The m802A/D converter card option provides m802 users with state of the art A/D conversion for the most demanding music recording applications. The purpose for this new card is to provide A/D conversion technology capable of matching the transparent, musical character of our mic preamplifiers, with the combination of the two creating a remarkable new level of audio purity. To understand what makes our A/D converter unique, we'll discuss the design's three basic functional blocks: the analog input stage, the A/D converter, and the clock generation (or regeneration).

Analog Input Stage

Our converter's analog input circuitry is simple and pure. This fully differential circuitry contains no electrolytic capacitors and utilizes precision 0.5% tolerance thin film resistors, to ensure that there will be no signal coloration from capacitor dielectric absorption and resistor thermal modulation. Careful attention to grounding and power supply layout eliminates any sonic aberrations caused from unwanted interference from digital circuitry. The analog input amplifiers are powered from their own dedicated Voltage regulators and each analog power supply rail is double regulated to provide extreme isolation from power line related noise. Driving the input of modern delta-sigma converters requires a low driving impedance and high current from the A/D input driver, and our experience from designing microphone amplifiers with precision line drivers translates very well to this task.

Also, there are significant advantages by having the A/D converter circuit wired directly from the analog microphone amplifier outputs (opposed to having separate preamplifier and converter chassis'). First, by having the preamplifier and converter in the same electrical enclosure, EMI interference from external sources (i.e. RF interference and ground loop hum) is greatly reduced. Additionally there is no need for ESD protection circuitry, RFI filtering, and complex input level adjusting circuits. The result is the most simple and pure signal path attainable with an absolute minimum of signal coloration.

A/D Converter

The A/D converter employs a fifth order delta-sigma modulator and a low pass filter that exhibits very wide dynamic range and low latency. With a more gentle slope digital filter than other A/D chips, it is the most musical of the high end converter ICs. It is capable of 120dB dynamic range with distortion and noise artifacts at less than -110dB. Separate power supplies for the analog and digital portions of the A/D converter ensures that the precision delta sigma modulator will not be affected by other surrounding circuitry. As well, the differential inputs provide additional input noise rejection.

Clocks

A perfectly executed analog input stage and the best performing A/D converter IC can only result in audio performance as good as the quality of the sampling clock. Even the smallest amounts of clock jitter will readily degrade the performance of the converter by introducing non-harmonically related noise and distortion.

When operating on an internal clock, the A/D converter sample clock is generated by a quartz oscillator which has very low jitter. However, many applications require that the A/D converter be synchronized to an external clock source, usually in the form of a word clock, which is where the greatest challenge arises.

There is a common misconception that using the word clock input on any piece of digital audio equipment will result in better sonic performance. In reality, the vast majority of word clock PLL circuits will have more intrinsic jitter than the word clock signal itself and usually more intrinsic jitter than the PLL within the AES/S/PDIF receiver chip. As well, these PLLs usually have no incoming jitter attenuation in the audio band.

Our A/D converters employ a two stage PLL system to provide practically jitter-free recovered clocks with extremely high incoming jitter attenuation. The first stage is a wide lock range ultra low noise analog PLL, which can lock to incoming word clocks and Digidesign Loop Sync signals with a +/-8% lock range. Rather than using standard CMOS based PLL chips for the first stage PLL, we use an extremely quiet, discrete VCO (voltage controlled oscillator). When using a quality external clock source, this PLL alone will provide a nearly crystal quality clock. The incoming jitter rejection of this PLL begins at 500Hz and increases at 12dB/octave with rising frequency. The wide lock range allows for the converter to operate in vari-speed applications without a sacrifice in audio performance, provided that the external clock source is relatively low jitter.

Then, when the incoming sample rate is within +/-200 ppm of the selected sample rate, the secondary (our proprietary s-LOCK™) crystal based PLL will lock to the first stage PLL, providing the quietest possible recovered sample clock to the A/D converters. The s-LOCK PLL is capable of extreme rejection of incoming jitter, which begins at less than 0.1Hz and is better than 60dB at 1000Hz.

The word clock output connector(s) can output the incoming word clock or the recovered word clock from one of the two on board PLLs. If the incoming clock is of dubious quality, the output can transmit the jitter free version. If several A/D converters are to be used simultaneously, the word clock output jack can output a buffered version of the input clock for a daisy-chain configuration.

While it would be very easy (and economical) to provide "jitter free" sample clocks by routing the audio data through an ASRC (asynchronous sample rate converter), we believe that the convenience of these circuits does not outweigh the potential sonic degradation caused by additional signal processing. The performance of the s-lock PLL renders even the worst case interface jitter problems to a level well below the noise floor of the A/D converter.

Whatever your application, the m802 preamplifier/ A/D converter provides perfectly pristine preamplifier and converter performance, combined in a single, powerful and elegant package.
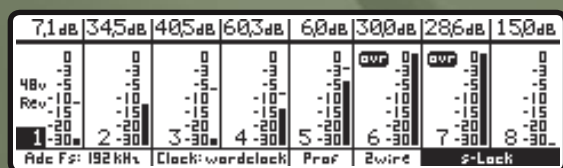
m802 A/D

A/D converter card option for the m802 preamplifier

features

- World class A/D converter performance: 24 bit, 44.1kHz – 192kHz sample rates

- Multiple clock sources: Internal crystal, external word clock and loop sync

- Clock output can be word clock in, recovered word clock or internal ref word clock

- Ultra pure high performance analog front end

- Very low distortion conversion: 0.0002% THD+N

- Low phase noise, wide lock PLL for external clock. Locks to Fs +/- 8%

- Extremely low jitter s-Lock™ crystal based PLL

- Two sets of 8 channel AES3 outputs on DB25 connector

- 8 channel AES3-id/IEC60958 (S/PDIF) outputs on BNC

- Single wire and dual wire operation (8 channels on DB25, 4 channels on BNC)

- Optional ADAT optical output module. Supports s/MUX for 88.2-96kHz sample rates

- All ADC parameters are adjustable from the m802RCU or m802 front panel

- All data outputs are transformer coupled

specifications

Dynamic range

20Hz-20kHz	>115dB
"A" weighting	>117dB

THD+N

1kHz, -1dBFS, 20Hz-22kHz	< 0.00026% (-112dB)

Frequency response

	+/-0.2dB	-3dB
44.1kHz Fs	5Hz-21kHz	22kHz
48kHz Fs	5Hz-23kHz	24kHz
88.2kHz Fs	5Hz-41kHz	44kHz
96kHz Fs	5Hz-45kHz	48kHz
176.4kHz Fs	5Hz-54kHz	72.5kHz
192kHz Fs	5Hz-59kHz	79kHz

Full scale input level

	+16dB or +24dB (+/-2dB trim)

CMRR

60Hz	>65dB
1kHz	>80dB
10kHz	>60dB
IMD SMPTE 4:1 60Hz, 7kHz, -3dBFS	<100dB (0.0008%)

Interchannel crosstalk

	<120dB

Group delay

44.1-48kHz	13/Fs

Maximum Non-harmonic Spurius Tones

1kHz, -1dBFS, 20Hz-22kHz	<-130dBFS

Sample rates, internal crystal

	44.1, 48, 88.2, 96, 176.4, 192(kHz)

External Clock Lock Range

Wide lock mode	40.1kHz-207kHz (+/-8% at each sample rate)
s-Lock™ mode	+/-250ppm (+350, -400ppm typical)

Intrinsic Jitter, 200Hz-20kHz BW

Wide lock mode	< 60ps RMS
s-Lock™ mode	< 40ps RMS

Jitter Rejection Corner Frequency

Wide lock mode, -3dB, 12dB/octave	800Hz
s-Lock™ mode, -3dB, 12dB/octave	10Hz

The above specifications are for the m802 A/D converter only, measured without the m802 preamplifier. For complete m802 preamplifier specifications, visit *www.gracedesign.com*. All specifications are subject to change without notice.

control

Control of the m802 A/D is made simple with our updated m802 preamp and remote firmware, which give the user both local and remote control of all A/D configuration options. When the A/D converter is activated, the system's sample rate, clocksource, format, and transmission mode are conveniently displayed on the user interface. In addition, the preamp metering automatically switches to monitor the digital output level of the converter using a dBFS scale. Latching digital over indicators are also provided independent of the bar meters.
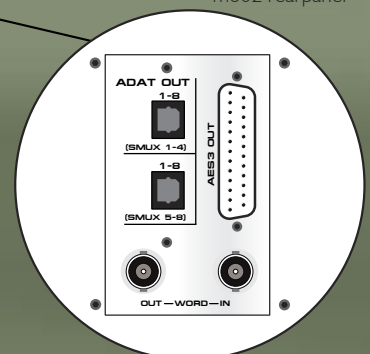
configuration
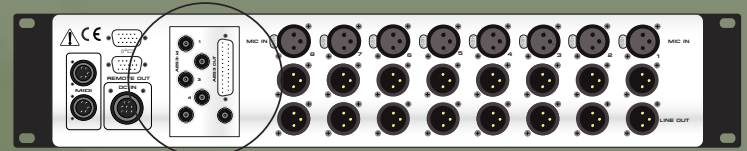
m802 rearpanel
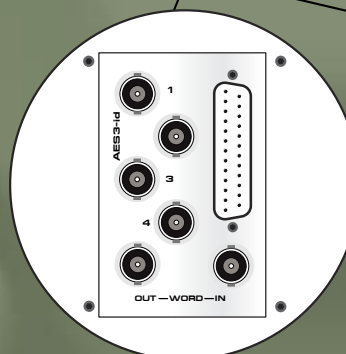
Output option A includes 2 sets of 8 channel AES3 outputs on DB25, Word Clock in and Out, and 1 set of AES3-id outputs on 4 BNC connectors.

Output option B incudes 2 sets of 8 channel AES3 outputs on DB25, Word Clock in and Out, and 2 8 channel ADAT / Lightpipe outputs.