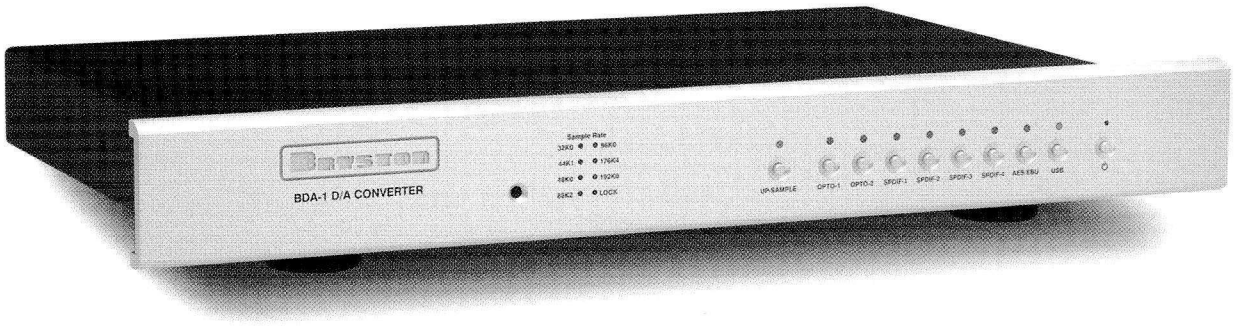
BRYSTON BDA-I

fuel for the senses

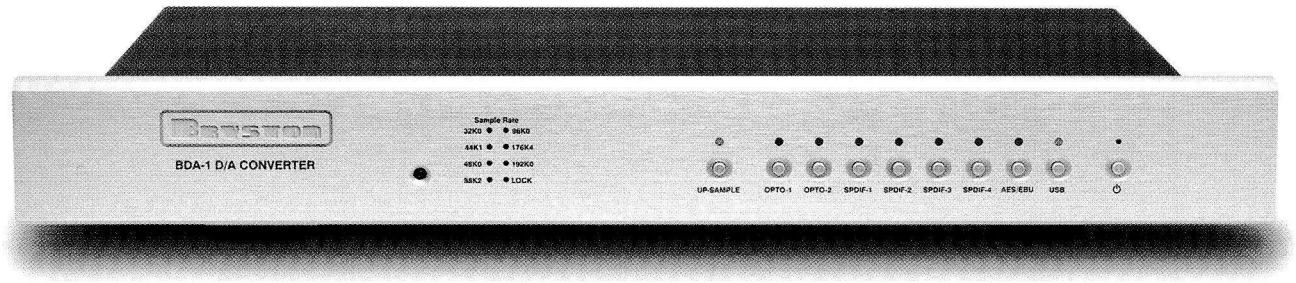


BDA-I EXTERNAL DAC

THE EVOLUTION CONTINUES

BRYSTON

INTRODUCING **THE BDA-1 EXTERNAL DAC**



BRYSTON BDA-1 EXTERNAL DAC

STATE-OF-THE-ART

The Bryston BDA-1 is a state-of-the-art external Stereo DAC (digital to analog converter) using fully discrete Class-A proprietary Bryston analog circuits, two independent linear power supplies and dual Crystal CS-4398 DAC chips. The BDA-1 features an impressive array of inputs for USB, COAX, OPTICAL, AES-EBU and BNC equipped digital devices. For audio outputs, the BDA-1 offers both balanced XLR as well as unbalanced RCA stereo connectors on the rear panel. The BDA-1 is RS-232 software upgradeable, making it the most flexible high performance DAC on the market.

BDA-1 FEATURES:

- Dual 192K/24Bit Crystal DAC's
- Independent dual power supplies
- Discrete Class A analog output stage
- Oversampling
- Synchronous upsampling (176.4K/192K)
- Selectable upsampling feature
- Independent analog and digital signal paths
- Inputs: USB (1), COAX (2), OPTICAL (2), AES-EBU (1) BNC (2)
- 32, 44.1, 48, 88.2, 96, 176, 192K sampling
- 16-24Bit PCM, 16Bit 32K-48K USB
- Fully differential balanced XLR and unbalanced RCA stereo outputs
- Transformer-coupled SPDIF and AES EBU digital inputs
- SPDIF COAX bypass loop output
- RS-232 software upgrade
- Optional remote control
- Remote 12-volt trigger
- Compatible with CD drives, sound cards, computers, music servers
- Cosmetically matches Bryston C-Series BP26/ MPS2/BCD-1

JITTER REDUCTION

Jitter is a mistiming of data being moved from point A to point B in any synchronous digital system. Think of jitter as individual ticks on a clock—however each tick is not occurring at exact one-second intervals. Some are slightly less than a second and some are slightly longer, and they average out so that no actual time is being gained or lost over a large number of seconds. Jitter is the difference between the shortest and the longest second, and in digital audio systems this specification is usually measured in nanoseconds.

Both the frequency and the jitter characteristics of the system's digital clock will affect the accuracy of reproduction. The frequency, if not accurate, can cause the pitch and speed of the music to change, and in some systems cause drop-outs if there is no data available.

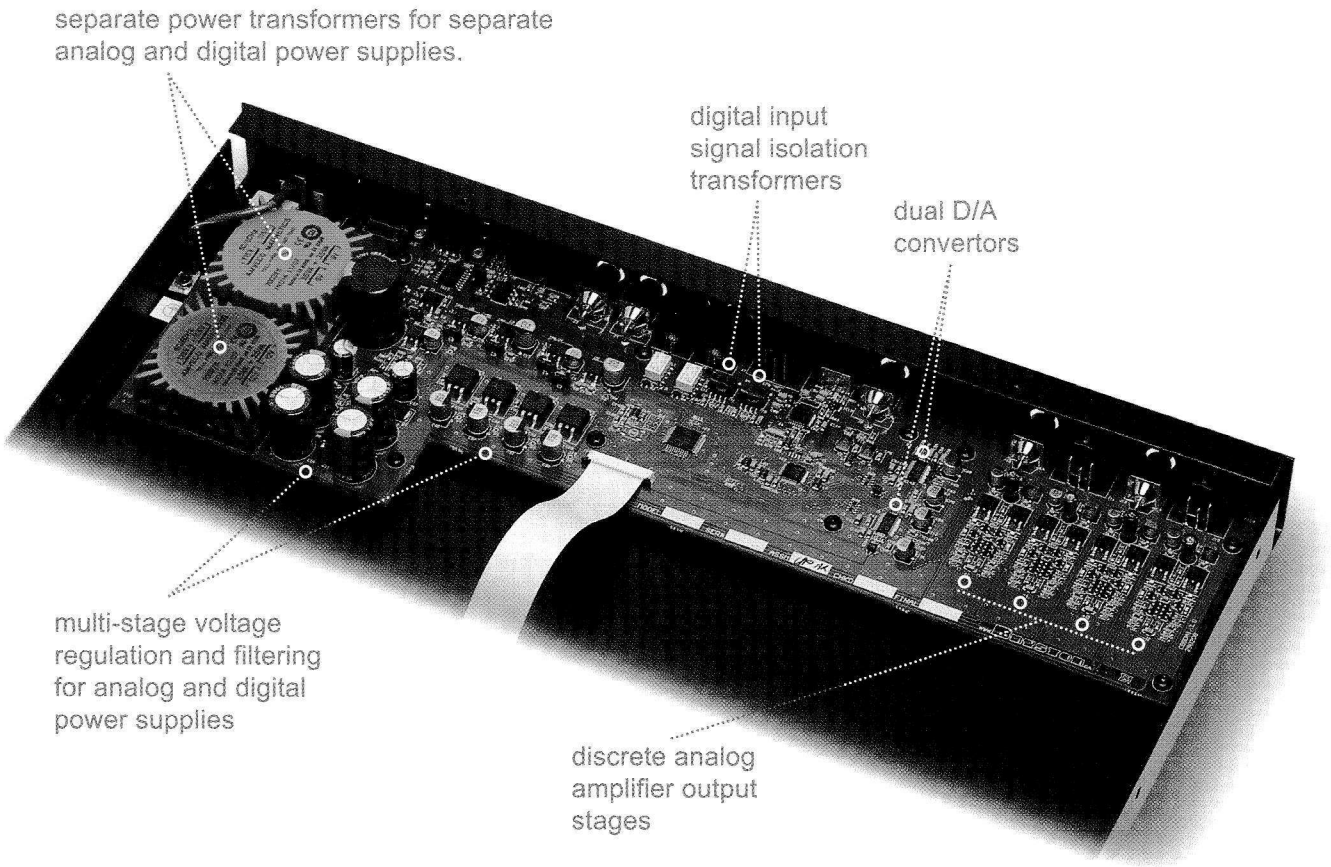
SONIC **SUPERIORITY**

THE BRYSTON SOLUTION

Bryston delivers superb sonic performance by re-sampling and re-clocking the digital input in order to reduce jitter. The result, a significant reduction in jitter (1/1000 of a nanosecond). But it isn't enough to just get the bits right; those bits have to be converted back into music with the same timing reference as when the music was first digitized. The input signal of the BDA-1 is re-clocked and re-sampled to reduce any possibility of jitter affecting the sound quality. Even the input receiver and the sample rate converter serve to further reduce jitter.

IMPEDANCE MATCHING TRANSFORMERS

The best way to understand the Bryston BDA-1 External DAC is to follow the flow of a signal from when it first arrives at the BDA-1 in digital form to when it leaves to drive an external analog input. The digital signal first arrives at the BDA-1 via either the SPDIF COAX, OPTICAL OR AES EBU inputs or the USB interface input. These are the standard digital outputs from a CD Drive, Sound Card, Computer, Music Server etc. There are 6 digital inputs, which are easily selected using a front panel switch. This digital signal contains data at over 1 million bits per second that requires a bandwidth of 5 to 10 million hertz (cycles per second). At these high frequencies, it is very important to maintain the quality of the signal by having the correct termination at the digital inputs. The BDA-1 provides for this termination in the best possible manner using devices called impedance matching transformers. Impedance matching transformers provide the optimal interface to the incoming source under all sorts of signal conditions. Lesser quality terminations will degrade the signal, causing increased jitter.



SYNCHRONOUS **UPSAMPLING**

UPSAMPLING

After the input stage, the signal goes to the SYNCHRONOUS upsampling circuit (sample rate converter). This circuit converts the digital signal from one sample rate and bit depth to another. In the BDA-1, the sample rate is increased from the input sample frequency (32K, 48K, or 96K upsamples to 192K and 44.1K or 88.2K upsamples to 176.4K). The 16 bits of depth (the CD standard) is increased to 24 bits. The added 8 bits are filled with placeholder information. This upsampling process provides a digital signal for later conversion to analog by the Crystal 4398 DAC chip. The upsampling process doesn't add any new, but does put the data in a form which can better be translated by the DAC as described below.

The advantage of this synchronous upsampling process is improved processing of the upsampled signal by the DAC chip, which was designed for higher sample rates and bit depths. There is also a noise shaping process implemented where "noise" within the audible spectrum is shifted up to frequencies above audible limits. An added advantage of this upsampling process is that a totally new clock signal is applied, which results in significant jitter reduction.

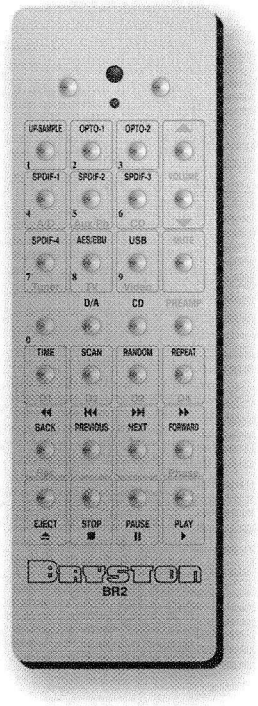
OPTIONAL UPSAMPLING FEATURE

A very unique feature of the Bryston BDA-1 External DAC is the ability to disengage the upsampling feature. You can compare an upsampled signal with a non-upsampled signal simply by engaging a switch on the front panel. This feature is functional when using sample rates of 44.1K, 88.2K, 48K, and 96K.

BRYSTON DAC

The DAC integrated circuit (chip) provides the conversion of the digital signal to the analog domain. The two independent DAC chip's used in the BDA-1 are the Crystal CS-4398. Due to the requirements of the conversion process, every DAC chip employs a digital filter to the signal in the digital domain and an analog filter after the conversion process has been applied. Without this upsampling technology, these filters would likely effect frequencies at or near the audible range, accompanied by unwanted level and phase changes.

The CS-4398 is a hybrid multi-bit delta-sigma DAC. This is an advanced generation chip, which uses several methods to optimize the conversion process. This DAC uses a process similar to the previously detailed upsampling process where it oversamples the incoming signal. The CS-4398 operates in one of three oversampling modes based on the input sample rate. Single-speed mode supports input sample rates up to 50 kHz and uses a 128x oversampling ratio. Double-speed mode supports input sample rates up to 100 kHz and uses an oversampling ratio of 64x. Quad-speed mode supports input sample rates up to 200 kHz and uses an oversampling ratio of 32x. This again allows for filtering that is safely out of the audible range. The output of this process is a sensitive analog signal. The timing of this process must be very closely controlled by a low-jitter clock.



OPTIONAL REMOTE

POWER SUPPLY

The stability of power in any audiophile equipment is imperative to superb performance. The BDA-1 uses two independent power transformers for the initial stages of filtering and regulation. In the BDA-1, each stage in the digital chain (input receiver > sample rate converter > digital audio converter) is independently regulated to prevent any interactions and to provide a rock solid supply of power for any up-sampling/over-sampling process.

The Crystal DAC chip also requires a very clean digital power supply if it is to function at its optimum level. Noise on the digital supply could cause added jitter and various forms of distortion. Incorrect circuit board routing of the digital power supply or related ground may also introduce digital noise into the analog circuits. The BDA-1's digital power supply is provided from a separate closely regulated and filtered source.

The DAC also requires a high quality analog power source. The analog signal is at its lowest magnitude within the DAC and as it exits the chip, so any induced noise or distortion will be greatly amplified by circuitry upstream from the DAC. Bryston engineers have employed a separate, heavily regulated and filtered power supply with carefully routed grounds that is critical to the superior sound of BDA-1. Careful trace routing eliminates the risk of noise via capacitive coupling and provides the extra dB's of noise and distortion reduction which separate truly great audio equipment.

DISCRETE CLASS-A ANALOG STAGE

The most critical part of the circuit design in the Bryston BDA-1 is the DAC's analog outputs—connected directly to a pair of proprietary Bryston Class A discrete operational amplifiers rather than the typical IC chips employed in most other products. These exotic amplifiers make a huge difference in transparency, resolution and dynamic performance.

The use of discrete devices allows the design of a circuit that exactly matches the needs of the DAC, whereas the use of general-purpose integrated circuits always involves compromises. Discrete devices allow engineers to generate more output power since the heat from the output driver transistors is physically separated from other sensitive components.

Discrete devices also allow specific matching of important characteristics such as input and output impedances based on the specific in-circuit requirements. Discrete operational amplifiers can also be designed to more closely match their power source leading to additional reduced distortion and noise. Bryston consistently utilizes discrete devices in our product designs because our circuits are engineered to require closely matched devices for optimum performance. Bryston does ultra-fine sorting and grading of discrete devices, which leads to superior sound quality.

PERFORMANCE WITHOUT **COMPROMISE**

HAND ASSEMBLED WITH CARE

Bryston hand assembles and individually tests each and every product we manufacture. We exclusively use only the finest components, 1% metal-film resistors, 1% polystyrene capacitors, and hand selected and matched transistors in order to reduce noise and distortion to the absolute minimum. Bryston applies techniques and employs custom materials in our everyday construction of electronic equipment that are typically utilized by military and aerospace industries. Our traditional adherence to the use of proprietary parts, sophisticated construction, and refined testing techniques guarantees that the Bryston BDA-1 DAC will perform superbly for many years.

PERFORMANCE WITHOUT COMPROMISE

Bryston has always maintained that the final arbiter of this exercise is to provide products that are as transparent and accurate to the original recorded performance. The BDA-1 DAC is the ultimate representation of this design goal.

SPECIFICATIONS

- Frequency response - 20 Hz - 20 KHz -.1dB
- Signal to noise – Audio Precision AP2700 analyzer FFT digital measurement 140 dB unweighted
- THD plus noise - .002%
- IMD - .002%
- Jitter – below the measurement capability of the AP2700 analyzer
- Output Level - 2.3V unbalanced - 4.6V balanced
- Shipping weight - 18 Lbs / 8.2 Kg
- Dimensions - 17 or 19 w / 11.25 d / 1.75 h inches
- 43.2 or 48.3 w / 28.6 d / 4.4 h cm

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