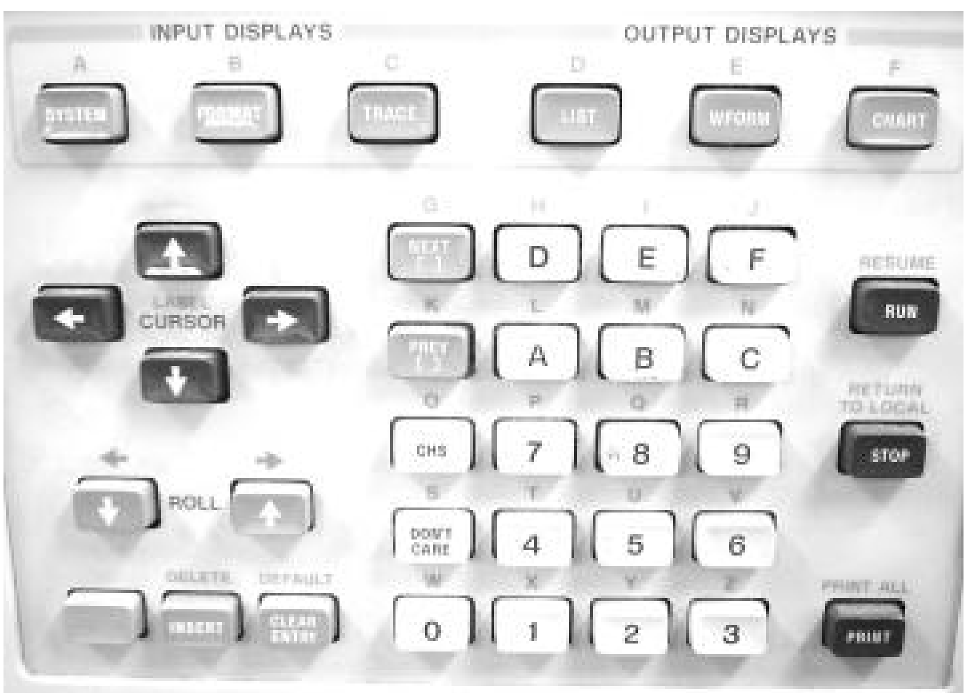
There are two additional things that I must note:

1) This is not meant to be an exhaustive study of the full functionality of the machines available. It is only a starter guide to allow one to repeat the measurements that I made, which allow for real time analysis of 8 TTL compatible logic channels.

2) Permission is hereby granted to copy, distribute, and otherwise disseminate this document, so long as credit is given.

The Panel:

This is not Micsosoft Windows, and there is no mouse. To move around within the various screens, the arrow keys will do the trick. To modify values, NEXT and PREV:



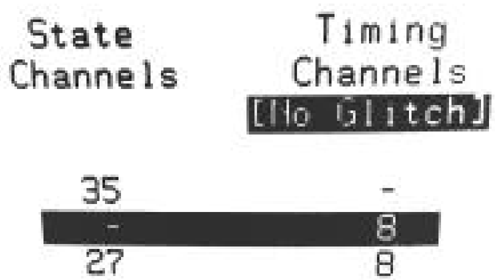
The six buttons on the top of the panel take you from main screen to main screen. The "INPUT DISPLAYS" and "OUTPUT DISPLAYS" are what I am talking about, and these screens pretty much get you where you need to be in the machine. Generally, you can set up and run your analysis by visiting those setup screens in order from left to right. I will take you through a set up and run, so that you can see how to do this.

Connections…

The probe pod that I used when taking my measurements was a small gray box, with a thick cable going to the analyzer, and the circuit connection wires coming out the other end. There may be more than one of these pods, but I only used 1. This one provides eight inputs (which apparently can be set for either TTL or open collector circuitry, but we will get to the software set up later). The solid black wire is ground, and the other eight wires, each color coded white with a different color stripe, are the logic connections. If you've come this far in EE, you can figure out what to do with these.

The First Screen

The first screen that you will come to when you turn on the machine is this one:

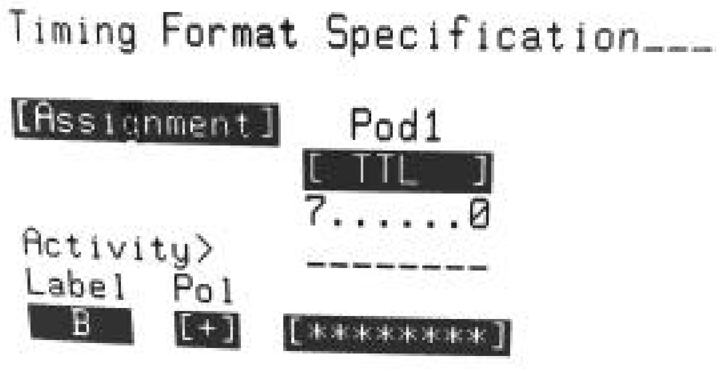


If this is not on the screen at startup, simply press the "SYSTEM" button to bring it up. In the above picture, the middle entry is highlighted, which is what we want. Use the arrow keys to move down and use PREV and NEXT to highlight that middle entry. You can also highlight the *glitch* setting, which allows you to choose between having no glitch protection, as shown above, and having the protection.

This glitch protection uses an extra channel per input to redundantly capture the data, so as to protect against glitches inherent in this state-of-the-art 70's hardware. What this means, effectively, is that if you want to minimize errors and do not plan to use more than 4 of your eight channels, then it is good to enable glitch protection.

In this example, I do not enable glitch protection because I want to use all eight channels.

The Second Screen

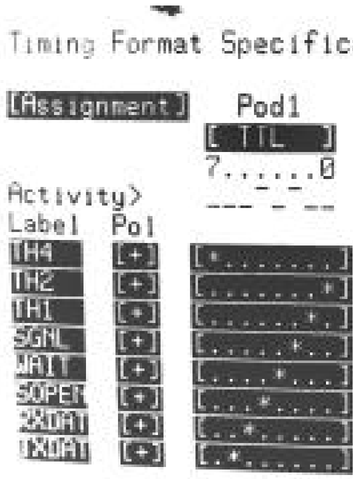


Move to the next menu by pressing the “FORMAT” key. In this menu, you have several things of interest. First, you specify the type of connection you want to use. For my purposes, this was TTL compatible. (I am fairly certain that CMOS was unknown at the time this thing was manufactured.) The channels “7……0” correspond to the channels that you connected your circuit to.

The “Activity” section of this screen is useful when debugging your test equipment (seeing if the inputs are being read by the machine). Even when the machine is not in active capturing mode, it is still monitoring the inputs, and it is in this screen that you can see their present value, just to the right of “Activity>.” In this case, all 8 inputs are low. If any had been high, this would have been indicated. And if any were rapidly changing, they would be portrayed as double sided arrows under their corresponding digits.

Finally, we have the last part of this screen, where your tags are entered to help monitor the screen activity. The arrow keys will move you down there, as always, but this time we have something new to play with: the letters. In order to type alphanumeric characters into the logic analyzer, one must push the blue key, which is the lower-left-hand key if you are colorblind, and then the key corresponding to that letter. (The letters are printed in blue above the keys.)

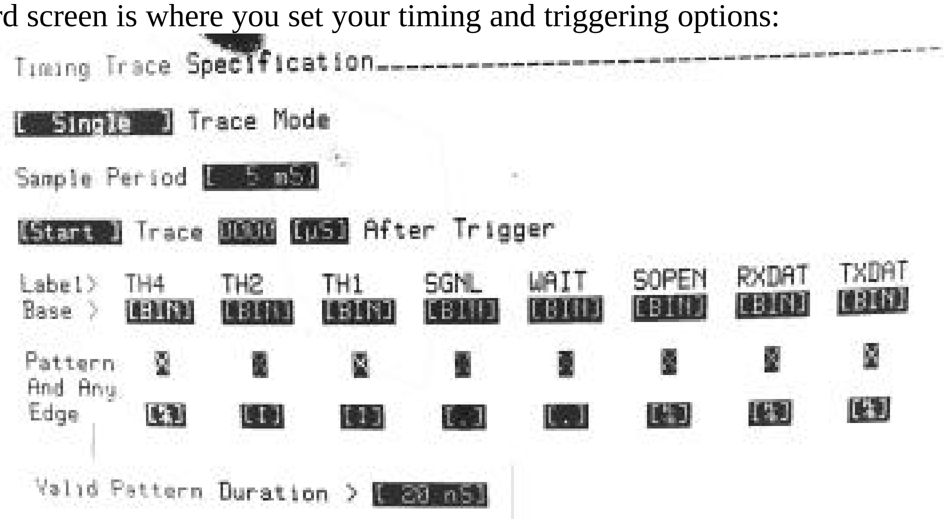
Put in your tags for your inputs, and along with them the inputs that they correspond to. This correspondence is indicated by a “*” and the unrelated inputs are indicated by a “.”. My completed list of inputs looks like this:



Notice that in this screen I have named the signals with names that are pretty clear as to their meaning. Also note that there is now activity on the input lines, as channels 4 and 2 are both high. After finishing setting all this up, move on to the final set up screen:

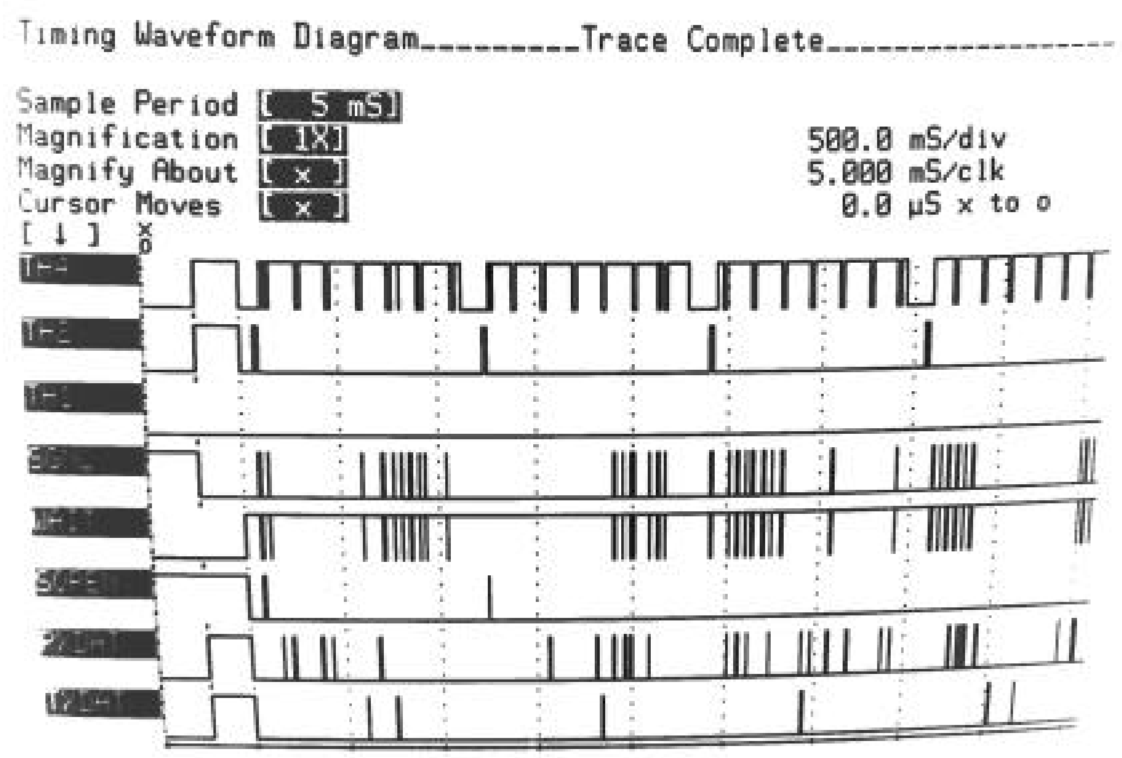
The Third Screen

The third screen is where you set your timing and triggering options:



Get to this screen by pressing the "TRACE" button. The "Trace Mode" can be set to be either single (on trigger) or continuous, and the sample period can be set to be convenient. Use the arrow keys, and the PREV and NEXT, to move around, as usual. Triggering for the channels is set to correspond with the labels you gave them in the previous screen. This is changed by the lower box to the right of "Pattern and Any Edge." Note that only the first four physical channels (0,1,2,3) are capable of triggering the analyzer, so make sure when hooking up your circuit to take this into account. To set the trigger, move the cursor to the lower box corresponding to the channel you want to trigger on, and use PREV and NEXT to change the arrow from none, to up, to down, to double sided. These obviously correspond to triggering on rising or falling slope, or on both.

Finally, you are ready to view your output. Start the trace by pressing "RUN" and shortly, depending on your input, of course, you will have something that looks like this:



By default, it will continue to refresh the screen multiple times as it collects a group of data, and then it will trigger again and write over the first screen. To stop the scope from doing this, press the "STOP" key. (It doesn't get much more obvious…) The labels did not turn out well in this picture, but they are there on the left side of the screen, alongside the traces that were taken. From this screen, you can reconfigure your sample period just in case you didn't set it right the first time, and you can view your data.

This is the goal, so this is the end of this tutorial. If you want to print this screen on one of those stone age dot matrix printers there (not really much else to do it on…), make sure it is on, connected, and has paper, and then hit the "PRINT" key. You may find it useful to turn off and on the printer if problems arise. Other than that, I have nothing else.

Good luck with your measurements.