

**Intructions for Building a  
Serial Port Card for your IBM PCjr**

## PREFACE

These instructions should provide you with enough information to construct a card that will provide another RS232 serial port for your PCjr. The card plugs into the internal modem slot. This gives the capability of running two serial devices, such as an external modem and a serial mouse, simultaneously.

## THEORY OF OPERATION

The one RS232 port provided on the PCjr uses the 8250A asynchronous communications chip. The PCjr internal modem card also uses this chip. The idea is to build a card using an 8250A that provides the same external interfaces as the RS232 port on the system board. The 1488 line driver and 1489 line receiver chips perform this function. An additional chip, the LS245 octal bus transceiver, provides two-way buffering for the data bus connecting to the 8250A.

When this card is plugged into the internal modem slot, it becomes the COM1 port, addressed at 3F8. The system board RS232 port is COM2, addressed at 2F8. This is consistent with PC operation. A stock PCjr without the internal modem has the system board RS232 port designated as COM1, but the address is still 2F8. Some programs, especially communications software, have trouble dealing with this inconsistency. There will be no problem with this card installed.

## PARTS LIST

1	INS8250A or INS8280AN Asynchronous Communications Chip	Z1
1	74LS245 Octal Bus Transceiver	Z2
1	1488 or 75188 Quad Line Driver	Z3
1	1489 or 75189 Quad Line Receiver	Z4
1	40 pin DIP socket	
1	20 pin DIP socket	
2	14 pin DIP sockets	
1	Blank Card with edge connector	
1	4.7K 1/4 watt resistor	R1
2	10K 1/4 watt resistors	R2,R3
5	0.1 mf ceramic disc capacitors	C1-C5
1	DB-25 Male connector and metallic shield.	J1
2	inline male-female plug pairs.	
	30 gauge solid wire (wire wrap type)	
	24 gauge stranded wire	
	Aluminum foil	
	Electrical tape	

### Notes on above parts:

There are 8250 chips, and there are 8250 chips. The original 8250 is used in the PC and has some known bugs that the PC and/or software corrects for. The 8250A corrects these bugs, and is what is used in the PCjr. For this reason, I have specified the 8250A for this project. I don't know if a 8250 will work or not. There is a file on IBMPC called ASYNCH PROBLEMS that discusses all of this. You can read it and draw your own conclusion.

The LS245, 1488, and 1489 are common chips readily available at electronics stores. The 1488 and 1489 can be found at Radio Shack.

The card is probably the most difficult part to round up. If there is such a thing as a blank card specifically for the PCjr then you are home free. I have no idea if there really is one. I found a card at a local electronics store that goes in an Apple. Its edge connector contacts were on the required 0.1 inch centers. The edge connector was longer than necessary, but it was a simple matter to trim it down. The whole card had to be trimmed also.

This particular card had two metal strips going around the perimeter, which were handy for Ground and +5 Volt busses.

There are two wires that have to be connected to the card from the system unit because the required service is not available from the modem slot. So that the card can be removed, you need some kind of inline connector for these wires. Use whatever works. Obviously, a dependable connection is important.

I hope that these instructions are sufficient enough that the PCjr Technical Reference is not required. If you have one, you will get a better idea of what is going on.

## PREPARING THE CARD

This is the first thing to do. If you have something that needs to be trimmed to fit, give some attention to how the card will be supported. I would not depend only on the modem slot for support. If you look directly back from the modem slot, you will see a plastic cradle near the back panel. Your card may reach back that far; mine did not. What I did for this was to attach a small 'leg' to the back of my card that extends down to the system board and rests on it. I made the leg out of some spare perf board. Note the two metal pins poking up from the system board just in front of the plastic cradle. Make sure these don't short to something on your card.

Now look at the underside of the PCjr cover panel. You will see some notches that the tops of all the cards fit into. If your card reaches back to the plastic cradle, it should also fit into the cover notch for a secure fit. As mine did not, I cut a similar notch into a small piece of styrene plastic, and glued it to the cover across from the notch for the 64K memory and display card. Plastic model cement works fine.

You may have to trim contacts off the edge connector. You need 30 contacts, 15 on each side.

Once everything is done, plug the card in and turn on the machine, just to make sure there are no shorts anywhere. Next step is placing the sockets and wiring them up.

WIRING THE CARD

SOCKET PLACEMENT

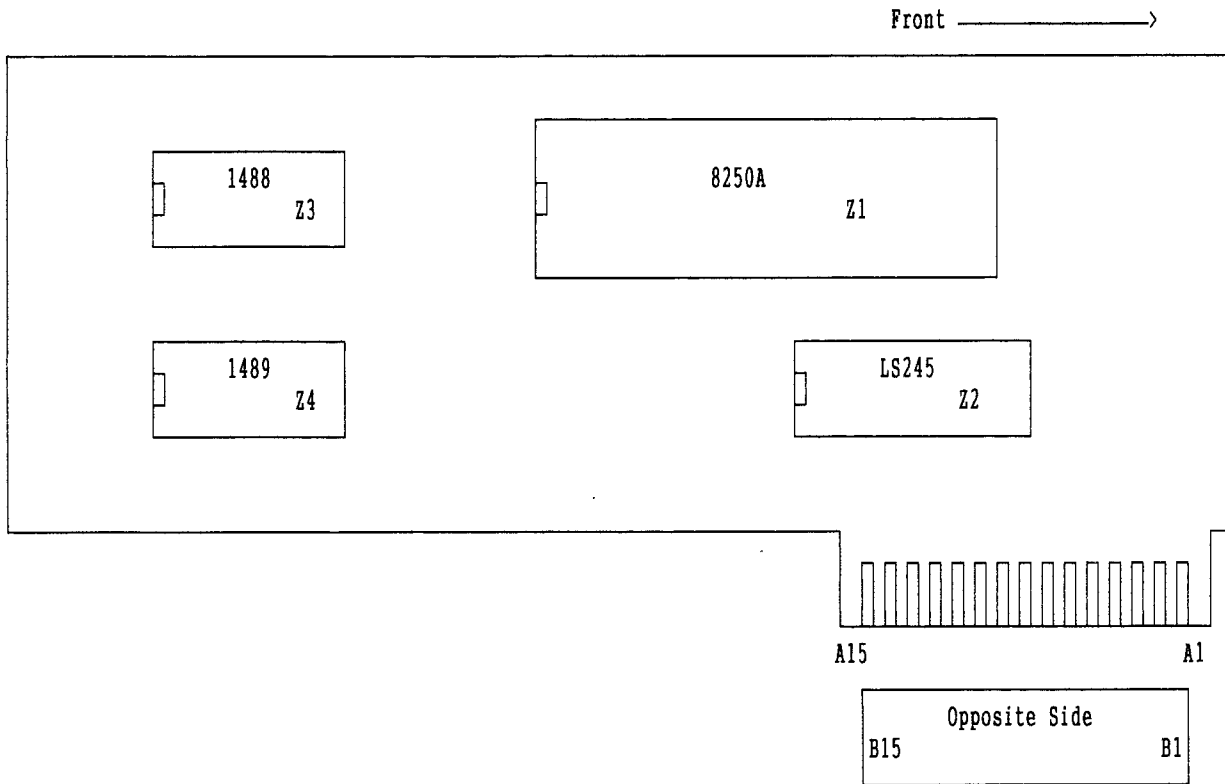


Figure 1. Partial Card Layout

I have included a drawing showing the placement of the chips on my card. This seemed to give the best wireability, at least as far as the 8 line data bus was concerned. If you look at the card as placed in the slot from the front of the machine, the chips should be on the left side, with the wiring on the right side. This arrangement matches the other cards in the unit. It is a good idea to orient all the chips the same way, so that you will know which is pin 1 without constantly flopping the card over.

Make sure you allow sufficient margin at the top of the card to allow clearance where the card fits in the support notches on the PCjr cover panel.

# WIRING

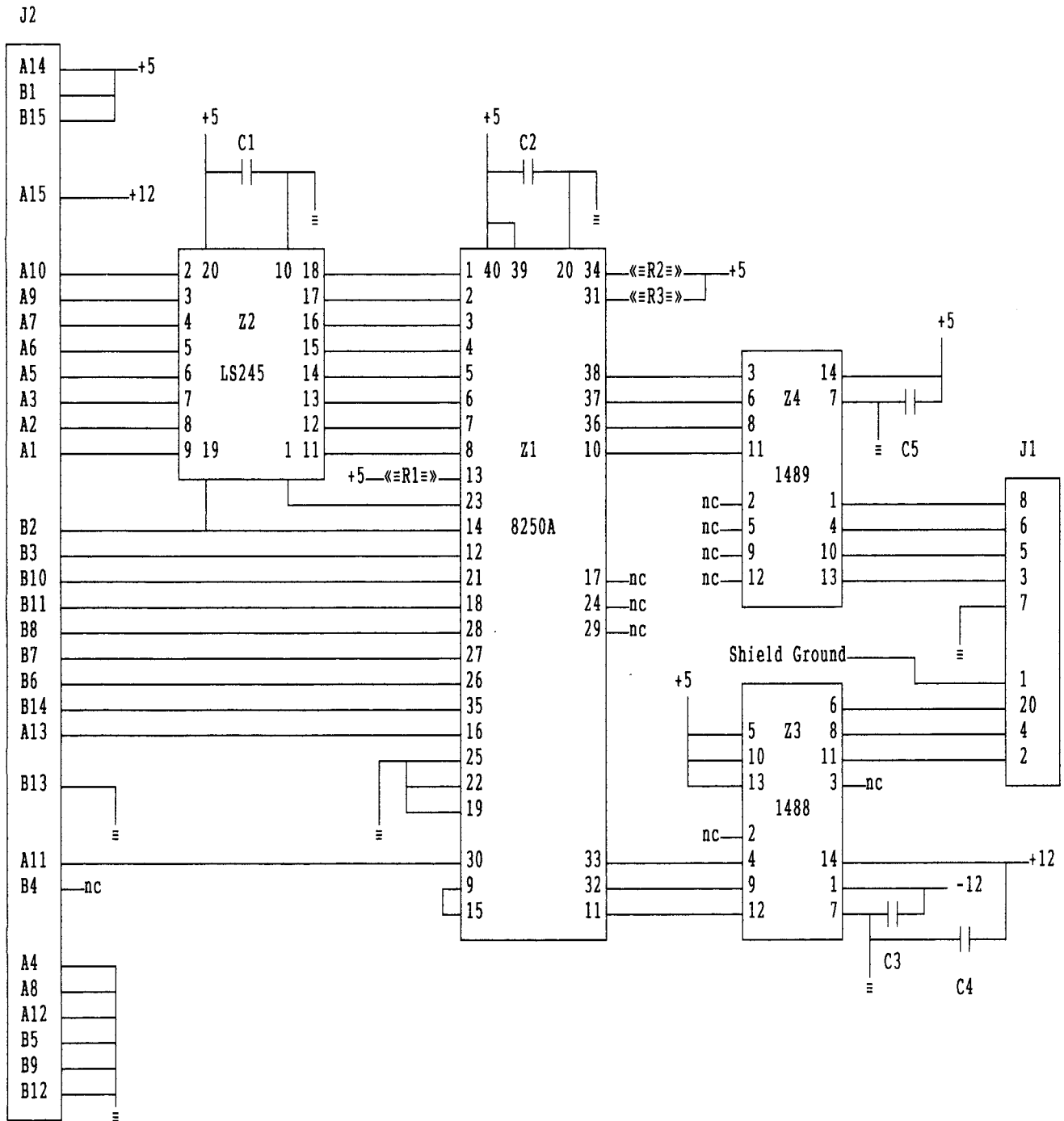


Figure 2. Schematic Diagram

Using the 30 gauge wire and the schematic provided go ahead and start connecting things up. I started with the data bus from the LS245 to the edge connector, and from the 8250A to the LS245. From then on, it was pretty much whatever seemed like it was next. It's a good

idea to run wires in more or less north-south and east-west directions, putting right-angle curves in them where necessary, rather than stringing them directly between pins. The end result is a little neater looking, and gives some slack in case you find you connected to the wrong pin somewhere.

NOTE!: Do not connect pin B13 of the edge connector (J2) to ground yet. This is what tells the PCjr that a card is in the slot. What you should do periodically during the wiring process is put the card in the slot and see if the computer goes through POST okay. If B13 is grounded, POST will attempt to communicate with the card, and an ERROR E will result. I know this because I tried it.

You will use the 24 gauge stranded wire to connect the card to the DB-25 (J1) connector. About 6 inch lengths should be sufficient. The drawing is correct in showing that only 9 pins are used. Pin 1 of J1 is labeled SHIELD GROUND. After all the other wires were connected to J1, I stripped about a foot of insulation off a piece of stranded wire. I connected this to J1 pin 1, then wrapped it around the other wires all the way up to the card. Then, the resulting cable was wrapped in aluminum foil, and finally, electrical tape. A metallic DB-25 shield that contacts the foil completes the connector. To run the cable outside the machine, cut a 1/4 by 1/4 inch notch at the top of the back panel of the system unit.

The other end of the shield wire was soldered to the metal shield over the display and serial jacks at the back of the system board. This was where one of the inline male-female plug pairs was used, so the card could be removed if necessary. It will probably be tempting to take a shortcut here and connect the shield wire to the signal ground on the card somewhere. This may work with no problems, but I am assuming that they keep signal ground and shield ground separate for some good reason. I think that the idea is not to have induced voltage in the shield getting into the signal path. This is just a guess, however.

There is one more connection that you have to make to the card. Pin 1 of IC 1488 (Z3) needs a -12 volt supply. This is not available at the modem slot. You can get this from pin 10 of the power supply card (that thing with all the heat sinks at the left side of the system unit). Pin 10 is the rearmost contact of the power card edge connector. There is a solder pad there that is easy to connect a wire to. The other inline male-female plug pair is used here. If you have a Technical Reference manual, be aware that there are several errors in it as far as the power card voltages are concerned. Most of the schematics show -6, but on my computer it is definitely -12. This subject has been discussed recently in PCJR FORUM on IBMPC. If your machine really does have -6 instead of -12, it should be no problem, since the 1488 on the system board is making do with it also.

The 0.1 pf capacitors should be mounted as physically close to their respective IC's as possible, so that minimum wire length connects them to the pins. I have found on other projects that these capacitors eliminate RF interference that can upset your TV picture.



## TRYING IT OUT

Once everything is wired and POST still works, you can connect J2 pin B13 to ground, and install the chips. The moment of truth has arrived. With the card in, the system should boot up with no problems. An ERROR E right after the memory counter stops and before the disk drive starts is a sign of a problem. No changes of any kind are required to DOS to get it to recognize the card.

If you attempt to run the modem test in the internal diagnostics (CTRL-ALT-INS), however, you will get a failure, even if your card is working correctly. This is because this test actually tries to run some internal modem functions.

Note: I have found that, once in a great while, if I have to do a CTRL-ALT-DEL while the modem was active, an ERROR E will come up. I had gotten this problem before when the modem was hooked to the system board COM port (ERROR D). Apparently this is caused by garbage coming from the modem rather than a hardware problem. Another C-A-D is always successful.

That should do it. I would be very interested to hear of any success stories or failures relating to this project. Also, any additions or corrections to instructions would be appreciated.

## ACKNOWLEDGEMENT

Thanks to Paul Berger for help with designing this project.