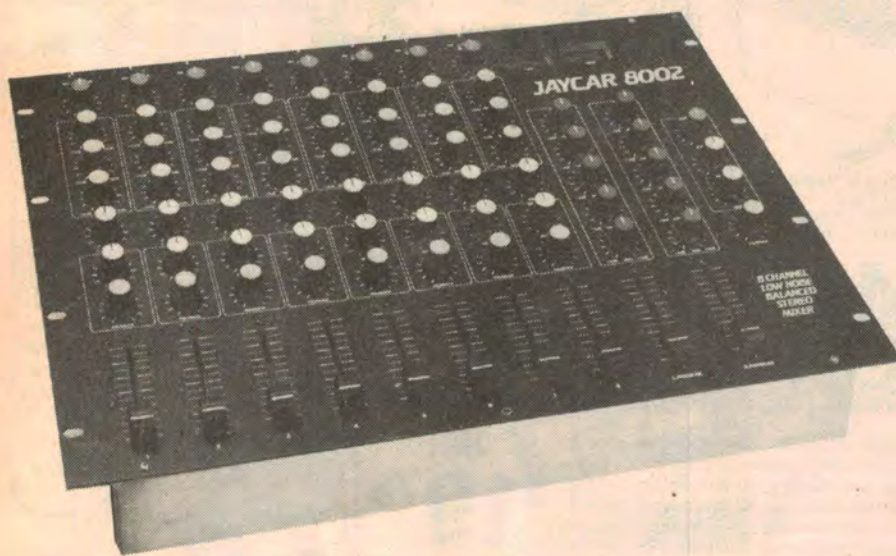


Easy-to-build design has a minimum of wiring

Balanced 8-channel Master Mixer: pt. 2

In this second and final article on the 8-channel Master Mixer we briefly describe the performance of the unit and give the full details of construction. Most of the work involves assembly and checking of the PC boards.

by LEO SIMPSON



Last month we discussed the general concept of the mixer and gave all the details of the circuitry which uses ICs throughout and no discrete transistors. Space did not permit us to talk about the actual level of performance which is achieved by the design so we will remedy that now.

While it is all very well to go on at length about the use of low noise integrated circuits and modern design, it is not until you come to measure the performance that you know that a design is good. This certainly applies to this present design. When we first appraised the design, it was in the form of many hand-drawn circuit sections. There was no complete circuit and certainly no performance specification.

However, detailed examination of the design calculations pointed to a performance which would give nothing away to current commercial mixers and would probably be better than in some respects. So when we actually set out to measure the unit we expected that it would be good while still being on the alert for "nasties" such as supersonic oscillation,

motorboating at certain control settings, hum or RF breakthrough.

We experienced none of these problems thankfully. And basic tests such as flatness of frequency response, gain and signal levels, and boost and cut in the equalisers were all spot on with the values depicted on the block diagram featured last month.

Signal-to-noise ratios and harmonic distortion figures are somewhat harder to quantify since they depend to a large extent on how the Mixer is used. To do this to best advantage you really need some practical experience and perhaps access to a book on the subject of mixing. One such book is "Modern Recording Techniques" by Robert E. Runstein, published by Howard W. Sams. This book is available from Jaycar at \$18.95.

Having said that, one can expect that harmonic distortion figures will be in the range of .03% to 0.1% for all normal settings and signal levels. The distortion components are mainly low order harmonics too, with very little hum or noise.

And with good mixer practice, the signal to noise ratio can be expected to

be -70dB or better with respect to rated output (ie, 1.2V RMS for balanced outputs or 614mV RMS for the unbalanced output condition). This applies to both balanced microphone inputs and unbalanced line inputs.

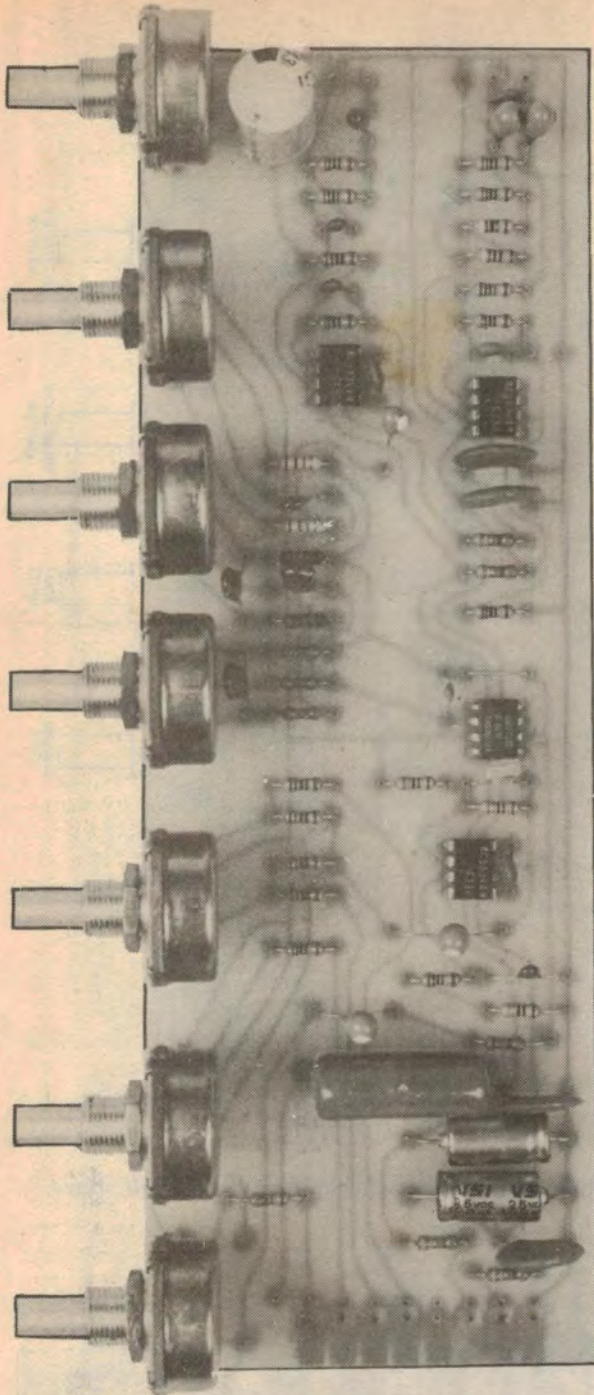
When you think about all the stages involved and the potential losses associated with mixing, these figures really do add up to a fine performance. Add to that a thoughtfully laid out panel and a minimum of wiring required in the construction and it all adds up to a winner. We think that this Mixer is a credit to the designer, Brian Chilcott, of South Woy Woy, NSW.

Construction

While there is a fair amount of assembly work on this Mixer — we would estimate about 15 hours for the average hobbyist — none of the work is really complicated or difficult. Assembly should begin with the smallest of the PC boards, the power supply, and the chassis. The power supply is accommodated on a small PC board measuring 65mm square. This accommodates the rectifier diodes, filter capacitors, two resistors, two three-terminal regulators and four bypass capacitors.

Assembly of the power supply board requires little comment except to note that orientation of all components, except the resistors and two ceramic capacitors, is important. Notice that the pin connections for the positive regulator are different from that of the negative regulator. Even so, the board has been arranged so that both regulators "face" the same way.

With this board complete, put it to one side and assemble all the hardware into the chassis base. This includes all the inputs and output sockets and the mains wiring. With the mains wiring complete, check your work carefully and then apply power. Check the secondary voltages of the transformer. This done, install the power supply board and make the connections to the transformer secondary.



Eight of these preamplifier boards are required. We suggest that you build and test them one at a time. Note that the pots are soldered directly to the PC board which greatly minimises wiring.

Apply power again and check the $\pm 15V$ rails. They should be within about $\pm 0.3V$ of the nominal value. If not within this range, something is wrong. Normally though, these voltages will be very close to the specified values. With the power supply working, the other boards can be checked as they are assembled.

Don't race ahead

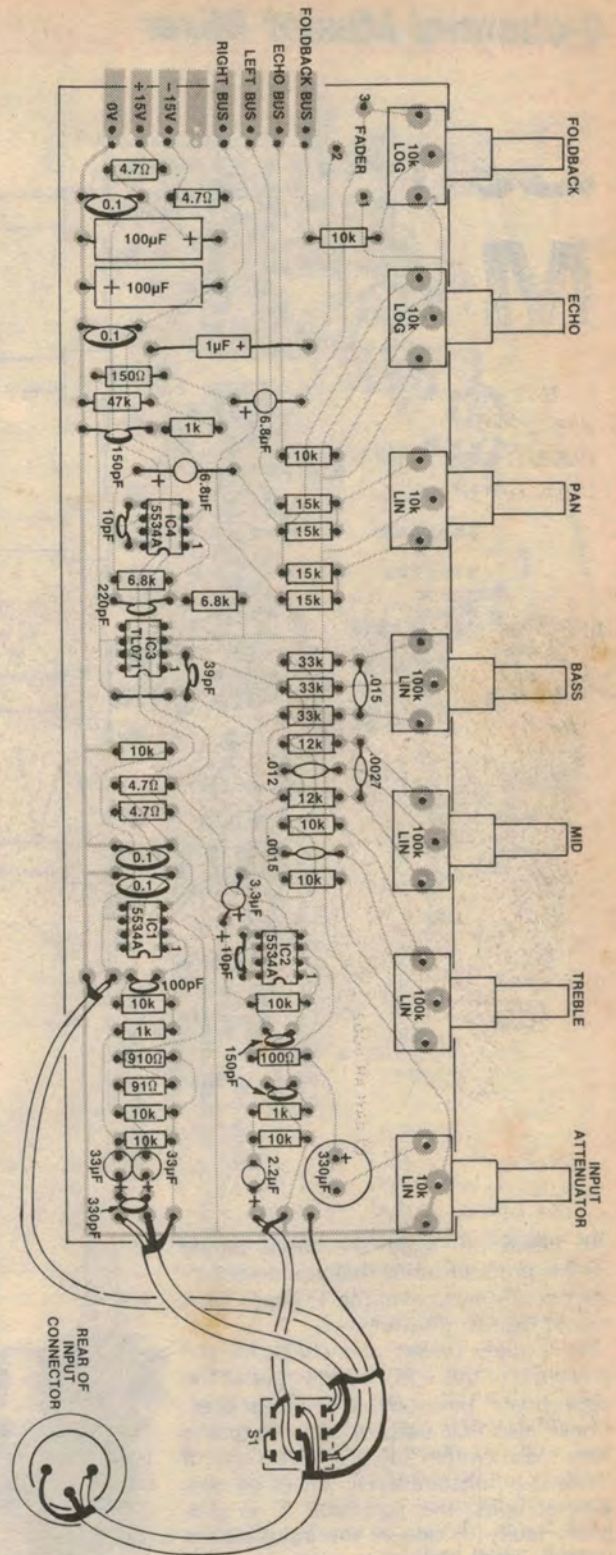
it is important that you do not race

ahead at this point and put all the boards together. We suggest that you assemble one of the eight preamplifier boards as the next step and then check. In this way, if you do make a mistake, you are not likely to repeat it seven times.

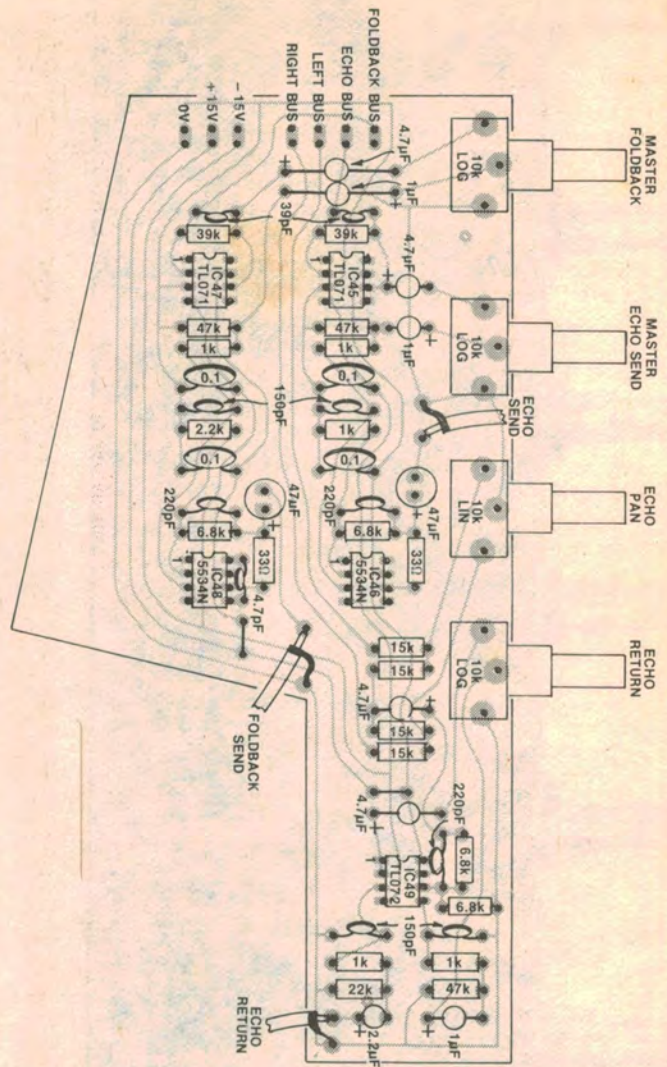
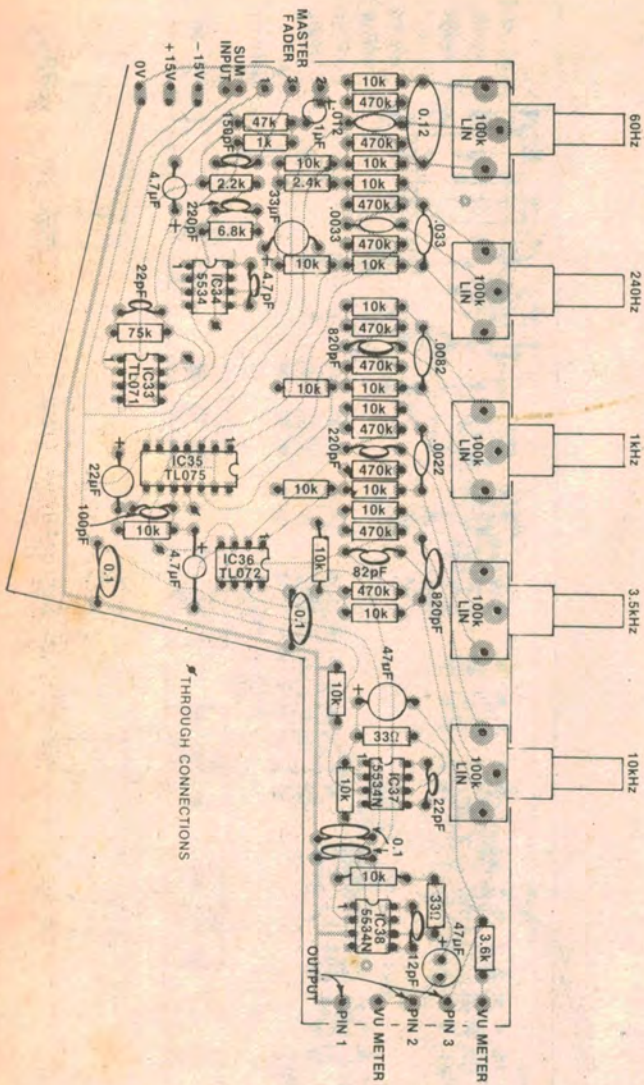
Again, little comment is required about assembly of the preamplifier board apart from the usual caution about polarisation and orientation of capacitors and ICs. Do not connect any lengths of

shielded cable or hook-up wire to any boards until they have all been checked out.

With the first preamplifier board complete, carefully check it over for correct orientation of the components, correct colour codes on all the resistors and for the presence of any dry joints or solder splashes which may short adjacent copper tracks. Then place a suitably large piece of card in the Mixer chassis to sit



8-channel Master Mixer



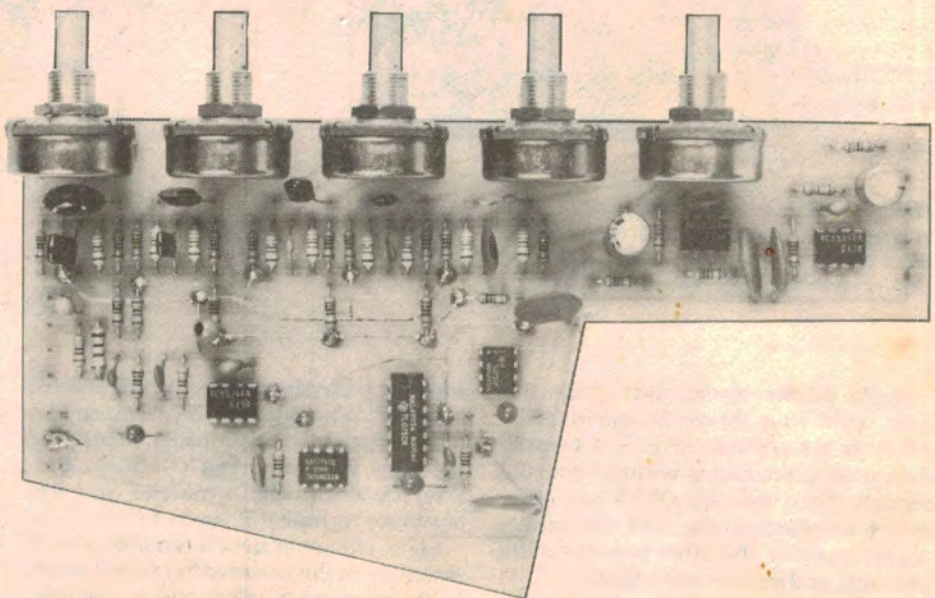
At left is the equaliser board with the effects board above.

the board on. Make the three supply connections, ensuring that you do not inadvertently swap over the 15V rails. That would lead to disaster.

Now apply power and check for the presence of the $\pm 15V$ supply rails at the appropriate pins on each IC package. Check also that each op amp output is very close (within say $\pm 50mV$) to 0V. If there is a substantial DC offset of, say, several volts, the particular IC is probably faulty or one of the input pins is partially open circuit.

Audio tests

Further checks require access to an audio oscillator and an AC millivoltmeter at the very least and, ideally, an oscilloscope. If you do not have access to an oscilloscope or an AC millivoltmeter, further checks will have to wait until assembly has progressed to the point where the main equaliser boards are installed and the VU meters connected. With these operational, only



This is the five-band equaliser board of which there are two. Note that it is double-sided and has pin-through connections.

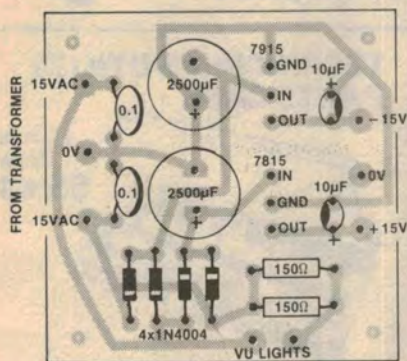
8-channel Master Mixer

an audio oscillator is required for more tests.

If you are fortunate enough to have access to these requisite pieces of test equipment, you can at least check the gain of each stage on the preamplifier board and also the amount of boost and cut provided by the three-band equaliser. The maximum boost and cut at the three centre frequencies (100Hz, 1kHz and 10kHz) should be within ± 1 dB of 12dB and the "flat frequency response" condition should be obtained with the equaliser pots centred.

Don't fit the knobs

With the first preamplifier board built and tested, you can then repeat the process for the other seven preamp boards. Incidentally, don't be silly enough to fit the push-on knobs to the pot shafts at



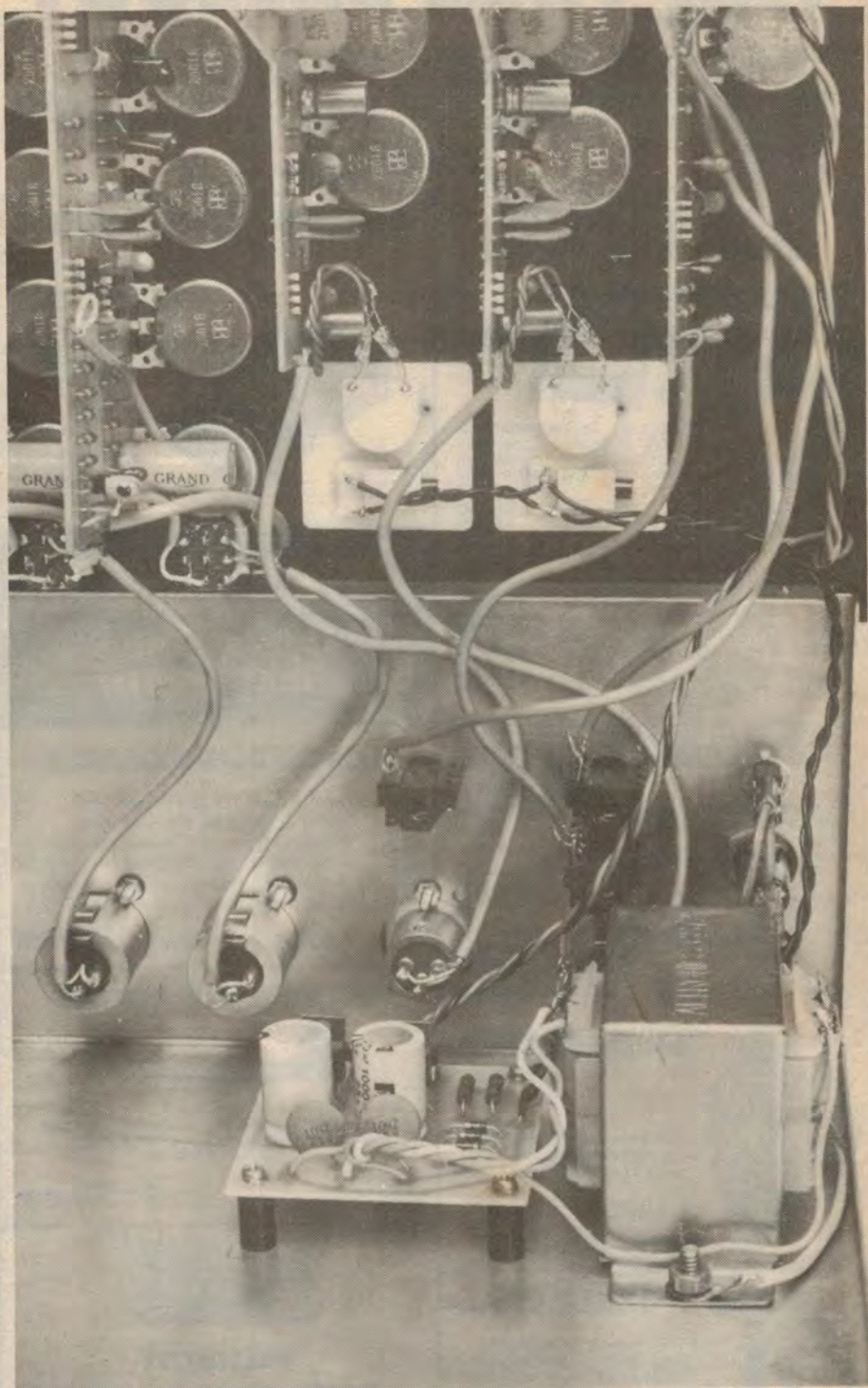
The power supply PC board accommodates two three-terminal regulators. Make sure they are installed correctly.

this stage. Don't put them on until everything has been finished and tested as they are devilishly hard to pull off.

The two five-band equaliser boards and the effects board are irregularly shaped so that they fit over the power supply board and transformer. Again, the effects board has no special features and is straightforward to assemble. The checking and testing procedure can be similar to that described for the preamplifier boards.

Pin-through connections

By contrast, the five band equaliser boards are double-sided (ie, tracks on both sides). The boards do not use plated-through holes. Instead, through-board connectors are made via some of the component leads and some pin-throughs. In all cases, the particular component leads and pin-throughs must be soldered on both sides of the boards. Each of these connections can be checked with a multimeter, between the



This photo shows the details of the input and output wiring and the VU meters. Note the diodes for the VU meters.

respective copper tracks on each side of the board.

From then on, with all boards complete, very little remains to be done apart from physically assembling the boards onto the panel. Interboard connections are all run in hook-up wire (use different colours for the different connections) while input and output connec-

tions are made via shielded cable. Note that the diodes for the VU meters are strung between the respective boards and the meters themselves.

Make sure you follow the diagram for the mic/line switch closely and terminate shielded cables as shown in the diagrams. After all that, you will have a very fine 8-channel Mixer.