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Evolution Series
650D Digital-to-Analog Converter / CD Transport

MOON

Power Emotion Soul

The **MOON 650D** Digital-to-Analog Converter / CD Transport follows in the footsteps of the highly acclaimed MOON 750D. Applying what is commonly referred to as trickle-down technology, we have created a product that yields almost of all of the 750D's performance, but at a more accessible price point.

True 32-bit fully asynchronous digital audio playback is achieved by the **MOON 650D** using a fully balanced differential dual-mono design featuring our own **M-AJiC32** circuitry (an asynchronous jitter elimination system). Built around the ESS SABRE^{32} Ultra DAC operating in 32-bit Hyperstream™, the conversion process uses an astonishing 8 DAC's per channel. The final result is a product that will breakdown all the barriers, bringing you closer to the music than ever before, regardless of how your digital media is stored, be it on a CD, computer, music server, etc.

32-bit fully asynchronous digital audio ...
Cutting edge technology

The back panel features a complete array of digital input and output connections to meet all the needs of today's ever-widening technologies. Eventually, an optional outboard power supply will be made available to further enhance the already life-like performance of the **650D**.

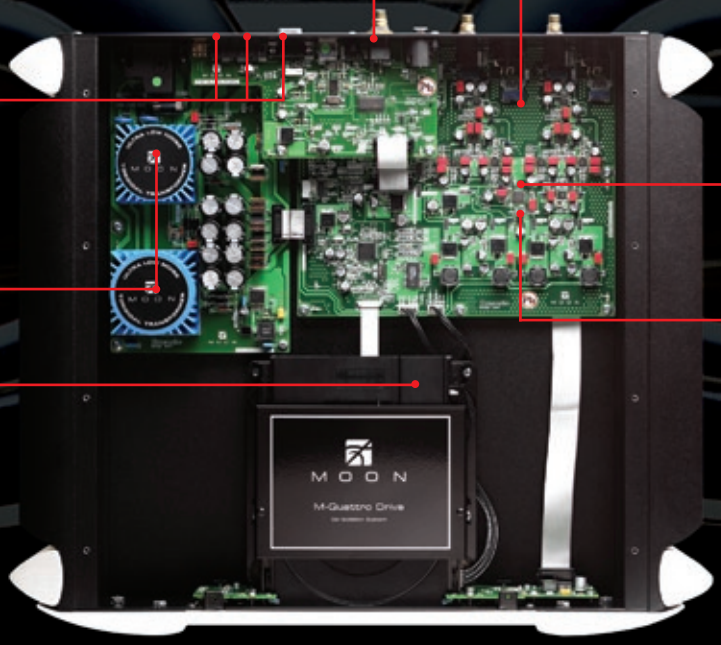
Significant Design Features

Four (4) digital inputs - AES/EBU, S/PDIF, TosLink and, USB; Two (2) digital outputs – AES/EBU and S/PDIF

IR input for external control, **SimLink**™ controller port allows for 2-way communications between other compatible MOON components and full unsolicited RS-232 for bidirectional feedback and firmware updates.

Separate digital & analog power supplies using 2 independant toroidal transformers

Proprietary CD drive system, using in-house developed hardware & software, mounted on our **M-Quattro** gel-based 4-point floating suspension for vibration damping.



A very short capacitor-free analog signal path using a DC servo circuit and proprietary 12dB/octave analog filter

32-bit Digital-to-Analog converter using ESS Technology SABRE^{32} Ultra DAC / Digital Filter (ES9016) working in 32-bit Hyperstream™ to achieve unprecedented jitter immunity and low-level linearity via a patented Time Domain Jitter Eliminator

A virtually jitter-free "1 picosecond" digital clocking system

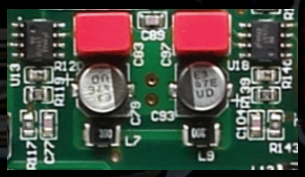
- Digital Audio Signal Processing using **M-AJiC32** (MOON Asynchronous Jitter Control in 32-bit mode)
- Four-layer PCB tracings resulting in a much shorter signal path and dramatically improved signal-to-noise ratio

- Power supply voltage regulation includes **I^{2}DCf (Independant Inductive DC Filtering)**: There is one inductor dedicated to each integrated circuit type component (DAC, Op-Amp, etc.) in the audio circuit's signal path – 18 stages in all

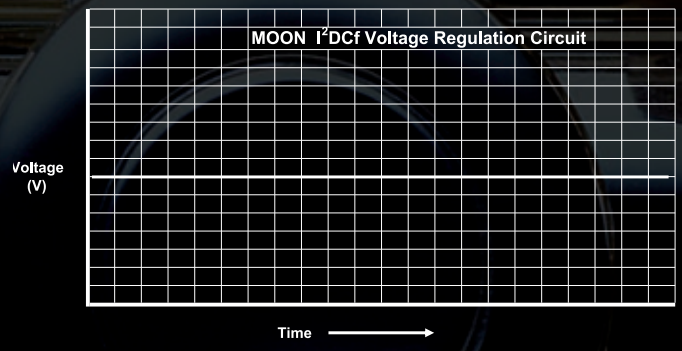
The most realistic and lifelike sound reproduction yet.

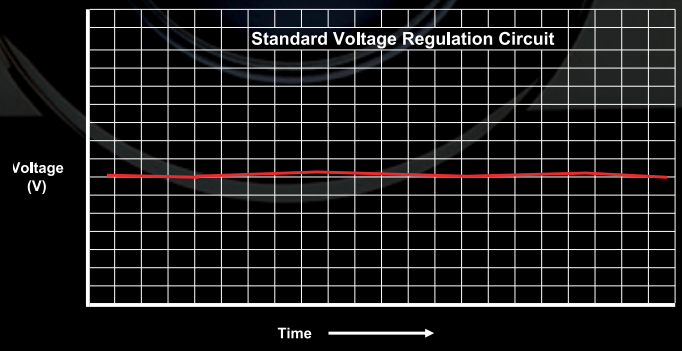
Simaudio Ltd. has been designing and manufacturing innovative, leading-edge audio and video products since 1980. **MOON** products have been globally recognized for their world-class performance, garnering numerous accolades for this outstanding achievement. Our products are engineered and built in Canada, utilizing advanced, efficient, "green" assembly techniques with strict quality control. Furthermore, our manufacturing processes are part of our philosophy, whereas the high quality and long-life of MOON products are the best way to preserve our environment, avoiding premature obsolesence. MOON products meet or exceed all international requirements for safety, performance and durability. At Simaudio, great music matters. However, great music for a lifetime matters most.

Independent Inductive DC Filtering (I²DCF) is a unique type of DC voltage regulation that was initially developed for the MOON Evolution series of components; Now it is used in numerous MOON series models. One stage of **I²DCF** represents a unqiue and specialized circuit. It eliminates all the glitches resulting from the DC power feeding the electronic parts found in a component's audio signal path, as well as isolating these parts from each other



One stage of **I²DCF** uses one inductor and its dedicated to each integrated circuit type component (DAC, Op-amp, etc.) in the circuit's audio signal path. This voltage regulation circuit achieves better noise filtering, substantially lower THD, improved channel separation and lower crosstalk, a reduction in jitter for CD players, and more consistent DC voltage throughout the entire circuit. The total number of stages in the **MOON 650D** is 18.



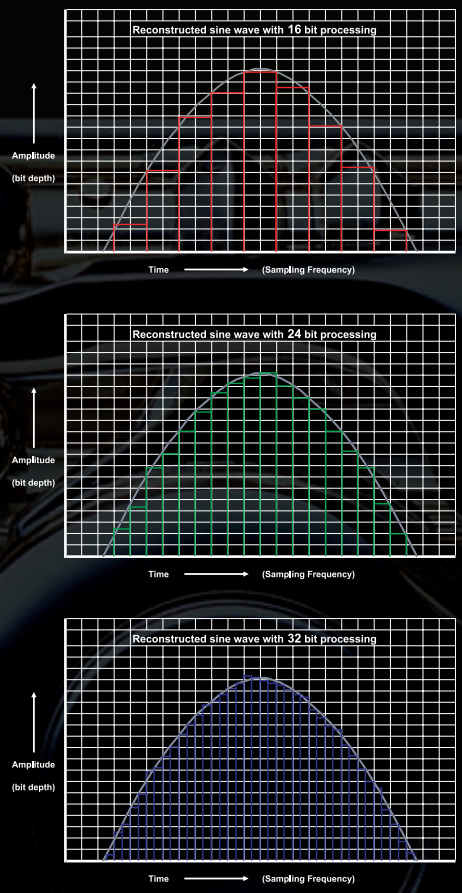


An audio component using **I²DCF** circuitry has a dramatically reduced noise floor, a dead quiet "black" background, a more realistic 3D portrayal of the recording and perfect signal level matching between channels. Audio components not using **I²DCF** circuitry can suffer from imperfect voltage regulation. This often results in various inefficiencies such as a lower signal-to-noise ratio, increased crosstalk, unneccessary jitter and a less realistic sonic landscape.

Sheer realism ... the genuine impression that the musical performance is taking place in your very own listening space ... your audio system will feel as if its effortlessly running on its own, without any electricity

Technical information

The digital-to-analog conversion process uses bits of digital information to produce an analog waveform, represented as a sine wave (in this example only a part of a sine wave is shown) to produce a music signal. When more digital information is made available, the result is a more accurate and detailed music signal. A higher bit-depth (or a higher resolution) yields smaller, finer and more accurate steps in the reconstruction of this sine wave (grey) as seen in the animated figure below. A 32-bit (blue) data stream contains significantly more information than a 24-bit (green) or 16-bit (red) data stream.



The advantage of using this 32-bit process to reconstruct a 16-bit digital signal (i.e. Redbook CD) is simple; This process interpolates the digital information more accurately by calculating the finer steps with 32-bit resolution that were lost during the analog-to-digital 16-bit mastering process. The result is, after the D-to-A conversion, a more realistic waveform that is incredibly analog sounding; Each musical note's harmonic decay is restored more accurately than with a 16-bit or 24-bit process, creating a uniquely life-like sound that was previously inaccessible from digital audio. In the past, the poor restoration of harmonic decay was a major contributor in what gave digital audio that cold, uninvolving and analytical feeling.

As a general rule, increased processing power is directly proportional to resolution: For each additional bit of resolution,the number of available levels will double, as shown in the following table:

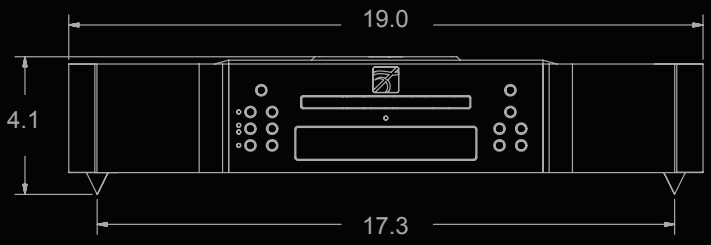
Bit Depth	16	24	32
Steps	65,536	16,777,216	4,294,967,206

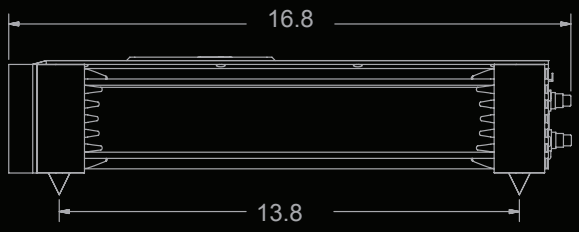
To summarize, the higher the resolution of the data, the smaller the steps will be. This results in more detail as each individual step covers a smaller section of the waveform. More detail in the digital domain leads to a much more accurate analog signal at the end of the conversion process. Another major benefit of this 32-bit process is smaller data truncation errors. These errors result from the extensive mathematical calculations performed during upsampling & sampling rate conversion, prior to the D-to-A process. These truncation errors - shown in the above figure, occur when the data sample rises outside (or above) the grey curve - will be signifcantly smaller as bit-depth increases due to finer and more accurate calculations. As well, because of the sheer processing power that's readily available at 32-bits, the errors will not impede the circuit's ability to accurately recreate the music waveform.

MOON 650D Specifications

Configuration	Fully balanced, dual-mono
Transport Mechanism	Proprietary Design
Digital Filter / Digital-to-Analog Converters	ESS ES9016 Sabre^{32} 32-bit Hyperstream™
Frequency Response (audible)	20Hz - 20kHz +0/-0.1dB (internal transport)
Frequency Response (full range)	2Hz - 100kHz +0/-3dB (external digital source)
THD @1kHz, 0dBFS (A-weighted)	< 0.001%
Intermodulation Distortion	< 0.001%
Dynamic Range	> 120dB
Signal-to-noise Ratio	> 120dB @ full output
Slew Rate	50V/µs
Channel Separation	> 116dB
Low Level Linearity	< ±0.25dB at -90dBFS
Intrinsic Jitter	1 picosecond RMS
Analog Outputs – Balanced	1 pair XLR
Max. Analog Output @ 0dBFS - XLR	2.0 Volts
Analog Output Impedance - XLR	100Ω
Analog Outputs – Single Ended	1 pair RCA
Analog Output Impedance - RCA	100Ω
Max. Analog Output @ 0dBFS - RCA	2.0 Volts
Digital Inputs (4)	AES/EBU (XLR), S/PDIF (RCA), TosLink, USB Type-B
Digital Outputs (2)	S/PDIF (RCA), AES/EBU (XLR)
Digital Input/ Output Impedance - S/PDIF	75Ω (0.5 Volts p-p)
Digital Input/ Output Impedance - AES/EBU	110Ω (3.7 Volts p-p)
Remote Control	All Aluminum Full-Function
Display Type	8 character dot matrix LED
Power Consumption @ idle	25 Watts
AC Power Requirements	120V / 60Hz or 240V / 50Hz
Shipping Weight	35 lbs / 16 Kgs
Dimensions (W x H x D, inches)	19.0 x 4.1 x 16.8

Specifications subject to change without notice





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Distributed by:

M O O N

Simaudio Ltd.: 95 Chemin du Tremblay, Unit 3, Boucherville, Quebec CANADA J4B 7K4
Simaudio Ltd.: 2002 Ridge Road, Champlain, NY 12919 NY USA

(877) 980-2400 **(450) 449-9947** **info@simaudio.com** **www.simaudio.com**

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