



# FINALLY, DIGITAL PERFECTED.

M Scaler

• CHORD •

Chord Electronics Ltd.



**The Hugo M Scaler is a revolutionary new component, the first of its kind, that will profoundly change the way you hear digital music. The M Scaler features Chord Electronics' groundbreaking upscaling and digital filter technology. It will take any digital file and bring it closer to the original master recording than any other digital component on the market today.**

## Background

The original technology associated with the CD called for sampling of the master recording 44,100 times a second. It was soon very apparent that something was lacking in the sound reproduction—it was harsh, two-dimensional, lifeless. The human ear and brain need to be presented with far more detailed information for there to be a satisfying listening experience. The audio industry has been endeavoring ever since then to make up for the inherent shortcomings of the format.

Thirty-five years after the introduction of the CD, some would think that huge leaps forward would be improbable at this point. The Chord Hugo M Scaler proves without doubt that is not the case. It may in fact be the single greatest advancement in digital sound reproduction ever. The Hugo M Scaler offers the world's most advanced upscaling technology, taking digital files from any source and transforming them into audio that's virtually indistinguishable from the original analog performance.

## The Problem with Digital

The creation of a digital music file by definition requires taking a "snapshot" or "sample" of the music waveform many times each second and digitizing those samples. In the case of a CD quality music file, a sample of the

music is taken 44,100 times per second. These digital samples approximate the music waveform and will later be converted back to analog in order to be played through your audio system.

At 44,100 samples per second, there's a gap between samples—22 microseconds to be exact. The problem is musical timing and transient information also occurs in these gaps and whatever information that exists in the gaps is lost when creating the digital file.

DACs can't recover missing timing information—they simply miss the start of the transient. Blurring of transients is the result. That gets confusing for the ear and the

brain. Which means we won't perceive timbre or sound-stage or the pitch of bass instruments properly.

Initially it was thought that the small losses between the samples would be indiscernable and that digital music files would deliver perfect sound. Today we know this was not so. The reality is the brain can discern definite differences between digital and analog music formats, and those tiny errors have a big impact on sound quality.

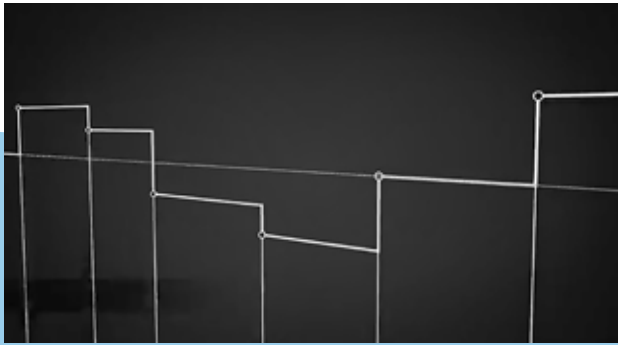
## What is Upscaling and Do I Really Need It?

Chord's 16 times upscaling is a breakthrough technology that essentially recaptures the data lost when creating a digital file of an analog musical performance.

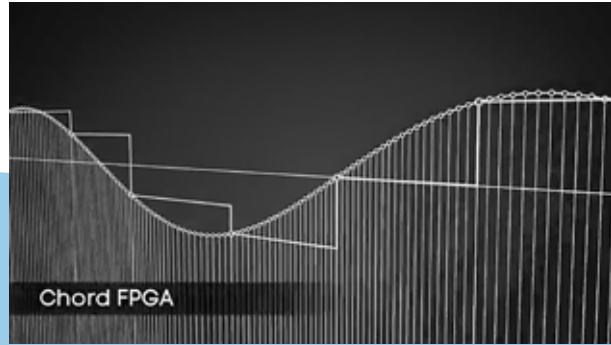
The Hugo M Scaler acts like a "pre-DAC". It takes the digital file and repairs it, adding back the information lost between the samples, then it sends the repaired file to the DAC. The M Scaler increases the sampling rate from 44,100 times per second (44.1 KHZ) by a multiple of 16, to 705,600 times per second (706.6 KHz). With 705,600

samples per second, a huge amount of important information that was lost when creating the 44.1 digital file is now recovered. The more samples, the closer you get to the original analog signal.

In essence the Hugo M Scaler places 15 additional new musical samples in between each original musical sample resulting in an astounding improvement in the recreation of the original music signal.



**Without Hugo M Scaler**



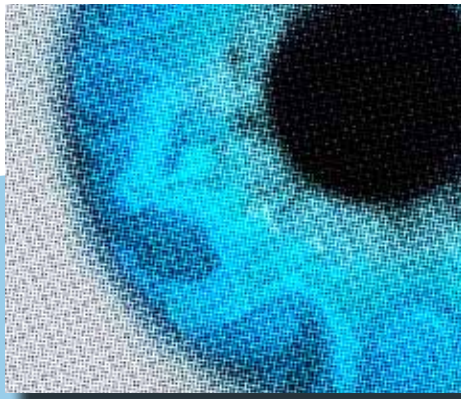
**With Hugo M Scaler**

As illustrated above the Hugo M Scaler takes a rough stairstep CD waveform and transforms it into a smooth analog-like waveform. With that quantum leap in sampling comes a breathtaking leap in detail, accuracy and realism in your music.

## The Key to the Reconstruction of the Analog Waveform: Tap Length and the WTA Algorithm

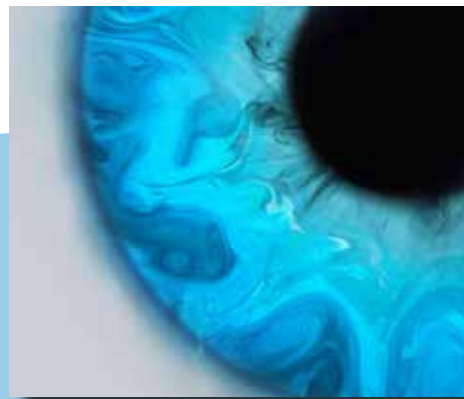
Rob Watts, Chord's Digital Design Consultant, has developed his exclusive WTA (Watts Transient Alignment) technology, which incorporates the most advanced interpolation filter of its kind in the world. That mammoth processing power allows for a huge breakthrough in what's known as tap length of the filter—to a previously unimaginable 1,015,808 taps.

Watts believed the loss of transient information was robbing digital music of its authenticity. A transient is a sudden change in the music signal—the initial plucking guitar string, for instance, which helps the brain determine pitch. Transients also affect our perception of the timbre of an instrument. Without transients, we would hear no difference between the sound of a trumpet



### Without Hugo M Scaler

A magazine photo reproduction uses small pixels to re-create the original image. It's a rough approximation, much like digital audio.



### With Hugo M Scaler

The original is sharper, clearer and much more realistic because it is an analog representation with no data lost by the digitizing process. Hugo M Scaler restores the lost data to faithfully recreate the original audio signal.

and a piano. Not only that, transients affect how we perceive the placement of sound sources—the soundstage. Rob Watts had a mission—to reconstruct those transients far more accurately—by changing the algorithm and increasing the tap length. What he managed to achieve is remarkably close to what a theoretically perfect sinc function would accomplish—a perfect replication of the original analog waveform.

To perfectly reconstruct an analog signal, you'd need an infinite amount of processing—and an infinite filter tap-length. Unfortunately, that's just not possible. But the Hugo M Scaler does manage to approach theoretical perfection—by employing the advanced WTA algorithm and vastly increasing the tap length—thus allowing digital data to be output at up to 768kHz.

Simply put, taps are a measure of device's capacity to reproduce the original waveform. The longer the tap length of the filter, the closer it gets to the original analog signal. What's more, the more filter taps, the better the transient timing—which is a very important component of how humans process music.

With this ingenious technology, the M Scaler doesn't do a crude interpolation like all other filters or "guess" to fill in the dots between each step. It peers deep into the actual data itself, as if looking under a microscope, and reconstructs the missing waveform in its exact original form thus creating an almost perfect new digital version of the original analog performance.

The Hugo M Scaler quite literally represents the realization of a lifelong dream for Rob Watts. Half a million lines of code and hundreds of listening tests later, listeners can now experience something they never could before—a huge difference in resolution, bass definition, sound staging, instrument separation and focus and more varied instrument timbre.

The Hugo M Scaler is a truly groundbreaking new component that will profoundly change the way you hear digital music. Short of going to a concert hall, there is simply nothing else, digital or analog, that can bring you closer to the actual performance.



## A Brief History of Tap Length

The original Chord Electronics DAC 64 had 1,024 taps. In 2008, the state of the art was 18,000 taps. In 2015, 164,000 taps. Each successive increase in tap-length, together with continuous improvements to the WTA algorithm, has resulted in markedly better sound quality. The Hugo M Scaler delivers an incredible 1,015,808 taps—a goal first imagined by Rob Watts back in 1981. The result? Far more accurate reproduction of transients, a stunningly lifelike soundstage, as well as a massive improvement in bass definition and instrument timbre.

## The Hugo M Scaler Is A Remarkable Breakthrough In Digital Sound. Here's What The Reviewers Are Saying.

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“Quite candidly, the M Scaler makes substantial, across-the-board improvements to almost every qualitative aspect of the sound... the unexpected sonic improvements I heard left me slack-jawed with astonishment ...Once you hear the M Scaler in action, there's no going back.”

—Chris Martens, hi fi+

“If you want the best, the M Scaler is a must-listen... you end up with a sound not available elsewhere. This is a unique and extraordinary product.”

— Noel Keywood, Hi-Fi World

“With the M Scaler in the signal path, this underlying tension is eliminated to reveal utterly natural, complex and smooth timbres, excellent dynamic expression and appropriate detail rendition with zero negative aspects.”

—Edgar Kramer, Soundstage Australia

“Huge difference. Suddenly everything becomes alive and real. You're hearing the original performer in the studio. It's as if you have access to the original microphone feed.”

— Rob Watts, Chord Electronics

## Works With Everything.

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The Hugo M Scaler is inserted in your system ahead of the DAC— it is not a DAC and it does not replace your DAC. The M Scaler improves the sound of all digital audio systems. It works with all digital files and streaming services and all digital source components; streamers, smart devices, computers, CD/DVD players and video systems.

The M Scaler works with all DAC brands so you don't need a Chord Electronics DAC to get the benefits of upscaling. Even if you have an older DAC that only accommodates 4 or 8 times upscaling, you will still get a very worthwhile improvement in sound quality when adding the M Scaler to your audio system.

