R*S Stereo Mixer V1.2

The Random*Source Equal Power Stereo-Mixer is a voltage controlled stereo mixer / panner / VCA based on 4 high-end THAT2180 blackmer VCAs, designed to emulate the behavior of Serge VCAs. Version 1.2 offers a number of unique features:

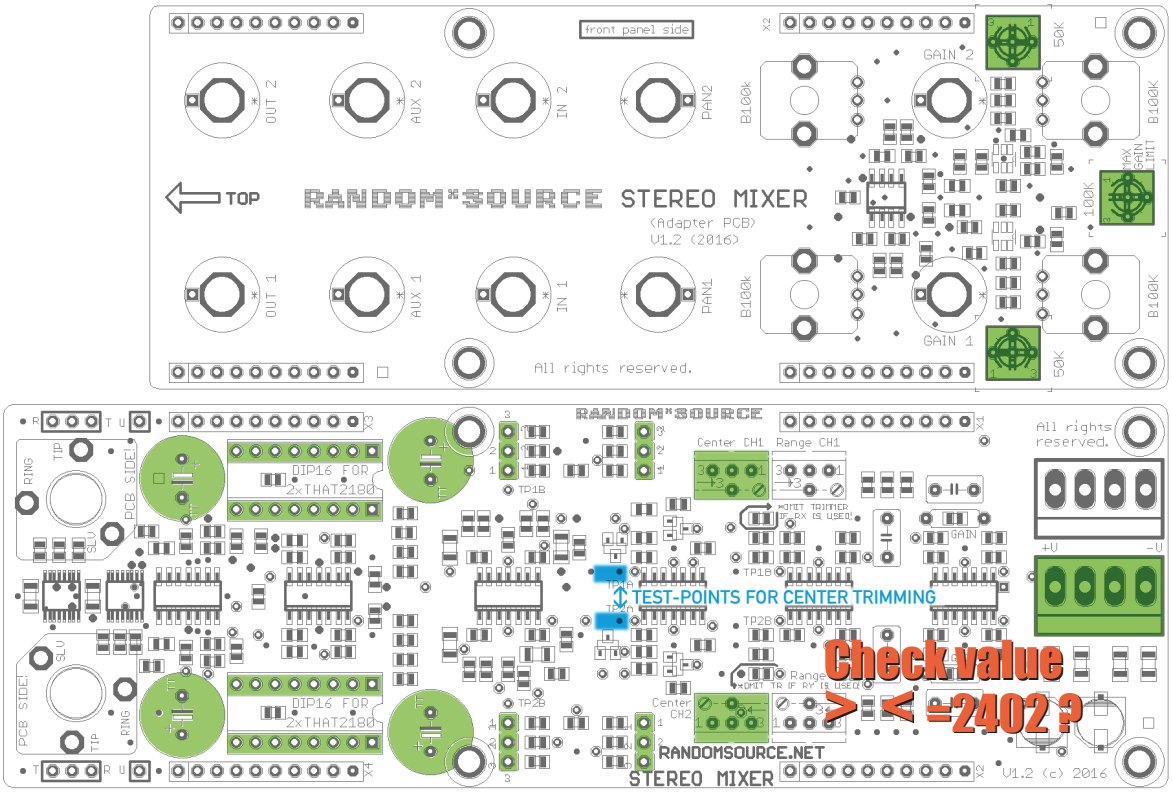
1. ***New Serge VCA emulation - using trimmers on the panel pcb, you can set the VCA behavior (i.e. the treatment of gain CV) to purely exponential (like on previous versions of the Stereo Mixer) or „Serge-esque“ - compressing the peaks and providing more „body“ - or anything in between(!).***

2. ***Balanced Outputs, using „a new generation of monolithic audio differential line drivers offering improved performance over conventional crosscoupled designs“ for low noise and distortion. These outputs can be connected to balanced or unbalanced equipment (amplifiers, A/D converters...)***

3. ***Burr-Brown op-amps in the audio path.***

4. ***Great distortion and soundshaping capabilities - try CV at audio rates and play with Gain.***

The Stereo Mixer is an improved version of comprises 2 pcbs, a main pcb and a component pcb - To build the board, **only install the through-hole parts shown green here** and omit / ignore any others:



Update: If the resistor marked above is 24k (marked **2402**), please read the notes on panning below!

Please read the build instructions below before commencing the build. The module is designed to be used with a +12V / -12V power supply. Any values given here assume such a supply.

Bill of Materials (Equal Power Stereo-Mixer 1.2)

Variable Resistors

2	50k	T1, T2	Precision Trimmer
-	5k	T3, T4	* DO NOT INSTALL *
1	100k	TC on COMPONENT PCB (sets maximum gain for both channels)	Trimpot - side adjust recommended, single-turn should do (Vishay T73XW or T73XF, Bourns 3362M, S or Z), if you prefer multi: Bourns 3296X-1-104LF or 3296Z-1-104LF should work
2	50k	TR-VCA1, TR-VCA2 on COMPONENT PCB (sets the VC-GAIN behavior for each side)	Single-turn trimpots - side adjust recommended, Bourns 3362M, S or Z should fit.

Capacitors

4	470n	C1, C2, C9, C10	Film (optional - see below)
4	47uF BP		Bi-Polar, Nichicon Audio-Grade Mouser: 647-UES1E470MPM

ICs

4	THAT2180B	IC7, IC8, IC9, IC10	Alt: version A (better, more $$$) or C

Misc

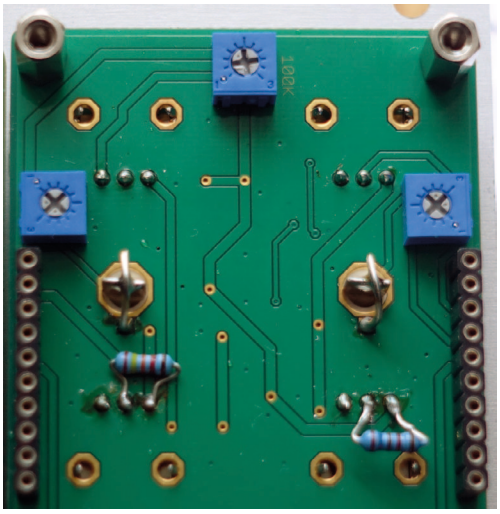
4	SIL header 3pol	JP1, JP2, JP3, JP4	Jumper for equal power db attenuation (optional)
1	MTA-156	PWR2	MTA-156 power connector
1	MTA-156	PWR1	10-pin connector, links main pcb to component pcb
4	SIL header 10pol	X1, X2, X3, X4	for THAT2180
2	DIP-16 sockets		Switchcraft N112BPCX 1/4" jack socket (6.35mm) Mouser: 502-N112BPCX
2	Phone Jacks	J1, J11	Emerson-Johnson Mouser: 530-108-0903-1 (black)
6	Banana Jacks	(bipolar) for AUDIO inputs / outputs	Emerson-Johnson Mouser: 530-108-0910-1 (blue)
4	Banana Jacks	(unipolar) for PAN / GAIN CV inputs	Alpha 9mm vertical pcb mount available from Thonk, Tayda
2	Potentionmeter 50K	PAN: linear (B50K) *updated	Alpha 9mm vertical pcb mount available from Thonk, Tayda
2	Potentionmeter 100K	GAIN: linear (B100K)	

General Build Recommendations

- Use DIP16 sockets can be used for the 4 THAT2180 ICs - precision ones (milled) recommended.
- Use upright / side-adjust trimmers on the panel pcb if possible - that saves you from having to remove the main pcb to adjust the trimmers.
- Make sure you pay attention to the direction of the THAT2180 chips - pin 1 (indicated by a notch on top of the IC) should point down to the power connector. Inserting them the wrong way will kill the chips.
- If you solder the TS jacks into the main pcb until everything else is done and the module is calibrated and tested, you cannot simply remove the main pcb any more - you have to unscrew the jacks from the front panel and remove them along with the main pcb.
- **UPDATE**: **If** pcb V1.02 contains the 2402 resistor in the spot marked above, this in combination with a PAN potentiometer value of B100K will cause the center of the PAN knob to not exactly correspond to the center of the channel, i.e. one side will be louder than the other in center position, i.e. the center will be a bit off. This does not affect the general function and is irrelevant if you use the mixer as a Stereo Mixer (left panned to the very left and right panned to the very right). However, this can easily be fixed:

  (1) using a B50K (or even B10K) will reduce the effect. However, no need to change the pots if you have B100K, the effect is much smaller than a tiny change in value of the resistor in the next step!

  (2) (This does not apply if you have 2403 = 240K installed in the spot above!) On each side, install a resistor as a taper between the 12V leg and the wiper leg of the PAN pot (from the back side, i.e. no need to remove the front panel, only the main pcb). The 12V leg you can recognize from the fat 12V trace leading to the leg (after you remove the main pcb). A value in the range of 24k to 27k should work nicely (both for a B50K pot as well as a B100K pot), the perfect value depends on the specific pot size and your eagerness (and how well you centered the knob on that pot!).



Options

Lowpass filtering of CV: C1 and C2 can be used to form a low pass filter for the Pan CV, C9 and C10 work similarly for the Gain CV. This leads to higher frequency CV being rounded / flatted, avoiding plops caused by abrupt voltage changes. However, this also disables certain (ab)uses of those inputs and makes trimming a bit more difficult.

Pan CV: 9.1k for R9 and 470n for C1 lead to a filter frequency of appr. 37Hz and restrict CV control over panning to fairly slow changes.

For Gain CV, however, you may want to be more generous - 10n for C9/C10 corresponds to a filter frequency of 7.2kHz. **If in doubt, leave those caps out altogether and see if you miss them**.

Setup / Calibration

Gain-CV (Serge VCA emulation): The 2 VCA trimmers on the panel pcb allow you to blend between pure exponantial behavior and a special “Serge-Mode” which is less exponential in a musical way: peaks which could lead to clipping are slightly reduced and the general loudness is increased. This is closer to the way acoustic instruments work and is part of the magic of the Serge VCAs. Recommended to go 100% Serge (usually CW but depending on the trimmer used).

MAX GAIN LIMIT / Gain potentiometer range: Trimpots **T1 on the panel pcb** sets the (upper) limit (amplification / overdrive) of the gain pots. As any control voltage sent to the Gain inputs is added, this can be used to set unity gain / avoid distortion or set the level of desired overdrive. Both channels are trimmed simultanously.

Please note that the MAX GAIN LIMIT determines 2 aspects: (a) the amplification / output level that can be reached with the GAIN knob only (i.e. without CV) - (b) the effect Gain CV has - depending on the setting, the GAIN knob acts like an attenuator. **Recommendation**: start by calibrating MAX GAIN LIMIT to get unity gain (or slightly) more when GAIN is turned up all the way and no CV is going in. Then test, how the GAIN knob acts to CV going in.

Center Attenuation:
The **jumpers** determine how much the combined volume is attenuated when the panner is in center position: **JP1** and **JP3** for Channel 1 (left and right) and **JP2** and **JP4** fot Channel 2 (left and right). Connect Pin 1 and 2 for -6dB equal power attenuation or Pin 2 and 3 for -4.5 db attenuation. Leave the jumpers open for no attenuation at all.

Equal Power Panning:
The panning circuitry is quite sensitive to voltage levels. You may want to check that your power supply is actually calibrated to +/-12.0V before you start.

You also need a scope and a (symmetrical) triangular control voltage (LFO) going from 0V to (exactly) 5V. It's a good idea to check the actual voltage - a (properly calibrated) Serge Dual Slope Generator works fine, the triangle output of a Serge PCO, however, does only go up about +4V and is therefore not suited.

Channel 1 and channel 2 have to be trimmed separately:

Using the pan pot, turn channel 1 (**left** side of the front panel) all the way to the **L**eft (CCW). (Pin 14 of IC1 - channel 1 corresponds to the **right**(!) side of the main pcb when looking at the component side - should be at 0V when no CV is sent into the PAN CV input).

Feed a fairly slow (a few Hertz) triangular wave / LFO that goes from 0V to +5V into the CV panner on the left. Slow is important if you use a capacitor as C1 as R7 and C1 form a low pass filter so that CV at higher frequencies gets rounded down/flattened out. Use a scope to look at the TEST POINT indicated in the picture above (pin 14 of IC3). Use T1 ("CENTER) to get a symmetrical wave:

For channel 2, turn the Pan pot all the way to the **R**ight (CW). Pin 1 of IC1 should be at (exactly) 5V when no CV is sent into the PAN CV input. If the voltage is above 5V, you'll not be able to get perfect symmetry in the next step, so you may have to check your supply voltage (if you haven't already done so) or turn the Pan pot back until you reach 5V.

Feed the same fairly slow triangular wave / LFO going from 0V to +5V into the VC PAN input for that channel and use the scope at TEST POINT (pin 1 of IC3) to trim the signal accordingly as before (using T2).

(Last Change: 12. June 2017, 10:59 PM)