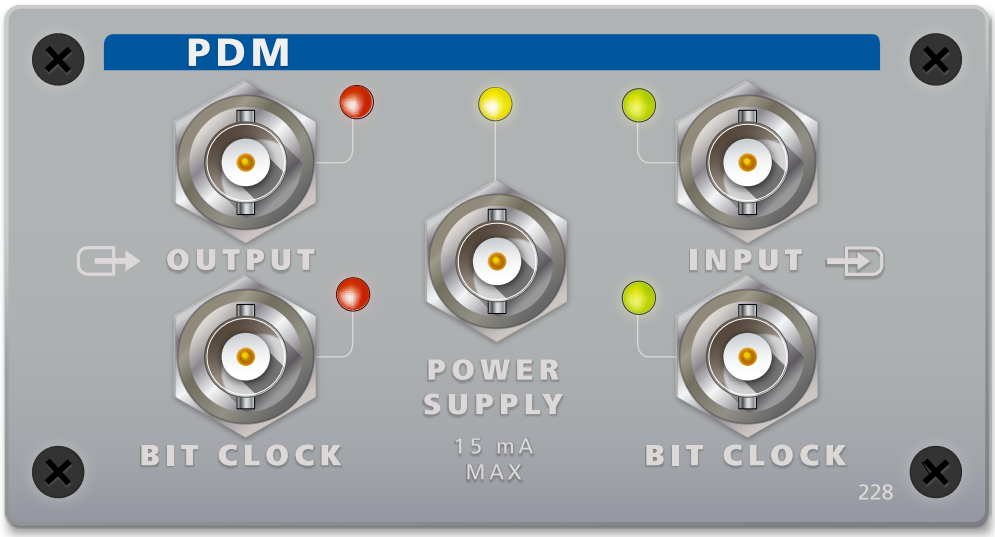
PDM I/O OPTION for APx

A complete solution for PDM device and mobile product testing

KEY FEATURES

- Direct connectivity to any device with a PDM input or output
- Support of independent audio channels on rising and falling edges
- Selectable clock direction for both input and output
- Undecimated bitstream analysis for diagnostics
- Jitter generation and analysis capability when paired with the Advanced Master Clock (AMC) option
- Flexible interpolation and decimation ratios
- PDM data control code I/O
- 0.8 to 3.3 V logic levels
- 0.0 to 3.6 V Vdd supply
- Power Supply Rejection measurements with PSR Frequency Sweeps
- Compatible with APx555, AP52x and APx58x series



The APx PDM option

PDM (pulse density modulation) is a one-bit, high clock rate data stream used with MEMS (Micro-Electro-Mechanical System) digital microphones, class D amplifiers, and digital signal processors used extensively in mobile products such as smart phones, tablets, notebook PCs, and wearable devices. The PDM option allows APx500 series audio analyzers to connect directly to any device with a PDM input or output, enabling comprehensive testing of audio for the fast-moving mobile electronics industry.

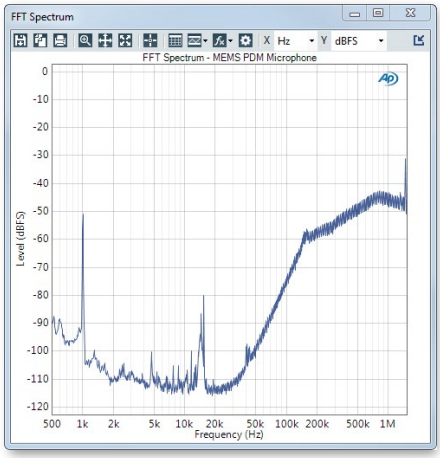
In addition to all the standard audio measurements, the PDM interface provides jitter impairments and jitter measurements*, a variable logic level down to 0.8 V, a variable Vdd DC supply voltage for MEMS device testing, variable sample rates, and a PSR measurement to test the device's full operating parameters. PDM (mono or stereo) can be selected for both the analyzer inputs and outputs simultaneously; alternatively, PDM as an input or output can be complemented with other available I/O formats. A special PDM bitstream mode permits analysis of the entire spectrum, bypassing the decimator.

Designed with PDM amplifiers and MEMS microphones in mind

MEMS microphone designers can connect their device output directly to the PDM input, taking advantage of both an integral clock and device DC power availability. A special suite of acoustic response measurements makes MEMS transducer testing fast, easy, and efficient, even in non-anechoic environments.

Until recently, semiconductor R&D engineers working on new PDM class D amplifiers and decimators have had no PDMA reference signal solution. Now they can immediately put the APx PDM to work, generating modulated PDM bitstreams and sending them directly to their devices with no further conversion or hardware.

The built-in generator and jitter analyzer simplify jitter tolerance testing without external analysis equipment.



Output of actual MEMS PDM microphone captured by an APx analyzer, showing a 1 kHz test tone and the effects of noise shaping above the passband.

Requires Advanced Master Clock (AMC) option

An Integrated Solution

The APx PDM option has all the functionality needed and is embedded in a fully-featured APx audio analyzer, enabling quick connection and sophisticated testing. APx500 measurement software provides over 30 customizable audio measurements, all of which can be easily put under automation control.

A Flexible PDM Modulator and Decimator

The APx PDM modulator provides a reference quality signal, embedding pristine audio from the APx generator. The flexible PDM input decimator simplifies direct audio measurements on PDM bitstreams.

Bitstream Analysis

PDM-to-PCM converters can decimate the embedded audio for testing, but the PDM option also makes the raw bitstream available for FFT analysis, an invaluable diagnostic tool.

PSR and PSR vs. Frequency

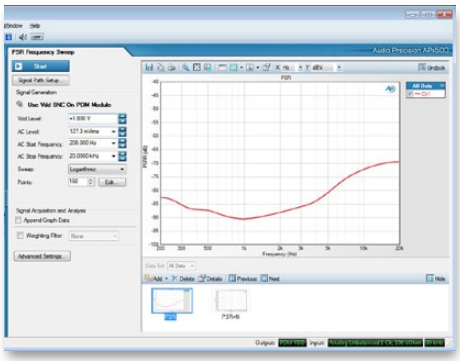
The MEMS device Vdd supply can be modulated with a sine wave or the standard GSM 217 Hz square wave. The APx software includes both PSR and PSR frequency sweep measurements; these can be used with analog MEMS microphones as well. A couple of clicks and you have PSR results.

Full Sampling Rate and Logic Level Ranges

Both the PDM input and output support audio sampling rates across a range of 4 kHz to 216 kHz. The logic level is variable from 0.8 to 3.3 V to test beyond the range of typical devices.

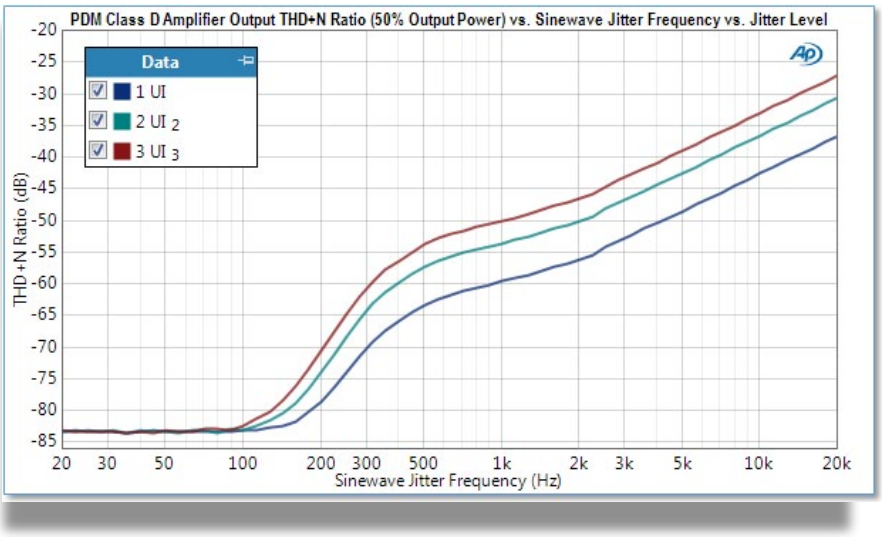
Jitter Tolerance Testing

The jitter generator and jitter analyzer provided with the Advance Master Clock option supports full PDM device jitter tolerance testing. Sweeps of jitter level and frequency may be performed to confirm proper device jitter tolerance for reliable use in circuits intended for noisy RF environments common to mobile phones and tablets.



Measuring the PSR of a MEMS microphone with a PSR frequency sweep of Vdd sine wave frequency.

APx525 2 -channel analyzer shown with digital I/O, digital serial, PDM and *Bluetooth* options.



A test engineer measures the jitter tolerance of a PDM class D amplifier. If desired, the result can be added to a larger automated sequence of measurements and then output to a formatted MS Word document or a database.

KEY SPECIFICATIONS

AUDIO PERFORMANCE

SNR
129 dB (1 kHz, BW, unwtd, 256x oversampling, 4th order modulator)

THD+N
-130 dB (1 kHz, BW, unwtd, 256x oversampling, 4th order modulator)

Dynamic Range
137 dB (AES 17, CCIR-RMS,256x oversampling, 4th order modulator)

Flatness
±0.001 dB (20 Hz to 20 kHz)

Connectors
Output data, output clock, input data, input clock, external power (all via BNC)

INTERFACE

Sample rate range
4 kHz to 216 kHz

Bit clock range
128 kHz to 24.576 MHz

Oversampling Rate
32, 64, 128, 256

Interface Logic Levels
0.8-3.3 V

Edge Modes
Rising edge, 1 channel; Falling edge, 1 channel; Stereo (Both edges), 2 channels

Vdd Output
0.0-3.6 V, 15 mA max

JITTER PERFORMANCE

Jitter Generator Waveforms
Sine, Square, White Noise

Jitter Generator Frequency Range (FJ)
2 Hz to 200 kHz

Jitter Generator Amplitude Range
0 to 1591 ns peak for FJ ≤ 20 kHz (Sine)
0 to 40 ns peak (Square & Noise)

System Residual Jitter
1.0 ns

Jitter Measurement Range
0.0 to 650 ns, 50 Hz to 150 kHz

Jitter Measurement Detection
RMS, Peak, or Average

Modulator maximum input level
-0 dBFS

Interpolation Ratios
33 ratios from x16 to x800

Decimation Ratios
45 ratios from x1 to x800

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