ASL165 Display Operation Evaluation

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1   Introduction

A number of ASL165 Display Units have been exhibiting an operational flaw; the LCD is not displaying anything when powered up.

The units do not power up correctly when cold. However, if powered is applied for 10-15 seconds and then power is cycled, the units usually power up correctly and the system operates as expected. Turn off the units and wait approximately 10 minutes; the units will not operate correctly when powered back up.

The goal of this effort is to determine the root cause of the failure, identify a solution and test the solution.

The solution is appropriate when the units can be power up and the Display shows the information. Testing shall be performed when the units have been turned off for at least 10 minutes and shall be repeated powered-up and evaluated for proper information display.

2   Analysis

2.1   Many feature are working.

The units are able to communicate with the ASL110. This implies that the microprocessor is executing the code properly. The communication protocol is rather strict, so any latency or bad packets would interrupt the connection.

I determined that the communication is working by pressing the Up and Down arrows to Enter and Exit the Bluetooth mode. I plugged in a Mouse Emulator (ASL558BT) into the PC and verified that the Mouse Emulator works when ASL110 is in Bluetooth and doesn't work when the ASL110 is NOT in Bluetooth Mode.

Also the Pads do drive my Desktop LiNX wheelchair system appropriately.

The User Port input also operates as expected. A buddy button is plugged into the User Port. When the button is held for a long period of time (i.e. 1 second), the ASL110 advances to the next programmed feature. When the button is momentarily activated, the ASL110 executes the selected feature.

3   Firmware Solution

The LCD's need a specific Initialization Sequence to be executed in specific orders according to the LCD driver chip manufacturer. The LCD driver chip is an "ILI9341" from ILI TECHNOLOGY CORP, Taiwan.

I have reviewed this document and reviewed the code and believe that the interfacing to the chip is properly executed.

It is possible that the MCU is executing the instructions for the interface too fast. I added waits, delays between various steps in the Initialization Sequence. None of them made any difference at all. The problem still exists.

4   LCD connection integrity

The LCD's have a multi-wire ribbon cable that is somewhat fragile and prone to breakage (Yes, my opinion based on years of experience). The connector is a "work of art" when considering the number of connections required, the integrity and strength of the connection, and the ease (technique) of connecting the ribbon cable.

I have 5 ASL165's of various vintage. I have "mixed and matched" the LCD's to the boards and noted possible ribbon cable fractures.

I am labeling each board by its serial number.

Legend. I'm classifying the operation as follows:

- WORKS GOOD. This indicates the unit power up normally when "cold" and for an additional 5 times.
- WORKS WARM. This indicates the unit did not power up when "cold" but powered-up normally after 10 seconds and for an additional 5 times.
- WORKS MARGINALLY. This indicates that the unit powers up inconsistently when cold and when warm. This is used to describe units that start up but not properly, i.e. "Snow instead of graphics" or "skewed graphics".
- WORKS NOT AT ALL. Backlight turns on but no information is displayed cold or warm.

4.1   Batch# PO#210808 01-33B-56

- "Faulty Unit" LCD. WORKS GOOD.
- "-76" LCD. Powered up first time "snowy" but GOOD for an additional 10 times.
- "-186" LCD. WORKS GOOD.
- "-57" LCD. WORKS NOT AT ALL.
- "-56" LCD. WORKS MARGINALLY. The first couple of tries, the screen showed "snow" and skewed graphics and then started working normally. Turned the unit off for a few seconds and powered back on and get "snow" for the first 2 times, then normal operation.
- "-5" LCD and not seated well. WORKS GOOD.

4.2   Batch# PO#193204, T2015-0-5

- "Faulty Unit" LCD. WORKS GOOD.
- "-76" LCD. WORKS GOOD.
- "-186" LCD. WORKS GOOD.
- "-57" LCD. WORKS GOOD.
- "-56" LCD. WORKS GOOD.
- "-5" LCD. WORKS GOOD.

4.3 Batch# PO# 210108, 01-003B-44

- As found with original "-44" LCD, 1st time, NO GOOD, 2nd time and subsequent times, WORKS GOOD.
  Reseated the LCD, works 1st time and every time.
- "Faulty Unit" LCD. WORKS GOOD.
- "-76" LCD. WORKS GOOD.
- "-186" LCD. WORKS GOOD.
- "-57" LCD. WORKS MARGINAL. Didn't work 1st time but worked for an additional 5 times, let it rest a few seconds and it powered up skewed a few times, then OK.
- "-56" LCD. WORKS GOOD.
- "-5" LCD. WORKS GOOD.

4.4 Batch# PO#181511, 18-1667-186

This unit has an "iffy" 6-pin Molex connector and does not communicate with the ASL110 unless I position the 6-pin connector 'just right'.

- "Faulty Unit" LCD. WORKS GOOD.
- "-76" LCD. WORKS GOOD.
- "-186" LCD. WORKS GOOD.
- "-57" LCD. WORKS GOOD.
- "-56" LCD. WORKS GOOD.
- "-5" LCD. WORKS GOOD.

4.5 Batch# PO#181511, 18-1667-76

I'm assessing that the connector on this board is marginal. I can move the LCD and get the 'Green hue on the background' to appear and disappear.

- "Faulty Unit" LCD. WORKS GOOD.
- "-76" LCD. WORKS WARM.
- "-186" LCD. WORKS GOOD.
- "-57" LCD. WORKS NOT AT ALL.
- "-56" LCD. WORKS WARM.
- "-5" LCD. WORKS GOOD.
- "-44" LCD. WORKS NOT ALL.

4.6 Batch# PO#310108, 01-033B-57

- "Faulty Unit" LCD. WORKS GOOD.
- "-76" LCD. WORKS GOOD.
- "-186" LCD. WORKS GOOD.
- "-57" LCD. WORKS NOT AT ALL.
- "-56" LCD. WORKS WARM.
- "-5" LCD. WORKS GOOD.
- "-44" LCD. WORKS MARGINAL.

Here's a table of operation. The Columns are the LCD glass. The rows are the PCB's.

	"Faulty Unit"	"-76"	"-186"	"-57"	"-56"	"-5"	"-44"
01-33B-56	GOOD	IFFY	GOOD	BAD	IFFY	GOOD	n/a
T2015-0-5	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	n/a
01-003B-44	GOOD	GOOD	GOOD	IFFY	GOOD	GOOD	GOOD??
18-1667-186	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	n/a
18-1667-76	GOOD	WARM	GOOD	BAD	WARM	GOOD	BAD
01-033B-57	GOOD	GOOD	GOOD	BAD	WARM	GOOD	IFFY

5 Findings and Conclusion

It does appear that some PCB's have better connection possibly due to better soldering of the connector itself or the connector itself.

It does appear that some LCD's are better than others. LCD "-57" does have a kink in the ribbon cable.

There is no "solid" root-cause identified by this study.