BUILD AN AFFORDABLE

IC STEREO LIMTER

BY

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Given the breathtaking price of commercial limiters, and the seemingly inefficient method of ganging two limiters for stereo use, making a stereo limiter on a budget more suited to the average college budget makes sense.

Circuit operation: The input is a noninverting amp with a gain of 6.6. Input impedance is 10k; change the value of the pot, or jump it with the appropriate resistor, if a different impedance is needed. If more gain is needed, change the 56k resistor to 100k.

Next is the limiter amp. The feedback resistor of this amp is a Vactec VT-732 photocell; its resistance varies from over 10M in total darkness to 3k or so in room light. As its resistance varies, so does the gain of the limiter amp. This amp feeds an output amp that allows variable output level. It also feeds the sumbias amp; this amp combines the left and right signals and biases the output to −5 volts. Any audio signals greater than 5 volts will forward bias the diode at the output of the sum-bias amp, and charge the 47uF cap. The charge on the cap is doubled by the LED driver amp; the LED then shines on the photocells, raising the feedback, lowering the gain. A 100k pot drains the cap, setting the release time. To prevent excessive gain at low audio levels, the cap is kept charged to around 2 volts minimum by the Max Gain pot.

(Diagram 1)

A word on the photocells and LED: They are mounted on a black-painted part of the PC board and covered with anything that excludes outside light. I used a piece of PVC pipe, a black cardboard top, and black rubber cement to seal the cracks. The photocells must first be positioned so that, with a given current through the LED, both give identical resistance readings. Leave the leads long enough so that they can be juggled around somewhat.

If you want to meter the amount of limiting, put a third photocell in with the LED, and use the circuit shown. It will drive any meter that uses 20 or fewer mA; the 10k pot adjusts circuit sensitivity.

(Diagram 2)

Installation and Adjustment: Connect the limiter to a signal representative of your studio-output, and set the input volumes to zero. Set the bias pot so that the output of the sum-bias amp is −5 volts. Set the release time pot to full resistance, and set the max gain pot so that the 47uF cap charges to 2v. Open the input pots till the output of the input amp is about 1v AC RMS. The output of the limiter amp should be around .5−3v AC RMS. Then set the volume out pot to the desired level. The output will drive any load that requires less than 20mA. You may want to adjust the release time and max gain pots to your particular applications.

Some construction hints: If the power supply is physically distant from the Limiter, parasitic RF oscillations can cause distortion. Prevent the problem by putting a few microfarads from the B+ and B− lines to ground. Also, a pair of back-biased diodes at the same points will prevent damage from accidental power supply hookup reversal. Don't reverse the phase of the lines coming into the limiter. The sum-bias amp will subtract instead of add if you do. Keep the amplification of the limiter amp under 10. Hi frequency response will suffer if the gain goes above that. This can be done by proper setting of the input volume and max gain pots. If you are running mono, one channel can be eliminated and the 66k resistor at the input of the sum-bias amp changed to 33k.

If you are FM and want to keep modulation high, 75 microsecond deemphasis and preemphasis can be accomplished by adding .0015uF caps at the indicated points.

As presently installed, our limiter corrects for inputs of .2 to 2 volts (20 db) with the output varying no more than 20%. Frequency response is virtually flat from 0-20kHz. Distortion is not detectable on a scope linearity test.

Be sure that the input has no DC bias. If DC is present, put a pair of DC blocking capacitors at the inputs.

Conversion to RMS rather than peak limiting should be possible by adding a resistor in series with the diode at the output of the sum-bias amp. It seems that a resistor equal in value to the release time pot, and a change in the 10k feedback resistor in the LED driver amp, to 30k, would accomplish the desired effect. If you have the interest and equipment to try this, I would be interested to hear the results.

This circuit is sensitive to power supply hum. I would recommend the power supply shown, or an equally well regulated one.

(Diagram 3)

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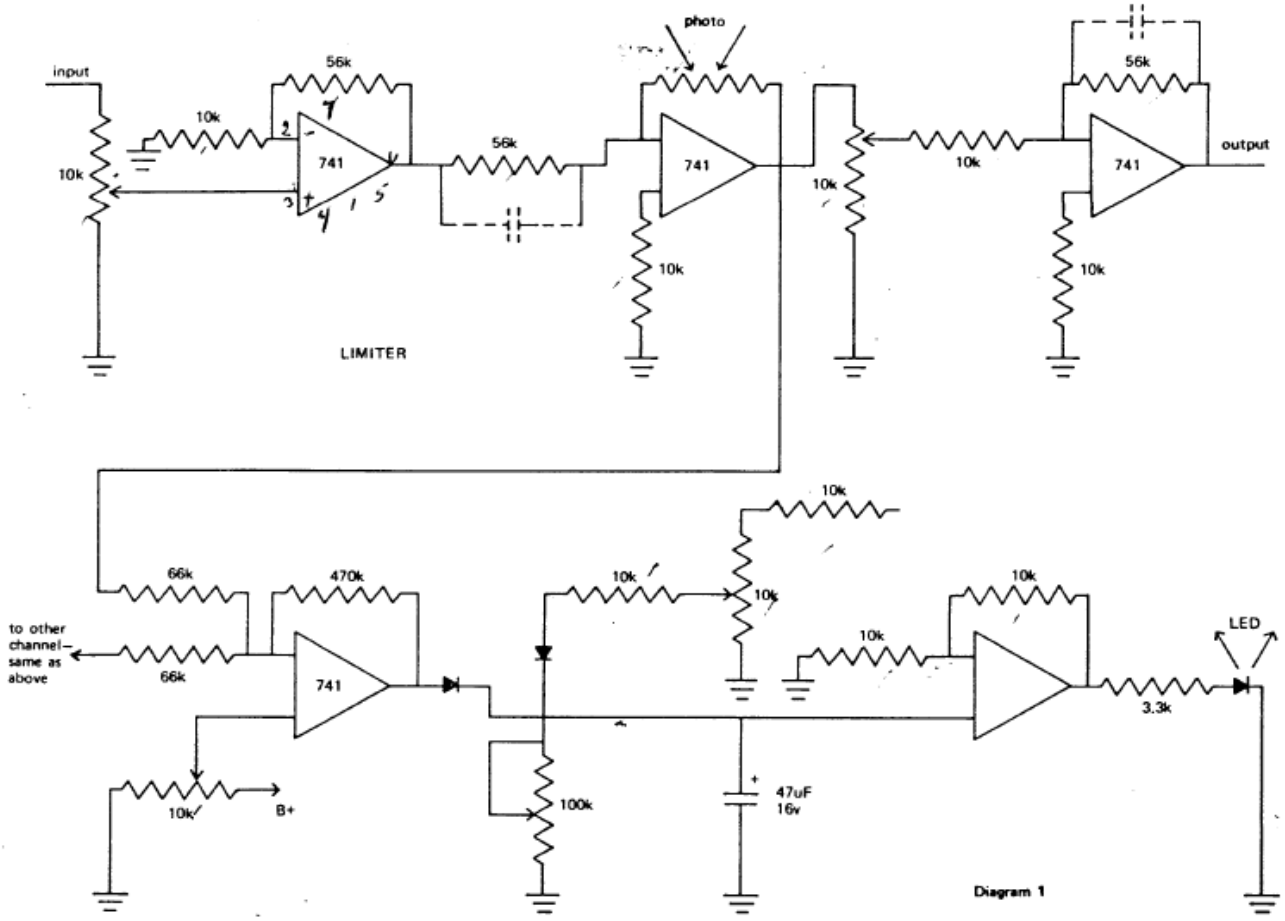
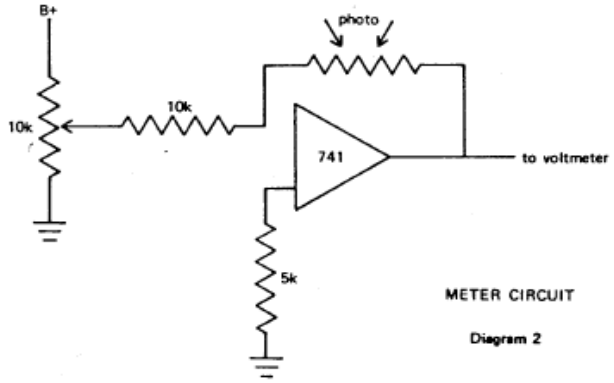


Diagram 1



METER CIRCUIT

Diagram 2

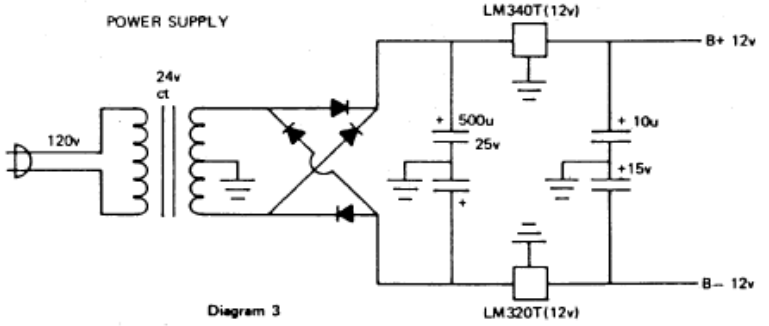


Diagram 3