Masters Series M2
Direct Digital Amplifier

THE WORLD'S MOST ADVANCED AMPLIFIER

The NAD M2 Direct Digital Amplifier represents a new level of amplifier performance. Combining the ultra low distortion and noise levels of the finest linear Class A and Class AB amplifiers with the efficiency and streamlined signal path of the digital amplifier, the M2 is the first implementation of a new amplifier technology called Direct Digital Feedback. Co-developed with UK based Diodes Zetex Semiconductor, and using a unique implementation of their patented DDFA architecture, the M2 redefines what is possible with digital amplifier technology.

The M2 Direct Digital Amplifier represents the culmination of a decade long NAD research project, capped by three years of intense development. The result fully justifies the investment. We believe that the M2 sets new benchmarks for both measured performance and subjective musical quality.

> FEATURES

Direct Digital Amplifier

- 2 X 250W Continuous Power at 8 and 4 Ohms
- >500W IHF Dynamic Power
- <0.004% THD 20Hz – 20kHz from 500mW to 250W
- >120dB Dynamic Range
- 40uV Residual Noise
- >2000 Damping Factor at 50Hz +0/-0.5dB Frequency Response 20Hz – 20kHz, -3dB >85kHz
- Channel Separation >90dB @ 1kHz, 80dB @ 10kHz
- Digital PowerDrive
- Digital Soft Clipping (switchable)
- 5 Position Digital Impedance Compensation Filter

Analogue-to-Digital Conversion

- A/D Conversion for Analogue Inputs
- Multi-bit Delta/Sigma 24/216kHz
- 0.0004% THD
- Sample rate 32kHz - 192kHz
- 124dB S/N Ratio
- High Resolution 120dB Digital Attenuator

Ins and Outs

- Inputs Digital SPDIF: AES/EBU, Coaxial X 2, Optical X 2
- Inputs Analogue: Balanced, Single Ended
- Processor Loop: SPDIF Optical (Mac PC compatible) out/in
- 2 Sets of Speaker Binding Posts to facilitate Bi-wiring
- Remote Control

Control Options

- RS-232 serial data port
- IR Input
- 12V Trigger Input and Output
- <1W Standby Consumption
- 90% Amplifier Efficiency

>DIRECT DIGITAL EXPLAINED

A true digital amplifier can be thought of as a Digital-to-Analogue Converter that directly drives the loudspeaker. This describes the M2 perfectly, except to say that the M2 actually has the same level of precision as the very best low level DACs! This technology is far more sophisticated than the Class D analogue amplifiers that are often erroneously referred to as 'digital' amplifiers.

This level of performance is unprecedented and is made possible by application of Direct Digital Feedback. The idea of a closed loop digital amplifier is not new, but the NAD M2 is the first practical implementation of the concept.

>FEEDBACK REINVENTED

The concept of feedback is simple and brilliant. Compare the signal at the output of an amplifier with the signal at the input; any difference is caused by the distortion of the amplifier. Now, invert that difference signal and add it to the incoming signal and the difference signal will offset and cancel out the distortion.

> continued



> FEEDBACK REINVENTED (continued)

But for a digital amplifier, implementing this concept is anything but simple! As we have pointed out, the M2 takes a digital input signal and outputs an analogue signal to drive the loudspeaker.

The conventional feedback architecture with a loop from the output to the amplifier's input is too slow and not a successful approach with a digital amplifier, so the direct digital feedback technology was developed to deliver the solution. A feedback error signal is generated through comparison with an extremely pure reference and then converted to the digital domain at a 108MHz sample rate prior to being used for digital correction. This very direct feedback approach is at the heart of the M2 architecture.

Some forms of feedback have been used with limited success before. The common problems with digital amplification and the various solutions are shown in the table below:

	Power Supply Noise Compensation	Dead-time Compensation/ Distortion Reduction	Ideal Output Impedance
Pulse Width Correction [1]	Negligible	Yes	No
Power Supply Feedback [2]	Yes	No	No
Pre-correction [3]	No	Yes	No
NAD Direct Digital Feedback [4]	Yes	Yes	Yes

1 **Pulse Width Correction** actively adjusts the pulse width (PCM to PWM conversion) to compensate for amplifier non-linearity.

2 **Power Supply Feedback** is a scheme where the power supply voltage is monitored and the amplifier gain is adjusted, compensating for pulse amplitude errors.

3 **Pre-correction** is a static compensation for known amplifier non-linearities.

4 **Direct Digital Feedback** operates simply by determining the pulse area error, no matter what the cause, and passing this information back to the digital domain where compensation can be made.

BLINDING SPEED AND PRECISION

For Direct Digital Feedback to work correctly requires a very wide bit path and very high speed operation. The M2's extremely wide 35-bit data path allows for compensation to be made without truncating any information in the original signal. Running from a master clock frequency of 108MHz there is enough speed to keep a very wide amplifier bandwidth and very low noise and distortion in the audio band.

STREAMLINED SIGNAL PATH

Because the M2 Direct Digital Amplifier can accept a digital PCM input directly, the noise and distortion added by cascaded analogue amplifying stages, as found in traditional Class AB or even Class D amplifiers, is completely eliminated. This streamlining of the system architecture can reduce the residual noise of the overall system by a factor of three.

A DSP is custom programmed with NAD's own high resolution digital volume control with an astounding 120dB attenuation range and perfect channel balance.

A five position digital impedance compensation filter allows fine tuning of the top octave to match the chosen speaker impedance that will result in perfectly flat frequency response at 20kHz.

ANALOGUE INPUT SECTION

Because there are still analogue sources, and because some users will want to use a traditional analogue preamplifier with the M2, we have provided a state-of-the-art Analogue-to-Digital converter stage. This fully balanced stage accepts both a Single Ended input and a Balanced XLR input. Both the analogue input buffer amp and the ADC are of the highest quality available today.

DIGITAL PROCESSOR LOOP

This unique feature allows the advanced user to insert external digital filters into the signal path. Using the Optical TosLink format allows fuss-free connection to Macs and PCs where there is a wide library of crossover filters and room correction programs available.

Digital outputs in both coaxial and optical formats make it possible to use multiple M2s for bi or tri-amplification of advanced loudspeaker systems.

ADVANCED POWER SUPPLIES

The M2 uses three power supplies, all of them highly efficient switch mode types. Each channel gets its own high current power supply in a dual mono configuration. The Input stage and control sections get their own dedicated supply with multiple regulated secondary voltages for individual sections.

HIGHLY EFFECTIVE CONTROL

Digital PowerDrive™ optimizes the M2's performance when driving real loudspeakers by maintaining optimum power delivery and lowest possible distortion. Unlike most digital amplifiers that do not have power reserves, the M2 has excellent dynamic power capabilities.

Digital Soft Clipping prevents the harsh sound and potential speaker damage that can result when a severely overdriven amplifier clips the tops and bottoms of the sine wave. Using digital precision,

this behaviour can be completely controlled by the M2. Multi-stage fail-safe protection is carefully engineered into the M2 to prevent amplifier or speaker damage under fault conditions. Short circuit, DC offset, overheat, and over current faults are handled instantly and an indication of the fault is displayed on the front panel.

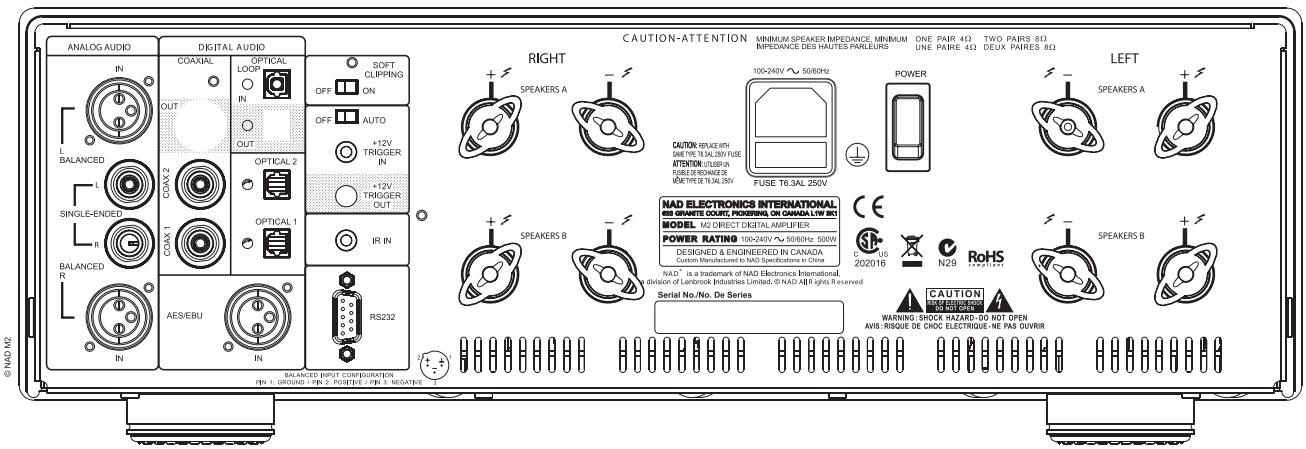
An RS-232 serial interface allows the M2 to be controlled from the PC or via advanced control systems like Crestron and AMX. 12V Trigger and IR Input allow for other popular control options and add flexibility for home and studio use.

THE NEW FRONTIER

As proven by our recent Masters Series amplifiers (M3, M25) NAD has brought the performance of the Linear Class AB amplifier very close to theoretical perfection. The next frontier for improved performance is the digital amplifier.

Now the M2 provides a benchmark for performance, both measured and subjective, in the new world of digital amplification. Highly efficient, immensely powerful and musically revealing and involving, the M2 Direct Digital Amplifier takes its place among the world's best amplifiers regardless of price or design philosophy.

> REAR LINE DRAWING



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