Analogue Opto-Isolator

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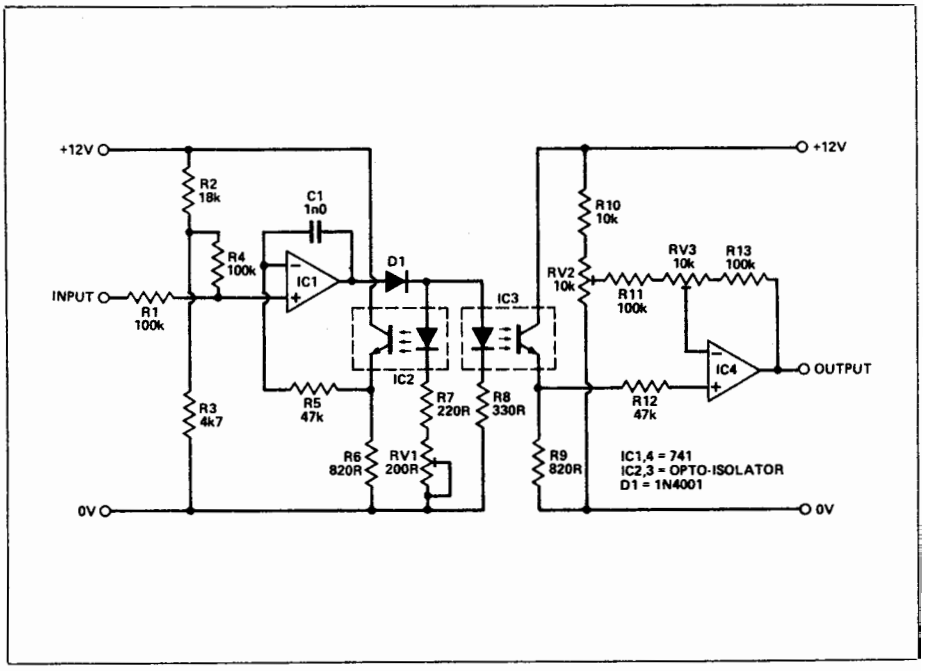

THIS CIRCUIT accepts an analogue input and transfers it to the output faithfully without any electrical connection, the link being optical. It is more usual to see V to f converters being used for this, but they demand more cumbersome circuitry and unless a train of pulses is required, the linear approach should be considered. Additionally, V to f converters integrate or smooth out the incoming waveforms, which may or may not be desirable. With slight modifications (changing a few resistor values) this circuit will feed A/D converters.

Linearity is maintained by using two opto-isolators; these are both non-linear, but equally so, and the effect can be made to cancel out. Although not done on the original, a dual type could be used to obtain the benefits of equal temperatures. It's not as important as it would be on a V to f circuit, and, the isolators are dissipating approximately equal power.

The two halves of the circuit are powered from separate supplies. The network R1,2,3,4 attenuates the incoming voltage and offsets it. This ensures that the LEDs always have a certain amount of current flowing in them. IC1 drives both LEDs and the voltages on its inputs are nearly equal. Current flows in R9, the offset is removed and the gain adjusted in the output circuit, IC4.

To get the best linearity, adjust RV1 to the centre of its travel and take two pairs of measurements of output versus input, one pair near the more positive end of the range of interest, the other pair near the more negative end of the range. Divide the differences between the adjacent pairs of inputs by the difference between the adjacent pairs of output values, giving two ratios which should be approximately equal. Adjust RV1, making note of how far it has been adjusted, and repeat the measurements and calculation. Compare this new set of ratios with the previous ones. There are three possibilities: the error will have diminished, in which case adjust further in that direction; it will have increased, in which case reverse the adjustment direction; or you may have adjusted past the point of linearity in which case you will note that the ratio which was the larger is now the smaller. In this last case reverse the direction of adjustment but don't adjust too far back again. Repeat until the linearity is acceptable.

In fact, the linearity is only a few per cent out with a 330 ohm resistor in place of R7 and RV1. If you can stand a certain amount of non-linearity substitute the resistor. If you possess a ramp generator and scope capable of XY display then you will be able to adjust the linearity by eye.

Adjust the gain and offset once the linearity is satisfactory. Do not be afraid to alter resistor values to suit other input values. C1 is not usually necessary but I have included it as it stops any tendency to oscillation. The power supplies are simple 3 terminal regulators. The original circuit runs IC1 ±15V but one may get away with just plus 15V, connecting pin 4 to ground. D1 would no longer be needed then since it only serves to protect the opto-isolator LEDs from polarity reversal.