

## A STAR IS BORN

Jon Marks experiences CD's silver lining with the Model 3 DAC kit from North Star Design.

On a scale of one to ten, digital kits probably come alarmingly close to the top of the complex-o-meter in most constructors' minds. Static-sensitivity and surface-mount parts the size of a stamp with more legs than a millipede convention loom in nightmares of unbuildability. The reality tends to be somewhat different though, as North Star Design's Model 3 DAC illustrates.

This converter can handle inputs from 33kHz up to 96kHz thanks to Crystal's CS8414 receiver and a pair of Burr-Brown PCM-1716 D-to-A chips. Yes, all three are SMD components with some very closely-spaced leads, but all three come ready-mounted on the single PCB. And that's the hard part finished – all the other components are leaded, and anyone with a little soldering experience behind them should have no fears about attempting this kit.

## MR DIGITAL AT AUDIO ANALOGUE

The name North Star Design may not ring too many bells with UK constructors – it is, after all, an Italian company. On the other hand, Giuseppe Rampino might cause some slight peeling; this is the man who created Audio Analogue's digital line-up, including the respected Paganini CD player. Hoping I might find in the Model 3 the same sort of neutral, open and musical sound manifested by AA's offerings as a whole, I opened the sturdy packaging eagerly and checked through the contents.

The manual itself is a humble photocopied item running to 14 pages of A4. Each of these is divided into a pair of columns, the one on the left explaining everything in what is doubtless perfect Italian, the one on the right doing the same thing in a form of 'Itanglish' which will occasionally have you grinning. Poking fun at home-spun translations is hardly fair, or politically-correct in Greater Europe.

As ever, once you've read the manual cover to cover (and discovered a couple of omissions), the next stage in readying yourself prior to a soldering session is to check that all the bits in the individual parts lists are actually to be found in the components bag.

Another point to bear in mind before populating the PCB is that it's through-hole plated – components have pads on both sides of the board. North Star recommend soldering both sets of pads to ensure the best joint quality. However, this makes removing incorrectly-located parts more difficult than with a single-sided board. It also increases the risk of component damage due to overheating. And if you're planning any upgrades, you might want to plan ahead and not solder all the way through the board, or put in pins to solder to, or be prepared to cut parts off the board before fitting their replacements.

## BOARDING PARTY

Having bolted the four stand-offs to the PCB, I began laying out the resistors. Forming the leads is easily done with a pair of needle-nosed pliers. The full-length leads can then be slipped through their holes, bent back parallel to the underside of the board, and trimmed with a small pair of side-cutters.

The manual suggests cutting the leads to length before fitting, but using cutters is considerably faster and allows the resistor to be held in place for easy soldering (bending back a pre-trimmed lead on a small solder pad is not fun!)

While R1-R46 were taking up residence, I spotted a cut track on the top-side of IC14's spot. Giuseppe confirmed this is a little post-production revision of the layout and not a duff board. Unless you read the instructions first, you might also be puzzled by silk-screening for both R44 and RV1 (neither of which appear on the resistor list). A subsequent note explains they are one and the same (and that this variable resistor is used to trim the crystal oscillator circuit during set-up).

Mounting and soldering the resistors was uncomplicated. The sockets for ICs 12, 13 and 14 came next, along with the three rectifier bridges.

If you know you're not going to be tweaking the Model 3 and you have no fears regarding soldering chips, I'd suggest that you leave out these sockets. Their main purpose is to allow the power supply voltages of the finished DAC to be checked without the chips inserted. These sockets introduce extra contact resistance and lead inductance, and due to their height increase the area of any current loops which might resonate and radiate at RF frequencies (see Guido Tent's article on RF layout techniques from XXXX's Supplement, or ACG at [www.galstar.com](http://www.galstar.com)).

To tweak or not to tweak will also dictate how you approach the rectifier bridges. No substitutions planned? Mount these parts flush with the PCB. On the other hand, if you feel the call to modify, give them 4mm-5mm clearance so they can be snipped off later.

Up next were more diodes in discrete form. These were slated for swapping as well, but I mounted them flush with the board as they'd be no trouble to snip off later. Next it was time for a slew of 100nF Wima polyester caps doing duty as bypass caps on the numerous electrolytics, then some tiny ceramics, and finally a sprinkling of tantalums.

#### MANUAL LABOUR. . .

While the bulk of the caps went onto the board without a fight, the markings for a couple of the tants hadn't been printed on the board, and it took some brief track-tracing to confirm the correct polarity. The 220uF electrolytics were also spec'd in the manual as 50volters. In fact, they turned out to be rated at 25volts, and had a smaller lead pitch than their solder pads. None of the above proved a problem, but it did detract from the otherwise slick, professional feel of the kit.

Once the 10 regulator ICs had been placed along with remaining sundries like the FETs in the discrete output stages, it was time to mate board to chassis. Or at least that was the theory. There were a pair of very unfilled markings on the PCB with C101 and C102 inscribed therein. In the parts list, these were described as 2n2 1kV polypropylenes. Mine were 1n5s. To

top it off, nowhere in the assembly instructions did these caps even get a look in. Another e-mail left swiftly for Italy, and the reply confirmed these blue box caps should be soldered in with everything else.

Aftersorting that conundrum, I scraped away the paint around each of the four board-mounting holes on the chassis, and slipped the eye of the earth lead's tab under the left rear stand-off. The manual also urges you to insert the XLR (without soldering it in place) before PCB and chassis come together. I found this made life unnecessarily tough as the board slipped into place. It's considerably simpler to fit the XLR with the PCB already in situ, held loosely with its four screws untightened.

The XLR socket comes with two countersunk holes to allow it to be fixed to the chassis, but in this instance, it is secured with its lower lip trapped between the rear of the chassis and the PCB. This sort of no-bolt fixing doesn't generally bode well for long-term reliability, as the solder connections take a pounding every time an interconnect is plugged or unplugged. I would prefer to have seen the XLR properly fastened to the chassis.

The next minor but annoying hiccup involved the fascia's LEDs. They were all there, but the bi-colour one which indicates signal lock was supposed to have a kinked lead, which would tell me the correct pads to solder to. However, the three wires sticking out of mine were all straight as arrows. Seeing as the worst that could go wrong would be green instead of red showing no-lock, I just flipped a coin and soldered.

### . . . AND MORE MANUAL LABOUR

So far, it was definitely a case of Kit: 1, Manual 0. I girded my loins for a final assault where my trusty iron would finish off the connections to the mains transformers. This boiled down to series wiring the two dinky donuts to the rocker switch on the back panel, and then linking this (and the earth lead) to the RF filter built into the IEC socket. Piece of cake (even if the diagram shows the blades of the switch at a confusing angle).

At this point, I heaved a sigh of relief and vowed to burn the manual once the Model 3 was working properly. However, during one last run over the board before firing it up and checking some voltages, I noticed the empty spaces where the four Tranzorbs (transient absorbers) were supposed to be. Hmmm, I was gearing up to offer the author of these instructions a hearty breakfast, a last cigarette and a blindfold.

I soldered the Tranzorbs in and managed to stop myself mercilessly shredding the manual as soon as I'd finished. Instead, I carried out the requisite PSU checks, confirmed all was OK (apart from two transformers which seemed to be duetting in Hertz's most famous work, the 50th), and plugged the remaining ICs into their sockets. Another flick of the mains switch, and BANG, it all went up in smoke. Well, that was what I was half expecting, but surprisingly, no fireworks, just music.

The sole fine tuning is to persuade the Lock LED to glow green, and the appropriate frequency indicator to light up, by adjusting the potentiometer in the crystal circuit. This is as simple as it sounds, and I soon had the output of a modified Pioneer DV-505 flowing through the Model 3.

Now it was time to screw the lid in place, enjoy a well-deserved cup of tea, and admire the end-product of all that soldering.

## SQUARE ONE

Without any burn-in time under its binary belt, the Model 3 sounded as you might expect –clearer, more detailed and more realistic than the DV-505's on-board converter, but not by much, and rather timid and constrained with it. Giuseppe had talked in terms of a 40-60 hour run-in period, so the Pioneer and partner were left to repeat for a day or two.

Over that time, the presentation acquired more body, more liquidity, and left behind less appealing traits like a mild sibilance and a plodding way with rhythms. As the sound filled out, the North Star's pedigree became increasingly evident on CDs such as the compilation, Bob Marley And The Wailers – The Early Years. One of the most noticeable improvements was

the clarity with which some of Mr Marley's more mumbled lyrics came through the bucket-bottom recording quality of many of the tracks. Then there was the swelling power to his voice which lent it real substance, and the lucidity of the soundstaging which meant backing vocals and instruments were far more easily picked out than on the '505.

## THE GOLDEN MEAN

As the days went past, the North Star proved it was perfectly capable of striking that fine balance which exists between out-and-out transparency, detail retrieval and crisp dynamics on the one hand, and natural tonal colour, musicality and realism. A lot of hi-fi struggles to find a workable solution to this problem, and tends to fall into one of two camps – 'fast' (used pejoratively to describe light bass and plenty of treble), hard and overtly detailed, or soft, rolled off in the treble and not very revealing.

One disc which will swiftly show if any given piece of equipment is a 'camper' is Alannis Morissette's Jagged Little Pill. Played through brighter equipment, this album can take the top of your head off, all of its plentiful rough edges exaggerated. Too much of the softly-softly approach fails just as miserably, the songs lacking the required impact and venom as their vital raw energy has been sapped. Get it just right though, and you'll have a smile on your face from track one through to the acapella tacked on after track 13. Here, Ms Morissette's vocals were incisive and suffered from no shortage of bite, but since the Model 3 wasn't adding any extra sibilance of its own, they never overstepped the line. The same went for 'You Oughta Know', where cymbals and vocals were powerful but controlled above the taut, propulsive bassline.

Koto Music Of Japan is probably not going to be one of the discs monopolising transport drawers across the land, but it has a sense of atmosphere that only the better-engineered digital gear can capture. Play this disc through mediocre machinery, and the lack of musical expression and involvement will leave the other-worldly vocals and extremely sparse arrangements sounding like random clips from the cutting room of Name That

Tune. There was no such shortfall in the North Star's rendition, the plucked koto strings, shakuhachi flute and bizarre singing dovetailing neatly into a spell-binding performance.

Such a stalwart it's graduated at the school of Lift Music, Vivaldi's Four Seasons nonetheless enjoyed a freshness and vivacity which made for a truly engrossing listening session. The Model 3 accurately and securely placed the various sections of The English Concert within a soundstage where fine width and depth were joined by a decent sense of height, not a forte for most converters. The tonal balance was equally satisfying, with none of the smearing which blends instruments together into an amorphous lump of noise.

### UP THE REVOLUTION

With a 24/96 disc (Red Rodney's 1957 jazz album on Classic Records) whirring inside the DV-505 at high speed, the Model 3 reacted in a very predictable manner. Basically, there were all the fundamental qualities it had show with 44kHz recordings, but now much more obvious thanks to the higher resolution format. Transparency, detail, dynamic range and impact all benefitted massively, which only served to heighten the musical enjoyment the North Star conveyed in the conversion process.

### ELECTRONIC ESCALATOR

Of course, gifted DAC that the Model 3 is, no self-respecting DIYer is likely to be able to resist the urge to tweak for long. As a starter in the right idrection, North Star publish a number of suggestions for component upgrades (caps, resistors and a third PSU transformer). They also comment on the effect different mains cables can have on the sound (which is why none is supplied with the kit).

In addition to the substitutions published on the web site, there's a couple of others well worth sampling. The 11DQ10 is a very major upgrade over any normal discrete rectifier diode, and a rating of 1.1A at 100V means it can be used in a wide range of equipment. Then there are the regulators. The next step up from the standard types would be Linear Technology's versions with

their higher spec. If you wanted to go all the way, there are bespoke devices from Audiocom, Acoustic Precision, etc. These two also provide a range of clocks, as do Dutch firm LC Audio and Trichord Research (the Model 3 runs at 6.144MHz). Finally, there's Noise Blocker visco-elastic spray from Rockford-Fosgate, available through car audio shops for about £23 for a 600ml can. Simply spray on one or two fine coats and listen as it cures over a fortnight. The improvements are not subtle!

### QUE BELLA

Viewed as a kit, the Model 3 gets marked down for poor instructions, which really should be considerably better. Viewed as a completed DAC, the Model 3 is very good value for money. Instead of the uninspiring and frequently uninvolved sounds emitted by too much digital equipment, the Model 3 does a real 'heart and soul' job of music-making. It scores convincingly in all the 'technical' areas – imaging, sound staging, detail, etc - and then tops off this attractive package with a genuine ability to coax the full emotional content from a recording.

North Star Design Model 3            300 Euros + VAT

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