

LI Documentation

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I. Turning on the LI Box

Verify that the LI box is plugged in, then locate the power switch at the lower right hand corner of the front panel. Flip it up to the on position. The red "Power" light on the front panel should now be lit, as well as the orange "Ready" light. A button is provided for a full reset, sometimes needed.

II. Getting started

A. Verifying connections

Verify that there is an LED inserted into the "LED2" slot on the circuit board below the front panel on top of the box. Make sure that optical fibers are running from the LI Box to the PMT that you are using. Also, make sure that there is an RS232 cable connecting the LI box (connector is on the front panel) to the computer serial port (COM1). Finally,

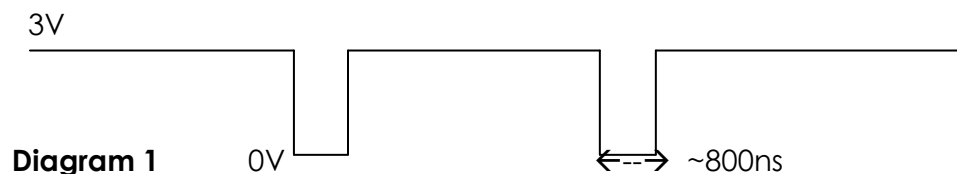
verify that the external trigger (connector on the front panel) is connected to the negative output of the pulse generator.

B. Setting the external trigger

The external trigger of the LI system requires a TTL-Bar signal, so we use the hp 8013A pulse generator to emulate this signal. Verify that the signal provided by the hp pulser meets the following criteria:

1. It is offset by at least +3V with respect to ground, with the trigger signal dropping to less than 0.5V (see diagram)
2. The 0V portion of the signal must have a width of at least 800ns.

Also make sure that the hp pulser is set to external trigger mode.



C. Strategy

The box sends out pulses of light corresponding to the settings you give it. Commands that provide pulse height, width, and the LED to be used are the setup. Then, some type of trigger is established and you are ready to go. When you 'turn off', all parameters are retained. If you do a hardware reset or power down, all is lost and you have to initialize again. We've written scripts so that the user doesn't have to memorize all these commands. The experienced user might switch to individual commands.

C. Using scripts

To control the LI box, use the YAT program, which is located in the Windows "Start Menu" under "All Programs." A variety of scripts have been written to make programming the LI Box as painless as possible. To use a script, open the YAT program, then click the "..." button next to the "Send File (F4)" button. Select the script you wish to use, then click the "Send File (F4)" button. All scripts are located in the "LI scripts" folder on the desktop. Here is a description of each script.

LI_Initialize.txt - this script must always be the first one used whenever the LI box is turned on or reset.

LI_Set_Zero_PE.txt - this sets the light level to the lowest possible (all pedestal) and then turns on the LED in external trigger mode. The blue "Active" light on the front panel of the LI Box should be lit.

LI_Set_One_PE.txt - this sets the light level such that the signal is approximately 95% pedestal events and 5% 1 PE events, and then turns on the LED in external trigger mode. The blue "Active" light on the front panel of the LI Box should be lit.

LI_Set_Max_PE.txt - this sets the light level to maximum, then turns on the LED in external trigger mode. The blue "Active" light on the front panel of the LI Box should be lit.

LI_Turn_Off.txt - This turns off the LED.

III. Advanced guide to LI, commands, and scripts

A. Commands

The following information will be useful if you wish to edit existing scripts, write your own scripts, or program the LI Box one command at a time with YAT.

Almost all of the following commands are case sensitive and must be prefaced with the character "a". The only exception is the "_X" command. So, if you wish to set the pulse width to 7 (see below), you must type "aD7".

List of commands

aA - Initializes the LI Box

E - Use this to choose which LED slot you wish to use. The choice is made with an ascii character, "LED1" corresponds with "a", "LED2" with "b", and so on. For example, to use the LED in slot 2, the full command is: aEb

D - This sets the width of the LED pulse. One can set it from 0-7, which corresponds to widths of roughly 20-35ns. As an example, the full command to set the width to maximum would be: aD7

K - This turns on the LED in internal trigger mode.

Q - This turns on the LED in external trigger mode.

O - This command must always be used after setting the LED pulse height.

The commands B and C:

B and C set the pulse height. The height is set in hexadecimal, with 000 being the lowest pulse height, and 3ff (corresponding to 1023 in standard decimal numbering) being the highest. The "B" command is used to set the 16² digit, and the "C" command sets the 16 digit and ones digit. This is best shown via examples:

To set the pulse height to 000, the sequence of commands is: aB0 aC0_0

To set the pulse height to 3ff, the sequence of commands is: aB3 aCf_f

To set the pulse height to 038 (which corresponds to a height of 56 in decimal notation), use this sequence of commands: aB0 aC3_8

Notice that with the "C" command, the two digits are always separated by an underscore _. Also, the letters (a,b,c,d,e,f) must be lowercase. Remember to always follow these commands with "aO".

The commands H and I:

When the LED is set to internal trigger mode, the triggering rate is determined by "H" and "I". "H" is a multiplier (high number), while "I" is the low number. Both can be set to any (hexadecimal) value between 00 and ff. Generally, you will want to use the following setting:

aH02 aI20

If the LED is triggered more rapidly (say, with an "H" value of 01), there is a risk of burning it out.

Removing the LED

We very strongly discourage removing the LED. However, if you must, **make sure that LI Box is turned off** before doing anything. Remove the optical cable bundle, then unscrew the conical collar. Finally, pull out the LED. When putting the LED back in, take note that the shorter leg of the LED should be to the right (when you're facing the LI box from the front). Make sure that the legs of the LED are not touching any of the nearby capacitors.

IV Troubleshooting

What follows is a list of the most common problems and troubleshooting techniques we've encountered, and surely more will be added from time to time.

- 1) In the middle of the board that holds the LEDs, there is a yellow fuse labeled "fs1." This fuse is kept at the same voltage (with respect to ground) as the LED, so checking its voltage is a good way to verify that voltage will be applied to the LED once triggered. (It should have 4V at startup, goes up to 12.5V with full amplitude.)
- 2) The external trigger requires a very particular signal, so make sure that it matches the diagram above.
- 3) It's always helpful to cycle the power or hit the reset button on the front panel of the LI box if you're unsure of the current settings. Remember to use the LI initialization script before doing anything else after turning the box back on (or resetting it).
- 4) When the light level is at maximum, and the LED is internally triggered with a setting of aH02 and aI20, it is possible to see the LED lighting up. This is helpful to verify that the LED itself is working.
- 5) If all the data in your histograms is in the zero bin, this is a good sign that the timing between the DAQ and external trigger is off. The external trigger's timing can be adjusted with the delay on the pulser, and the integration gate length can be adjusted within the DAQ program.