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I repair Waters Bus LAC/E interface cards. I also have some stock of my own to sell.

I have been repairing these cards since 2008, I started my business in 2006.

From 2009 through to 2014 I have normally had about 20 to 30 boards in stock at any given time. However I do not have a dedicated supplier for these boards and may run out completely one day soon. If you have any cards to sell, please contact me.



There has been an incredible amount of liquidated Waters HPLC equipment auctioned off over the past 9 to 10 years. I spoke with one person who was losing his job at Pfizer and he had said that his company alone had liquidated 12000 auction lots and that was back in 2009. BMS, Merck and several others have also liquidated vast amounts of equipment.

Normally computers are not included in these auction lots. I have had a hard time selling refurbished Waters instruments over the past few years but I have found a niche in repairing and reselling Bus LACE boards.

While used HPLC system prices have dropped or remained the same, these cards have increased in value by about 7X since 2006.

If you have a board that is not working please do not throw it away. I can buy defective boards to repair and resell later or I can repair yours for a fraction of the price of what I can sell one to you for. I believe Waters has discontinued these boards now but a repair would have been less than 10% of the cost of a new board back when they were still being sold circa December 2011.

Assuming the connector that plugs into the computer is facing down, there is a series of 8 LEDs on the top right of the board.

When the computer starts up, these LEDs will light in a sequence. If I know what sequence they are lighting in, I can give you an upfront estimate by phone or email. Below there are examples of various errors, you will likely be able to match one of these errors to the trouble you are having.

If you send your card and the cost is higher, there is no charge for the further evaluation and I can ship the unrepaired card back on your account, free of

charge, anytime.

I have been servicing scientific instruments full time since 1999 and had some part time experience with them before this. I have participated in chat rooms and mailing lists that focus on electronics. While I have studied diligently and continue to do so to expand the scope of things I can do, I have consistently been surprised at the level of knowledge that some people in these internet groups have. These people may not know anything about scientific instrumentation but they have certainly read vast amounts of material concerning electronics.

Please consider sending me your Bus Lace boards for repair, there may be a multitude of people in the world that know more about electronics than I do but I believe I am the only person on the planet that has a dedicated shop setup for repairing these cards.

It has been very difficult to learn this circuit as Waters will be the only organization that has the schematic but after hundreds of hours(in fact I am probably just past the thousand hour mark) of working with this circuit I have the knowledge required to repair them at an affordable cost.

These boards contain two chips that are FPGAs. An FPGA is a special chip that can act as a programmable circuit. A designer can fabricate a circuit within the FPGA by programatically reconfiguring logic blocks inside the device, thereby creating a little circuit inside.

FPGAs are handy for designing circuits but they also provide a serious deterrent to those trying to copy the design of the board. The circuit contained inside them is virtually impossible to copy.

I purchased a number of cards that were intentionally damaged and then discarded. They are unrepairable but contain these FPGAs. I can rob these priceless chips from my surplus boards to repair yours, others simply will not have this option available. In addition I have heavily invested in test equipment and I can monitor signals on well over 200 pins at the same time. You may have an electronic genius in your organization but they will likely be stuck with oscilloscopes and multimeters. They will need extra days to accomplish the same tests I can carry out in minutes.

Estimate by Telephone/Email

There are many different errors that can occur with these cards and there are many different kinds of repairs that are needed to fix them. Sometimes I will discover a new process and the ease of a repair will change but below are some descriptions of errors that can occur and their ranking of severity.

Please see the row of LEDs in the top right corner of the board.

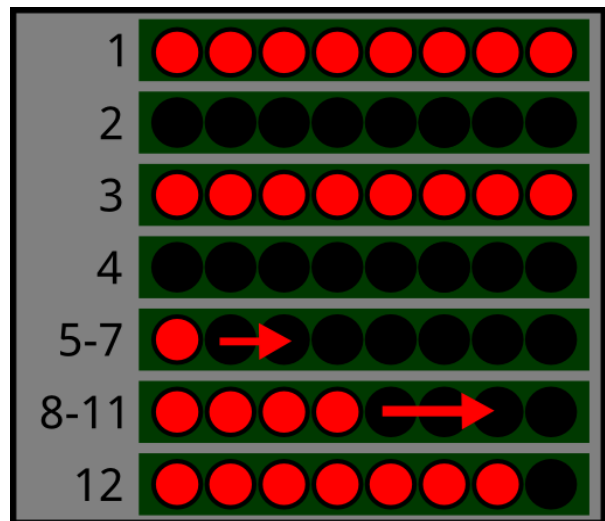
This image depicts a healthy boot sequence on powering up the computer:

- Step 1) All LEDs flash on
- Step 2) All LEDs flash off
- Step 3) All LEDs flash on
- Step 4) All LEDs flash off

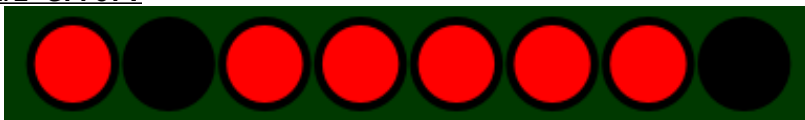
- Step 5) LED 1 lights
- Step 6) LED 2 lights
- Step 7) LED 3 lights, The time for LEDs 1 through 3 is about a second or so.

- Step 8) There is a pause of a few seconds and then LED 4 lights
- Step 9) LED 5 lights
- Step 10) LED 6 lights
- Step 11) LED 7 lights, LEDs 5 through 7 take about a second or so to light

- Step 12) LED 8 does not light on power up

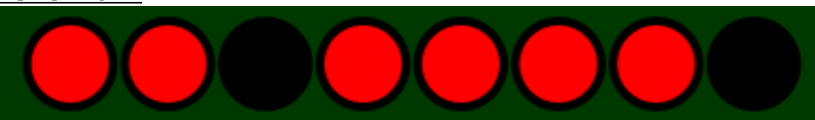


#2 error:



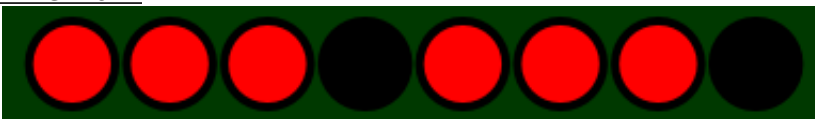
The boot has finished but #2 LED has failed to light. This is good news. This is one of the easiest repairs.

#3 error:



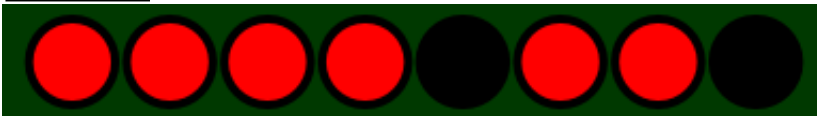
Like the #2 error, this is good news.

#4 error:



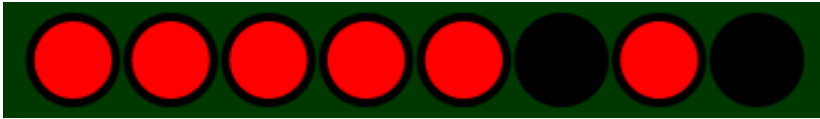
This is one of the worst repairs, if not the worst.

#5 error:



This is a serious error, it is however extremely rare.

#6 error:



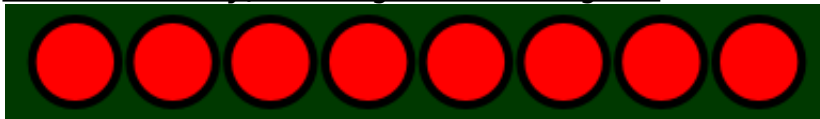
Like the #4 and #5 errors this is a serious error but like the #5, it is extremely rare.

#7 error:



The #7 error is a moderate repair.

No LED activity, All lights or no lights:

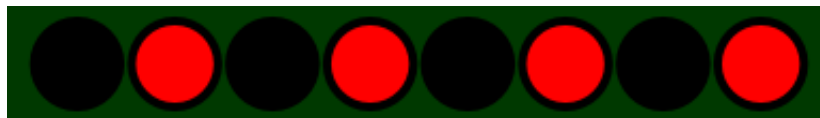


or



I really hate this error as more than half the chips on the board can create it. However it often be resolved without expensive parts. It is a moderate to serious error.

Every other light:



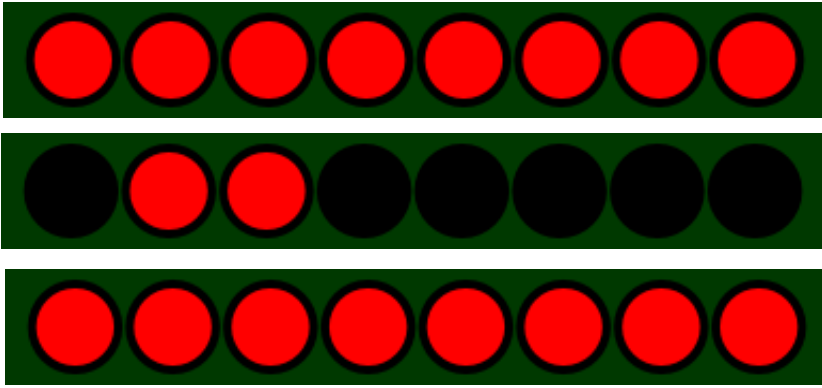
This is a moderate repair.

First three then computer hangs:



This is another rare error. Sometimes the first 3 LEDs will come on but the boot sequence stops there. It is a serious error.

Flash then 2 + 3, then flash:



I really hate this error too. It is the one code I cannot provide an accurate estimate upfront with. There are 3 electronic components that can cause this and they range vastly in price. It can be a moderately simple repair to an very serious one.

The following errors appear to have healthy boot ups but then fail later, They are all serious errors:

Reboots during run.

Drops communication with instruments during during run.

Computer screen turns blue and error message about core being dumped is displayed.

Not found by the operating system.

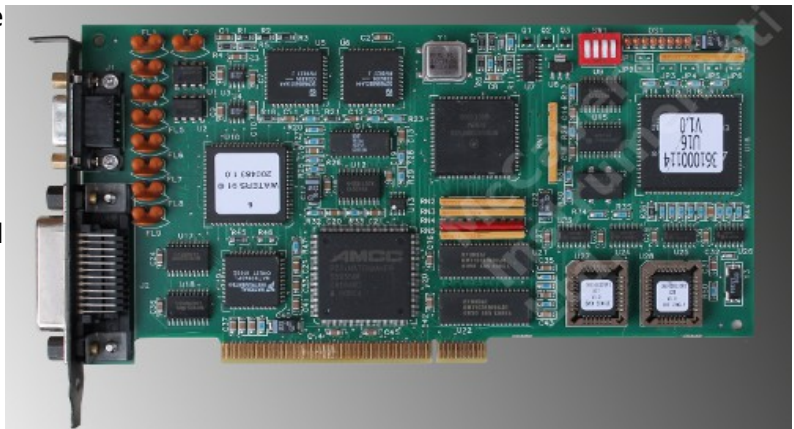
Found by the operating system but not Empower/Millennium.

Found by Empower but system cannot be brought on line.

Be sure to check the DIP switches with SW1(at the top middle-right of the board)all switches on the bottom side should be pushed in, on the "long" card pictured below or all switches should be pushed to the bottom half in the "short" card pictured at the beginning of this document.

You may also be able to repair the card by using an eraser to clean the card connector edge.

Please note that I am not affiliated with Waters Corp in anyway and that LAC/E, Empower and Millennium are trade names owned by Waters as well.



-Patrick McCavery