

# Monarchy Audio M24 DAC

## Monarchy Audio M24 Digital-to-Analog Converter

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List price: \$1590



**PHOTO 1:** Monarchy M24 DAC in one of my equipment racks. Sitting on top is the Parts Connexion D2D-1 Sample Rate Converter and the Jensen IsoMax CI-2RR. The M24 features a robust steel chassis, and a thick, brushed, and anodized aluminum front panel with rounded corners, making a nice visual match for the D2D-1. Monarchy's DIP Upsampler and GW Labs' DSP Upsampler should also work well with the M24.

Monarchy Audio has been making high-end outboard D/A converters at affordable prices for over 15 years. The M24 is its latest DAC offering. Charles Hansen offered a thorough battery of measurements for this product in *aX* 6/07. This listening evaluation and topology description is intended as a companion to that review.

Monarchy is a California-based company, and the M24 was designed in the US, but it's actually manufactured in China. The M24 doesn't look like any Chinese-made product that I've seen (**Photos 1** and **2**). Its robust construction, heavy steel chassis, panel-mounted, Teflon-insulated RCA connectors, and thick, brushed, and anodized aluminum front panel look and feel very much like Monarchy's older US-made products. In fact, the M24 is similar in construction and appearance to the older Parts Connexion products (info@partsconnexion.

com); my D2D-1 Sample Rate Converter looks like a matching unit when sitting atop the M24. Like many US-based companies, Monarchy undoubtedly was forced to move manufacturing to the Far East to reduce costs, but I commend the company for not compromising the first-rate build quality of its products.

The M24 has two digital inputs—coax S/PDIF via an RCA connector and TOSLINK optical. The M24 may be unique, because it includes two sets (L and R) of analog outputs from the D/A converter—one pair from the tube output stage and another from a solid-state current-to-voltage (I/V) converter. The M24 also has a built-in vacuum tube line amplifier, with an internal volume control, so the unit can feed a power amplifier directly. You can switch the line amplifier between the line input on the rear panel and the internal tube DAC output via a push-button switch on the front panel.

If you wish to connect the solid-state I/V converter to the line amplifier, you'll need to install jumper cables on the rear panel between the solid-state DAC output and the line input. If you choose this option, the M24 will function as a single-source preamplifier, because the line input is no longer free for another source (a phono preamp, for example). Figure 29 in Chuck Hansen's measurement article clarifies this.

## DESIGN UPGRADE

The M24 has recently undergone a significant design upgrade (Chuck Hansen's measurements were performed on the latest version, the same sample I used for these listening tests). The unit still bears the designation "Model 24," but the original version had a silver front panel; the new version is black. The original M24, introduced in 2005, contained a Cirrus Logic CS8414 input receiver and Burr-Brown/TI DF1704 digital fil-

ter, both 96/24 chips, but the DAC ICs were Burr-Brown PCM63 converters, the same chips Monarchy used in its M22 and M33 DACs (I reviewed these in *Audio Electronics* 2/1999).

The PCM63, a 20-bit DAC operating at sampling rates up to 50kHz, has been obsolete since the late 1990s, and is no longer manufactured. The original M24 was "96/24-compatible," because it would accept a 96/24 datastream, but could not decode at this resolution. When fed a 96k or 88.2k/24-bit datastream, the PCM63 would simply truncate the last four bits and ignore every other sample.

For the new Model 24, Monarchy has replaced the PCM63 with the PCM1704P-K, Burr-Brown's well-known and highly regarded 96/24 DAC chip. The "K" grade is a select version, with a guaranteed dynamic range of 112dB and THD+noise of 0.0008%. The input receiver and digital filter remain the same as the original, so the unit is now a true 96/24 DAC.

Things have moved quickly in the world of digital audio, too quickly sometimes. Though they are still outstanding performers, the Cirrus Logic and Burr-Brown chips are also no longer recommended for new designs by their manufacturers. Burr-Brown has replaced the PCM1704 and DF1704 combination with the PCM1796, a 192k/24-bit PCM chip that is a combination 8x oversampling digital filter and DAC in a single package. The PCM1796 also accepts the Direct Stream Digital (DSD) datastream, and has become popular in multi-format DVD players. Although Burr-Brown made a 192/24 outboard digital filter—the DF1706—this chip is not recommended for new designs either. Cirrus Logic has replaced the CS8414 input receiver with the 192k/24-bit CS8416.

My reference outboard D/A converter has been the Parts Connexion DAC-3, with the Signature parts upgrade (reviewed in *Audio Electronics* 6/2000 and *Glass Audio* 6/2000), which I use with the company's D2D-1 Sample Rate Converter (not reviewed, but my de-emphasis mod article for this product appeared in *aX* Jan. 2003). Although these 96/24 products have been superseded by

the 192/24 generation of digital hardware, they remain excellent performers. The DAC-3 uses the same digital chips as the M24, but with some important distinctions.

The DAC-3 employs a pair of

PCM1704 DAC chips *per channel*, operating in a true differential mode. The DF1704 digital filter feeds the PCM1704s through a 74AC86 EX-OR gate, which provides true differential datastreams for the two DAC chips.



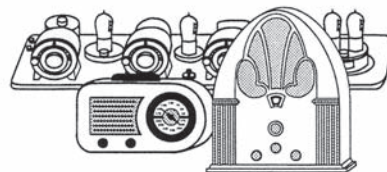
PHOTO 2: M24 rear panel. From left to right, the pair of Line Outputs from the tube line amplifier, Line Inputs to the tube line amp, and the DAC outputs, tube on the bottom and solid-state I/V outputs on the top. Coaxial and optical digital outputs are right of center.

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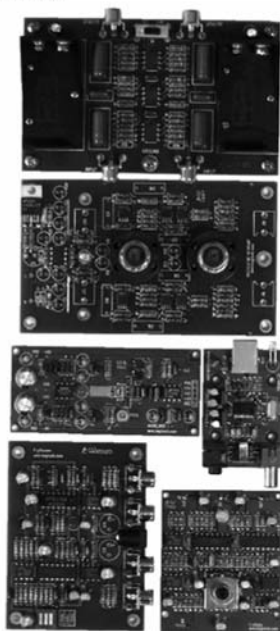
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Separate I/V converters (Burr-Brown OPA627AP) and output amplifiers (Burr-Brown OPA627AP buffered by their BUF634) are used for the positive and negative legs of the analog signal path. A true differential re-combine in each output amplifier yields the benefits of the differential D/A conversion whether the balanced (XLR) or unbalanced (RCA) analog outputs are used.

The stock DAC-3 was supplied with Pacific Microsonics' PMD100 HDCD DAC chip, which was a 48kHz device. I opted for the PCM1704 DAC option because I wanted true 96k/24-bit conversion capability with hi-resolution DVDs (a later version, the DAC-3.1, used the PDM200, a 96/24 HDCD chip, making the PDM1704 upgrade unnecessary).

Monarchy's M24 has a much simpler circuit topology than the Parts Connexion DAC-3. The M24 uses one PCM1704 DAC per channel in a conventional single-ended arrangement. The left and right data outputs of the DF1704 digital filters feed the data inputs of the PCM1704 chips directly. In each channel, the current output of the PCM1704 is fed to both the tube and solid-state analog stages in parallel. The DAC's current output is terminated with a 1k resistor, providing "passive" I/V conversion.

The signal path to the tube stage is routed through a 4-pole L-C low-pass filter to a series gain stage consisting of two halves of a 6DJ8 dual triode. The first half provides the gain, with the output taken from the plate. The signal from the plate feeds the second half, operating as a cathode follower, which provides low output impedance. 6N1P dual triodes, mostly from Russia, have become popular upgrades for the 6DJ8 in high-end tube equipment. My M24 sample was supplied with a pair of Sovtek 6N1Ps in the tube DAC circuit.

The PDM1704 current output is also fed to an inverting AD811 op-amp stage. This active, integrating I/V converter also provides some low-pass filtering, as shown in Chuck's frequency response measurements (Fig. 1). I ran a simulation on Monarchy's active I/V stage and found that the -3dB point is just over 40kHz, considerably lower than is usually the case with an active

I/V converter. This allows the I/V to be connected directly to a preamp with minimal additional filtering.

## TRANSFORMER COUPLING

After receiving the M24 from Chuck Hansen, I checked the unit out on the bench to verify proper operation. On the solid-state I/V outputs I observed some digital by-products riding on the distortion waveform, using my Sound Technology 1700B analyzer wide-band. Monarchy recommends using a coupling transformer such as the Jensen CI-2RR to provide both ground isolation from your preamp and additional low-pass filtering. Using the CI-2RR, I noticed that the digital by-products disappeared from the distortion waveform.

Monarchy also suggests the Lundahl LL1592 line input transformer as an alternate to the Jensen CI-2RR. Chuck Hansen and I have reviewed the Lundahl transformer and will report on its performance with the M24 in an upcoming issue.

Monarchy has always been extremely generous with power supply regulation in its DAC products, and the M24 is no exception. The M24 has two hefty toroidal power transformers with multiple secondary windings, one for analog circuitry and the other for the digital hardware. Six separate regulators using LM317 and LM337 three-terminal devices are included for the solid-state circuitry, and an additional pair of LM317s is used to regulate the filament supplies for the tubes. The B+ supplies are also regulated.

Each of the four 6DJ8s is powered by an International Rectifier IRF830 HEXFET N-channel power MOSFET. The IRF830s are configured—using zener diodes—as high-current voltage references.

The schematic supplied by Monarchy did not include the tube line stage, so I could not determine the exact topology. Monarchy uses a high-quality blue Alps potentiometer as the volume control in the line stage. My M24 sample had unbranded 6DJ8s in the line amplifier.

## NO DE-EMPHASIS

The M24 has an LCD display that shows which digital input has been selected, along with the input sampling

frequency. One peculiarity in the M24 design, also noted by Chuck Hansen, is the lack of de-emphasis.

Pre-emphasis is an optional high-frequency boost, shelving to around +10dB at 15kHz, which is built into the Sony/Philips "Red Book" specification. Pre-emphasis was a way to minimize high-

frequency, low-level linearity problems of early A/D and D/A converters. A number of early CDs, mostly Japanese discs manufactured by Denon, contained pre-emphasis. All early versions of CD players contained de-emphasis circuitry, which was automatically switched in if the player detected the pre-emphasis



PHOTO 3: Inside the M24. Two power transformers are used, one for analog and the other for digital circuitry. Construction is robust and parts quality is high, with Teflon-insulated internal audio wiring.

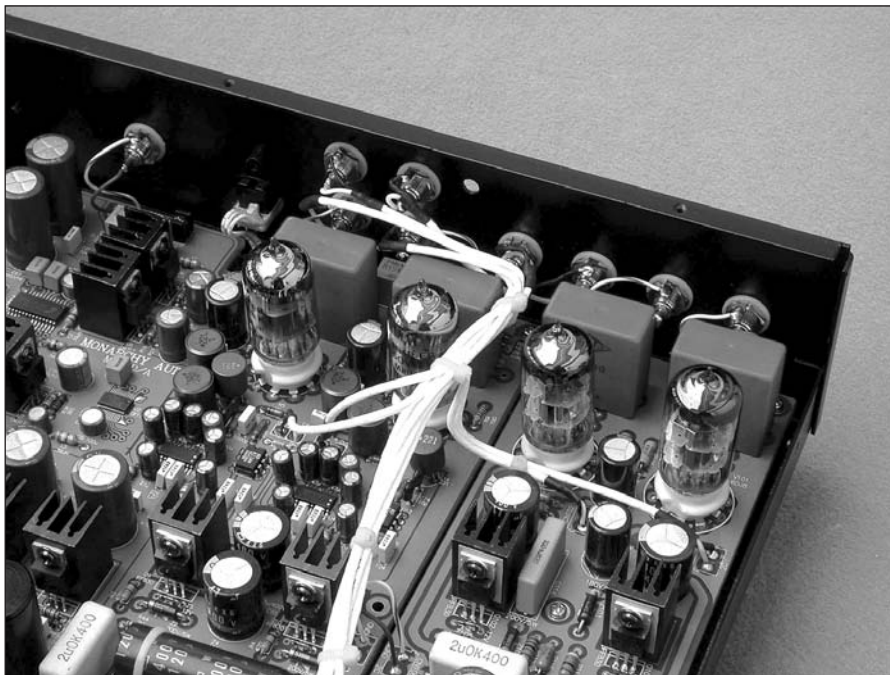


PHOTO 4: Closeup of the tube circuits. The line amplifier is on a separate board, on the right, and the tube DAC output stage is on the main PC board. No fewer than a dozen separate power supply regulators are used, for the various tube and solid-state supply rails.



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flag on the CD.

By around 1990, low-level linearity of A/D and D/A converters had improved to the point where pre-emphasis was no longer useful, so the few CD manufacturers who had used it stopped, and for the past 10 years or more, many makers of CD players and outboard D/A converters have failed to implement it. This might be a problem for those of you who own early CDs with pre-emphasis. I have quite a few, including Eliahu Inbal's excellent Mahler cycle with the Frankfurt Radio Symphony Orchestra on Denon.

Early CD players implemented de-emphasis as an analog filter, usually switched in with a relay (this was the method used by Philips/Magnavox in its CDB-460, 560 and 650 players, and DAC960 D/A converter). By around 1990, chip manufacturers began implementing de-emphasis in the digital domain on the digital filter. Pin 3 of the CS8414 input receiver, labeled Cc/F0 on the datasheet, is one of seven multifunction pins. The functions of these pins is determined by programming SEL pin 16 on the CS8414, and will either be error and frequency reporting (F0) or channel status (Cc).

To implement de-emphasis, part of the channel status function, +5V is applied to SEL. If the input receiver detects a pre-emphasis flag on the CD, pin 3 goes high, to +5V. Pin 16 on the DF1704 is the DEM pin. If this pin is held low, at 0V, de-emphasis will not be performed (Monarchy grounded this pin). Apply +5V to this pin, and the digital de-emphasis circuit kicks in.

Normally, all that's needed to implement de-emphasis is to connect pin 3 of the CS8414 to pin 16 of the DF1704. However, Monarchy is using pin 3 of the CS8414 to provide sampling frequency information to the front panel display module. This function is programmed by grounding SEL pin 16. So, there's no way to modify the M24 to implement de-emphasis.

For most users, this won't matter. Parts Connexion implemented the de-emphasis function, and even included a light on the front panel of the DAC-3 to indicate the presence of a CD with pre-emphasis. That manufacturer's oversight was the fact that the D2D-1 sample rate

converter would not pass the pre-emphasis flag (a simple modification fixed that problem, described in the article cited previously).

Sound Forge 9.0, the digital editor I use at home and at work, is supplied with an iZotope Mastering EQ plug-in that has CD pre-emphasis and de-emphasis presets. Out of 5000+ CDs, I probably own 30 or 40 with pre-emphasis. I plan to re-master them with Sound Forge, using the iZotope de-emphasis function, which will eliminate this issue once and for all.

## POLARITY ISSUES

Chuck Hansen noted that both DAC outputs are polarity inverted. The line amplifier also inverts polarity, so the net result of connecting either DAC output to the line amplifier will be correct absolute polarity. If you use the solid-state DAC outputs with a transformer, you could simply reverse the polarity of the primary transformer windings. This may invert everything else that is routed through your preamp, however. If you use the solid-state DAC output with a transformer, you could simply reverse the polarity of the secondary transformer windings. This would be my long-term preference.

The Jensen CI-2RR is supplied with inexpensive PC-mount RCA connectors. You could replace these with Teflon-insulated, panel-mount types (insulated from the chassis), which would make reversing the primary connections very easy. Note that in the Jensen CI-2RR there are no chassis ground connections on the primary or secondary transformer windings. Grounding is accomplished in the connected equipment. So, reversing the primary transformer leads will have no effect on performance, including hum and noise. However, in the CI-2RR one side of the secondary winding is also connected to the transformer's Faraday shield, so polarity reversal *must* be done on the primary side.

## LISTENING EVALUATION

I used the M24 with my Onkyo DV-SP800 multi-format player as a transport, along with the Parts Connexion D2D-1 upsampler. Upsampling of 44.1 and 48kHz sources to 96kHz, and interpolating word length to 24-bit on lower

bit-rate sources, will normally improve the performance of 96k/24-bit digital circuitry by allowing the digital filter and DAC chips to perform to their fullest potential, and the M24 is no exception. Monarchy's DIP upsampler (*aX* Jan. 2003) or GW Labs' DSP Upsampler (*aX* May 2002; [www.gw-labs.com](http://www.gw-labs.com)) should also work well with the M24.

With the tube DAC output fed to my extensively modified Adcom GFP-565 preamp, the M24 performed superbly. The most immediately striking characteristic of the M24 is its ability to retrieve the sense of acoustic space around the instruments. There is a liquidity to the reproduction that is downright captivating. Inner detail is excellent, but this detail is combined with an air and bloom around the orchestra and blending of the instruments in their original acoustic space.

Tonal balance is very neutral throughout the critical midrange. The bass region has impressive weight and extension without being overblown or uncontrolled, as it can be with some tube equipment. It is important that correct absolute polarity be maintained, as noted.

If you don't take steps to ensure that your system is polarity-correct with the M24, the bass region will lack proper weight and impact, particularly on naturally-recorded classical material such as the bass drums on those vintage Telarc Soundstream recordings. With correct polarity, the low end on David Hancock's superbly engineered recording of Rachmaninoff's *Symphonic Dances* has excellent weight and definition. The treble region is a bit laid back via the tube DAC outputs, but the reproduction is smooth and sweet.

Instrumental timbres are reproduced with an uncanny realism by the M24. Massed strings, such as the opening movement of Respighi's *The Birds*, are incredibly rich in their harmonic structure. Realism of solo instruments has always been a hallmark of the Rachmaninoff recording. These qualities are even more impressive when the 96k/24-bit DVD is played through the M24.

The M24 has excellent dynamic contrasts, particularly on the loud end of the spectrum. Recordings with demanding material for full symphony orchestra,

such as "Siegfried's Funeral March" from the Solti recording of Wagner's *Götterdämmerung*, are reproduced effortlessly, without strain. On the low end of the dynamic spectrum, my Parts Connexion DAC-3 has a lower subjective dynamic range limit, but the M24 retains every bit as much clarity and detail when reproducing low-level material.

Imaging and soundstage accuracy are outstanding. On the Mercury CD of Schoenberg's *Five Pieces for Orchestra*, an excellent soundstaging demonstration, the placement of instruments within the soundstage is as precise as I've ever heard on this recording. Soundstage size is impressive, both front-to-back and left-to-right. The sword rattling in the section leading up to the "Forging Scene" in the Solti *Siegfried* is extremely deep in the soundstage, with excellent localization.

One noteworthy characteristic of the M24 is its performance on difficult CD material. CDs that sound hard or bright on other digital playback gear are rendered much more listenable on the M24. Decca's three CD reissues of the Solti recording of Richard Strauss's *Salome* have sounded a bit hard in the treble region, though the most recent two are better than the first. Heard on the M24, the treble has more of the smoothness of my three LP versions of this recording.

## SOLID-STATE DAC

Switching to the solid-state DAC outputs, which I routed through a Jensen CI-2RR transformer, the M24 retained many of the musical qualities of the tube outputs. However, I found the solid-state outputs to have greater inner detail and better high-frequency extension and "air" around the instruments (I know this runs contrary to the measurements, but that's how I hear it). Compared to the tube DAC outputs, the solid-state outputs are more accurate—they retrieve more information from the discs but never sound analytical or sterile. The tube outputs are just a bit richer-than-life, and many listeners will be seduced by the euphony of the tube DAC circuit.

I prefer the solid-state DAC outputs—for me, the transformer-coupled, solid-state DAC strikes the right balance between accuracy and musically involving performance. Don't be put off by

the need to use a transformer. Normally, an I/V converter will be followed by another active gain stage and/or active buffer. Transformer-less circuit designs have been all the rage for years in both the pro and consumer audio industry (active circuits are actually cheaper than a high-quality transformer). The anti-transformer biases that exist in many audio circles (I admit to some guilt here, myself) seem downright silly when you hear the M24 I/V output through a Jensen transformer. It's hard to imagine an active circuit having greater transparency than the Jensen CI-2RR.

I find it interesting that the solid-state DAC output retains some of the liquidity and warmth of the tube outputs. Chuck and I agree that this is a result of the tube stage being connected in parallel with the solid-state I/V output, and undoubtedly makes a positive contribution to the sound of the solid-state output. Longtime readers of my reviews know that I normally prefer accuracy to euphony, but it's hard to argue with the sound of the M24's I/V output.

I have used my Parts Connexion DAC-3 with great pleasure for eight years. At the time I reviewed it in these pages, it had brought my audio system to a new level of digital performance. Having lived with the M24 for some time now, I recently switched back to the DAC-3, for reference. Compared to the M24, my DAC-3 actually sounds rather analytical, and on certain recordings even a bit sterile. The M24 simply provides a more palpably lifelike musical experience than my DAC-3.

The DAC-3 reveals a little more inner detail, but using the M24 with the Jensen transformer via the solid-state I/V output closes much of the gap, if not eliminating it completely. The complexity of the DAC-3 circuit topology, particularly the differential DAC and analog circuitry that follows, is an impressive engineering achievement. But there may be something to be said for simplicity. The M24 offers superior musical performance using the same digital



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## HIGH-GAIN LINE STAGE

I was not as impressed with the performance of the M24 used with its own tube line stage. With the solid-state I/V connected to the line input through the Jensen transformer, there is a bit of hardness and glare on full orchestral passages. The smoothness and sweetness I observed using the DAC alone just isn't there. Feeding the line stage from the tube DAC via the front panel switch improved matters somewhat, but the wonderfully musical performance of the tube DAC feeding my own preamp was compromised. With either configuration, I was frustrated by the fact that the gain is set so high in the line amplifier. I was constantly running the volume control around 8:00 or 8:30, near the bottom end of its rotation.

As Chuck Hansen noted, the line amplifier gain is set at about 18.5dB, which equals a voltage gain of around 9. I suggest that Monarchy reduce the voltage gain to 5 (14dB) and also drop

the tube DAC output to bring it in line with the solid-state output, which is just over the 2V Red Book spec. This would allow higher volume control settings, which should make an audible improvement in the sound of the line amplifier (Chuck agrees with this).

In my system, the M24 was silent when used via the DAC outputs. If I turned my preamp volume control up full, there was barely a trace of background hum with my ear within inches of the loudspeaker (no program material, of course!). With the line amp connected to my power amps, there was a slight residual hum at the loudspeakers, but I had to get my ears within a foot, or so, of the speakers to hear it. At a normal listening distance, it was not audible. I used the M24 with a grounded power cord at all times, but lifting the ground did not affect hum and noise in my system.

## CONCLUSION

The Monarchy M24 is an exceptional-sounding D/A converter, and one of the most musical pieces of audio equip-

ment I've had the pleasure of auditioning. My reservations about the line amplifier should not deter music lovers looking for an outstanding D/A converter at a reasonable price, for use with their own preamp. At \$1590, the M24 is certainly not cheap, and you'll need to add close to \$200 for the transformers if you plan to use the solid-state DAC outputs. But the M24's performance as a D/A converter certainly justifies the price.

The M24 may appear to be superseded by the latest generation of 192kHz DACs, but Monarchy has proven that there's a *lot* of life left at 96k. The M24 excellent sonics combined with superb build quality make this a highly recommended product. **AX**

## Manufacturer's Response:

*It is gratifying to see Gary focuses his opinion on the SONIC performance: "the palpably lifelike musical experience," totally unbiased by the circuit architecture or measurement results.*

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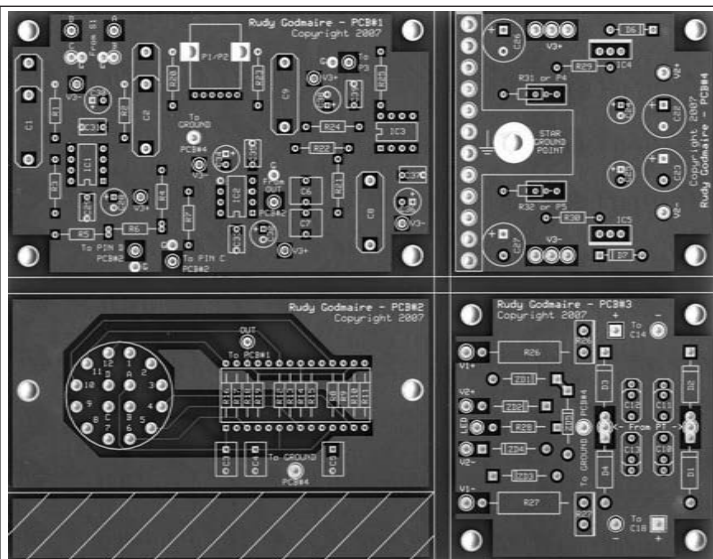
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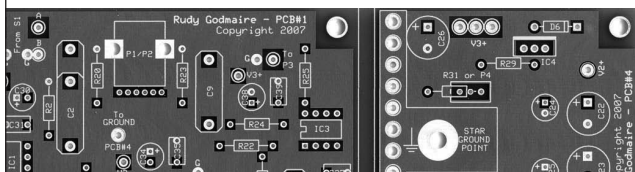
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of audio equipment should give the user. Specifications and measurements are far less important. Users of our products will agree that although our products do not measure outstandingly well, they all give the user a very satisfying listening experience.

For users who want less output from the Line Amp, they can simply remove the capacitor in parallel with the cathode resistor (100Ω, one per channel).

This cap is a 1800μF, 10V HFQ audiophile grade electrolytic (HFQ is known for its low ESR). Removing this cap will reduce the gain by about 10 to 15%. The

more adventurous might even want to try a different value of the cathode resistor to best match the tubes they use. The original value, 100Ω, can be increased up to 470Ω depending on the tubes and the resulting sonic performance. However, this value should not be decreased. All 6.3V dual triodes of the 6DJ8/ECC88 variety can be used as a substitution.

We wish to express our gratitude to both Charles Hansen and Gary Galo for the many hours they spent on this model.

**C.C.Poon**  
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## REFERENCE RECORDINGS CDS

Ravel: *Alborada del Gracioso*. L'Orchestre de la Suisse Romande conducted by Ernest Ansermet. London 433 717-2

Rimsky-Korsakov: *Scheherazade*, Op. 35. Chicago Symphony Orchestra conducted by Fritz Reiner. RCA Victor Living Stereo 68568-2 (UV22-Encoded Limited Edition Gold CD version of 68168-2).

Mussorgsky/Ravel: *Pictures at an Exhibition*, especially track 2, "Gnomus." Chicago Symphony Orchestra conducted by Fritz Reiner. RCA Victor Living Stereo 68571-1 (UV22-Encoded Limited Edition Gold CD version of 61958-2).

Schoenberg: *Five Pieces for Orchestra*, Op. 16. London Symphony Orchestra conducted by Antal Dorati. Mercury Living Presence 432 006-2.

Respighi: *The Birds*. London Symphony Orchestra conducted by Antal Dorati. Mercury 432 007-2.

Wagner: *Der Ring des Nibelungen*, especially "Siegfried's Death and Funeral March" from *Götterdämmerung* (CD 4, Tr. 10-11), and the "Forging Scene" from *Siegfried* (CD 2, Tr. 3-5). Birgit Nilsson, Wolfgang Windgassen, et al. Vienna Philharmonic Orchestra conducted by Georg Solti. Decca 455 555-2.

R. Strauss: *Salome*. Birgit Nilsson, Eberhard Wächter, et al. Vienna Philharmonic Orchestra conducted by Georg Solti. Decca 414 414-2 or 475 7528-2.

## CD LAYERS ON SACD DISCS

Stravinsky: *The Firebird*—Suite. Atlanta Symphony Orchestra conducted by Robert Shaw. Telarc SACD-60039. (Hybrid SACD/CD; DSD conversion of original Soundstream recording).

Stravinsky: *The Rite of Spring*. Cleveland Orchestra conducted by Lorin Maazel. Telarc SACD 60563. (Hybrid SACD/CD; DSD conversion of original Soundstream recording).

Holst: *First Suite in E-Flat*, Op. 28, No. 1. Cleveland Symphonic Winds conducted by Frederick Fennell. Telarc SACD-60693 (Hybrid SACD/CD; DSD conversion of original Soundstream recording).

## DVDS

Rachmaninoff: *Symphonic Dances*, Op. 45. Dallas Symphony Orchestra conducted by Donald Johanos. Classic Records DAD 1004. (96kHz, 24-bit PCM transfer of 30-ips analog tape engineered by David Hancock).

Berlioz: *Requiem*, Op. 5. Utah Symphony Orchestra, University of Utah Civic Chorale conducted by Maurice Abravanel. Classic Records HDAD 2012 (Both 192kHz/24-bit DVD Audio and 96kHz/24-bit DVD-video programs are included; transfers of original Vanguard analog tapes).

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