

Joystick PCB Electronics- Theory of Operation

By Gordon JC Pearce – February 2009

Look at page 6 of the Poly-800 Service Manual PDF, in the bottom left of the circuit diagram there's the PCB for the joystick. Printed circuit board KLM-599 is drawn in its own separate box.

Okay so we've got a quad opamp NJM2056D, which is probably something like a TL074 or similar - not critical.

R6 and R7 provide around 2V (2.024V assuming the resistors and 5V supply are bang on) which is buffered by IC1d (following the convention on datasheets and pin numbers - the actual chip section isn't written on the diagram). Note that the 2V supply goes to the non-inverting input and the inverting input is tied to the output, forming a unity-gain buffer. This means that no matter how you waggle that stick, you won't affect the voltage being supplied.

The center taps of the joystick are held at 2V to provide the center "dead band" - perhaps one of the reasons for a jittery controller is dirt on the track, or a noisy signal?

The MG joystick has a 2k2 resistor to +5V at one end, with the other grounded. By waving a bit of Ohm's law at it, we find that a 2k2 resistor in series with a 10k resistor (the total resistance of the joystick track), we get 4V approximately at the top of the pot. That gives us a swing of 0V to 4V, with a dead band around 2V in the middle.

Now, what about the pitch bender? That's a bit more complicated. Not much, but a bit.

The pitch bend pot supplies a signal going from 2V to 4V as the bend range is increased, because one end is wired to the 2V supply and the other is wired through a resistor to 5V. IC2b, R3 and R4 form an inverter (C2 and C3 just stop it oscillating), which has an output going from 2V to 0V as the input increases - the output is relative to the non-inverting input which is wired to 2V so it's worked out as $4V - V$ control. This is then fed to another inverter (which is again relative to the non-inverting input) giving its output as $4V - V_{pin7}$. The bend range pot is wired across the outputs of the two inverters. The practical upshot of all this is that as you increase the bend range from 0 to 10, the voltage from the pot goes from 2V to 4V and the voltage at the ends of the pot "spreads" from 2V at both ends to 0V and 4V. Confused? Read it again and look at the diagram. Think of it as the electronic equivalent of opening a pair of scissors...
