

LOST IN SPACE REPAIR: IBM-5155 SERIAL CARD.

H. Holden. August. 2018.

This is the kind of repair that might have to be done on a spaceship when your computer breaks down and there are no spare parts available.

During work on a clone of a Votrax Type 'N Talk unit, I was using the serial connections on my IBM-5155 computer. I have two serial ports: One is the standard IBM Async card, set up on address 3F8h as COM1 and the other as an extra on the Six Pak Plus card at address 2F8h, set up as COM2.

I found out that the IBM Async card was intermittently malfunctioning. At times it would completely ignore incoming data on its Rx input on pin 3 of its DB25 connector. Yet sometimes it would work for many hours.

I wrote a small software utility to send continuously changing data to the COM1 port so I could look at the serial data voltage waveforms on the oscilloscope. Though as it turns out, it was possible to diagnose the fault with a simple meter.

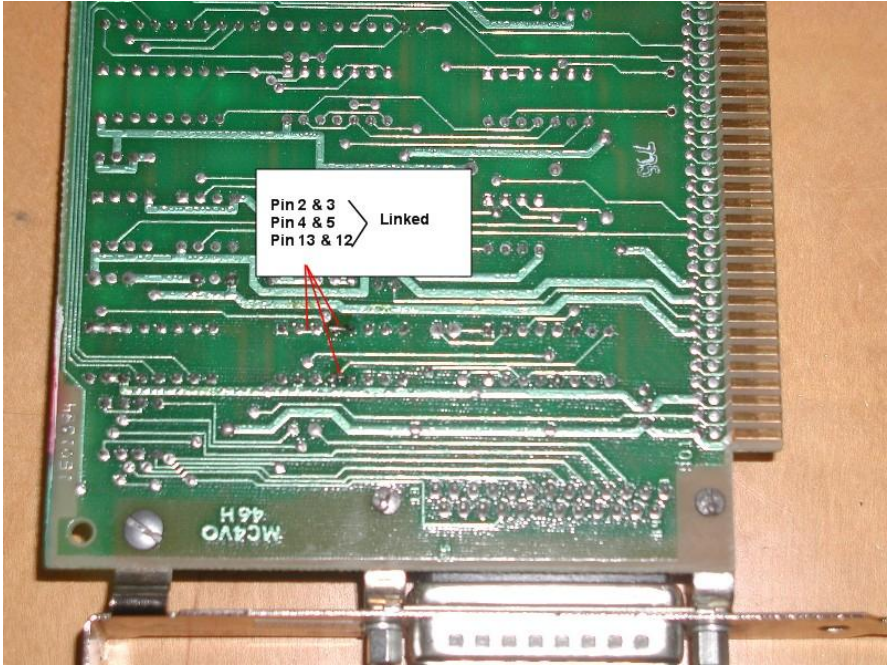
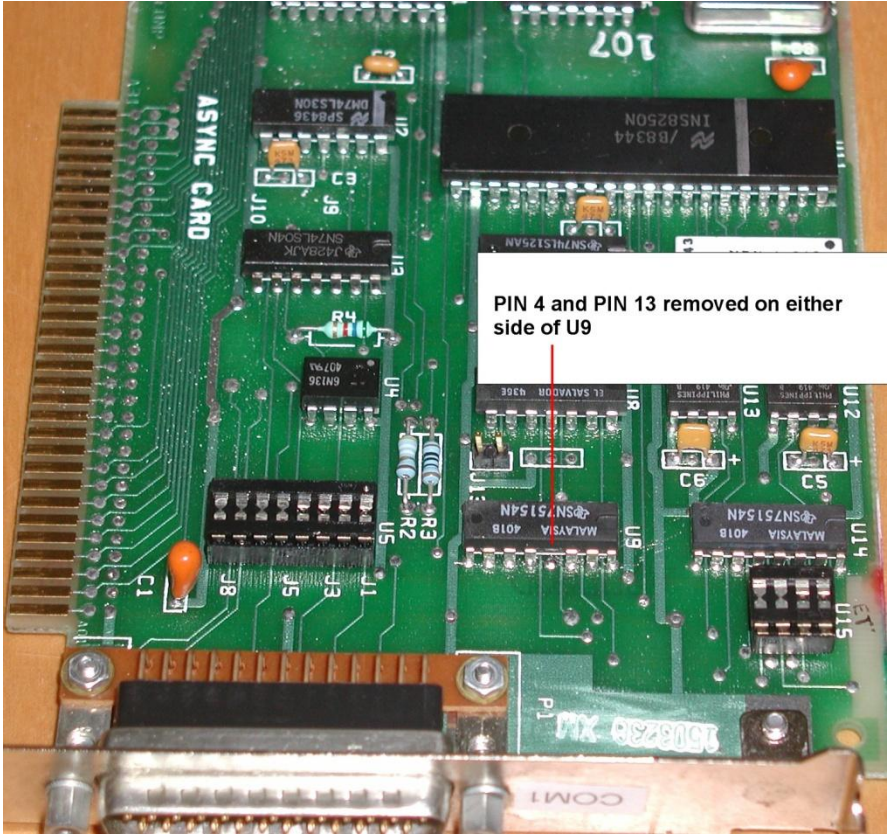
Looking with the scope; the voltage swing on COM1's Tx output was what it should be, close to + 11V and -11V. As soon as a loop-back tester was added (which connects Rx to Tx), the negative going voltage on Tx decreased in magnitude by at least 7V, to about -3 to -4V. That looked suspicious, as this voltage is borderline for a satisfactory serial data logic level.

Normally, with no data being sent, the Tx output sits near -11V. Placing a current meter, from the Tx output, to the Rx input showed the current was 14mA and the voltage dropped to -3.5V. Comparing this to the situation on COM2, the Tx to Rx current on the Six Pak Plus Card's connector, it was only about 2.3mA, with only about 1.5V of loss of amplitude when the Rx line loaded the Tx line.

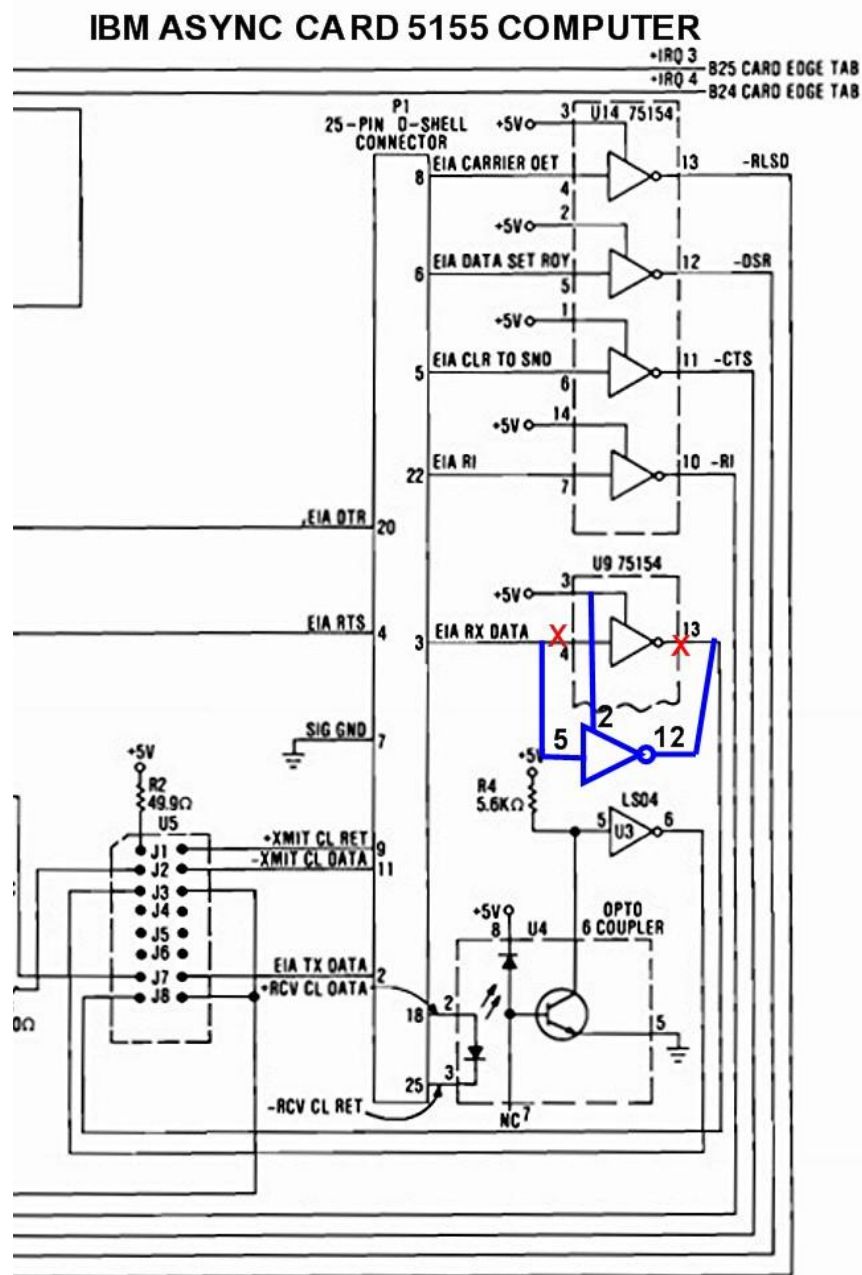
Inspecting the schematic for the IBM Async card, the Rx input is pin 3 of the DB25 connector and it passes directly into the input (also pin 3) of a DS75154N line receiver IC labelled U9. A quick test on the current into pin 3 of the IC demonstrated the IC had failed drawing excessive current on that pin. Right away I knew I didn't have one in my IC stocks and I would have to order them with about a 2 week delay.

However, the DS75154N contains 4 line receiver buffers. I noticed that the remainder of the buffers in IC U9 had not been used by IBM. So I clipped off U9's pin 3 and pin13, unsoldered and removed these two IC pins from the pcb.

The repair then only required 3 links on the back of the board connecting 3 pairs of adjacent pads:



The schematic below shows how one of the unused inverting line receiver buffers in the U9 package takes the place of the defective one:



I have some of these IC's on order now, but for now, the IBM Async card is working perfectly normally.