

# Build the EM Stereo Spreader

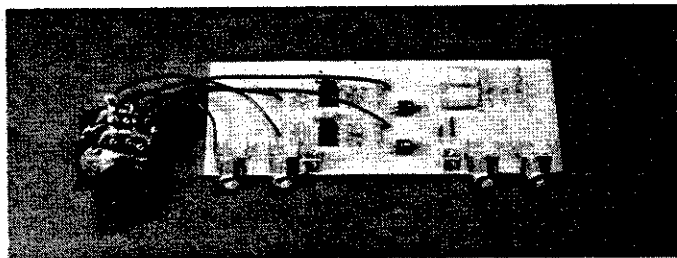
**With this project,  
you can have your  
digital cake and  
“tweak” it in analog.**

**By Jules Ryckebusch**

**T**hese days, most electronic music equipment delivers stereo outputs. This is a wonderful thing, but the nature of the stereo image is determined inside the instrument, and you may want to alter the perspective of the image presented.

The Stereo Spreader is a one-knob device that provides a simple way to manipulate a stereo image by extracting the difference between the left and right signals.

It's simple. Let's say you have a sound heard to the right in a stereo mix, but you want it further to the right. At this point, the signal is



The EM Stereo Spreader circuit.

greater in the right channel than the left. To change this, you need to alter the right-to-left ratio, which you can do in two ways: either raise the right level or lower the left level. We'll use the second method.

## THE THEORY

The Stereo Spreader sums an inverted right signal with the left and an inverted left signal with the right. When identical signals are mixed out of phase, they cancel each other. If they are not the same amplitude, only a partial cancellation occurs.

Let's look at three different cases:

**Case One: A mono signal.** The right and left signals are the same amplitude. When you add in the inverted signals, all that occurs is an overall reduction in the amplitude of both right and left signals.

**Case Two: Right signal twice the amplitude of the left.** Set the mix control halfway up. The left signal is now summed with an inverted signal one half the amplitude of the right. The right started out at twice the level of the left, so the two signals are equal in amplitude, and the left signal is cancelled out. The right signal is summed with one half of the inverted left. This results in a shift in our signal to a hard-panned right.

If you increase the mix control beyond the halfway point, the inverted right signal outweighs the left, and an inverted version of the input signal emerges on the left side.

**Case Three: Input signal panned hard right.** This time, there is no left signal to become inverted and cause a can-

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## ● DIY/STEREO SPREADER

cellation in the final right signal. The left signal may contain an inverted right, depending on the mix setting. The final effect on the stereo mix depends on two factors: a sound's original position in a mix and the control setting.

### HOW IT WORKS

When the stereo signal enters it is sent down two paths. The main path is a unity-gain inverting buffer composed of IC1a and IC1b. The input also is sent to the mix potentiometer. Next, the signal enters a 2-input, inverting mixer stage built around IC2a and IC2b. The other input to this stage comes from the mix potentiometer. Note that these signals are 180 degrees out-of-phase and are crossed left to right. As the mix pot varies, you go from a straight stereo to an R-minus-L and an L-minus-R signal. At full mix, an entirely mono signal will be eliminated.

### BUILDING THE SPREADER

This is a simple, low-gain op-amp circuit. The NE5532 has become my op-amp of choice for audio. It is very quiet, can provide 10 volts RMS into 600 ohms, and, when mail-ordered, inexpensive. The resistors are 1% metal film. The NE5532 is so quiet that noise from carbon composition resistors is significant; all the wiring coming from the circuit board should be shielded.

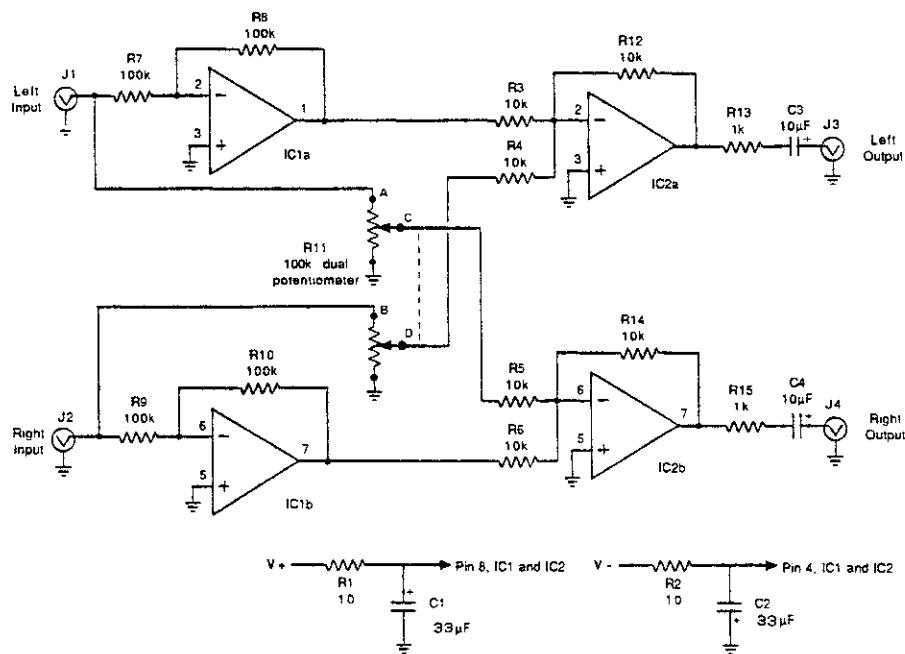


FIG. 1: Schematic for the EM Stereo Spreader.

### USING THE SPREADER

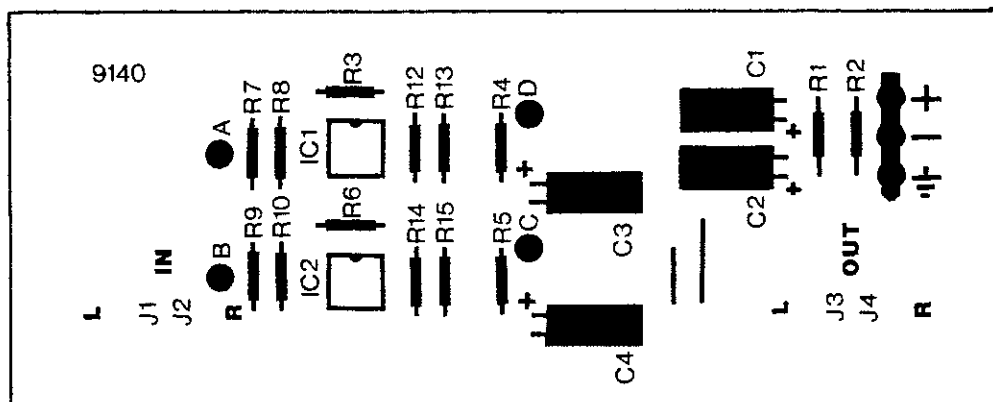
Before powering up, check all your wiring. Pay close attention to proper power-supply polarity. (More than once, I have accidentally wired power in reverse.) Turn the mix control all the way down. Connect a stereo source to the input, the more complex the better. While you are listening, slowly turn up the mix control. You should hear a distinct shift in the stereo spread. At full mix, centered parts—usually the bass material—will fade, causing a distinct shift, almost like a tone control.

Here is something you just have to hear in headphones: If a sound is already panned hard right or left and you send it through the Stereo

Spreader, it seems to move over even further due to the presence of out-of-phase material between the right and left channels. Check this out, all you psychoacoustics fans.

I have found the Stereo Spreader to be very useful for changing the spread of digital reverbs in real time, and especially for expanding an already-recorded stereo submix.

*Jules Ryckebusch is a minor deity of analog electronics who wields a +3 soldering iron of enlightenment and only occasionally burns himself.*



## PARTS PLACEMENT DIAGRAM

# PARTS LIST

## QUANTITY DESIGNATIONS VALUE/TYPE MARKINGS

**RESISTORS** - all resistors 1/4 watt 5% carbon or 1% metal film

2	R1, R2	10 ohm	brown-black-black
2	R13, R15	1K ohm	brown-black-red
6	R3-6, R12, R14	10K	brown-black-orange
4	R7-10	100K	brown-black-yellow

## POTENTIOMETER

1	R11	100K Dual Linear Taper Potentiometer
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## CAPACITORS

2	C1, C2	33 uF 25v. electrolytic
2	C3, C4	10 uF 25v. electrolytic

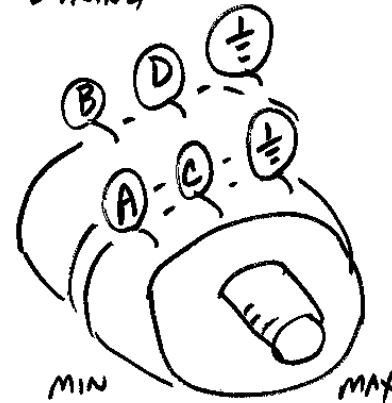
## INTEGRATED CIRCUIT

2	IC1, IC2	5532 Dual Op amp
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## OTHER

4	J1-4	RCA phono jacks
1	Knob	
1	length of 22 gauge stranded insulated wire	
1	#9140	printed circuit board

DUAL-GANGED POT  
WIRING



## POWER REQUIREMENT

+/- 9 to +/- 15v. regulated power supply

## STEREO THEORY AND THE EM STEREO SPREADER

The operation of the Stereo Spreader is based on the principle that a stereo audio signal has both similarities and differences between the left and right signals. If there were no differences, the result would be a mono signal on two outputs. If there were no similarities, you would have completely different sounds from each speaker.

The Stereo Spreader is designed to work with *amplitude panning* of sounds in a stereo mix. Subtracting the left input signal from the right input signal (and vice versa) causes cancellation of the mono signal. This gives us two difference signals, referred to as "L minus R," and "R minus L."

There are types of stereo information other than simple amplitude differences. Signals that are delayed relative to one another (but otherwise the same) do not cancel exactly. Instead, they produce a *comb filter*, similar to flanging except there is no sweep. Time delay has become a popular way to create stereo imaging in a mix. This results in some odd filter effects if you use the Spreader on a finished mix.

You also can create powerful stereo effects when the left and right signals have the same frequency spectrum, using a different time delay for each component of the spectrum. This is called *decorrelation*. Digital reverbs all decorrelate their signals to some extent. If the left and right signals are completely decorrelated, the Stereo Spreader will not produce cancellations. With decorrelated inputs, the more you crank the Spread control, the more the Spreader's outputs resemble one another. With the control set at its full clockwise position, the outputs will be identical, but out of phase.

Although the Spreader is designed as an "in-line" device, you also can process its output signals using time delay, EQ, or dynamics processors, and return these signals into the mix along with the original signal. In this way, you can obtain some unusual and interesting image effects. Finally, you can create a "surround" effect by directing the Spreader outputs to auxiliary side or rear speakers, while listening to the main mix from the front.—Gary Hall

the EM  
Stereo Spreader  
Kit # 9140/k

from:

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