DAN'S REFERENCE DIGITAL SYSTEM

11/20 for Chord DX DACs

(November 2020, www.audiowise.ca, dan@audiowise.ca)

SUMMARY

This reference system represents a culmination of 24 months of product development, measurements and listening tests. It's a testament to the high quality of sound reproduction that's possible through extreme isolation of the already excellent Chord DX DACs. From the outset, I followed the guiding principle that the DAC's final D/A conversion is all that matters for digital sound quality. The translation of recorded digital music from bits to volts at close to the theoretical limits is all that can be hoped for and that's what I wanted to achieve.

The sound fidelity experienced by my ear/brain was dependent on the sonic transducer being used (monitor, speaker, headphone) so my choice of Focal SM9 Studio Monitors—an industry reference—was essential for this task. I adopted a nearfield listening position in order to judge highs, mids, lows, transients and staging as accurately as possible. Basically I wanted to accurately discern changes in my reference setup in much the same way a recording engineer can reliably hear how mix effects alter the music.

Audio measurements were used to confirm my listening tests. I initially used an Audio Precision to establish baseline performance but soon realized that audible levels of transparency could not be resolved by the noise floor of this tool. I moved to a Spectrum Analyzer to measure out-of-band noise (from 100MHz into the GHz range) and found that it was a corollary for sound quality. Less Radio Frequency (RF) noise measured at the input or output of a DAC indicated better sound. Mainly, however, I used my ear/brain to confirm an improved Qualia even when I could not measure the audible change.

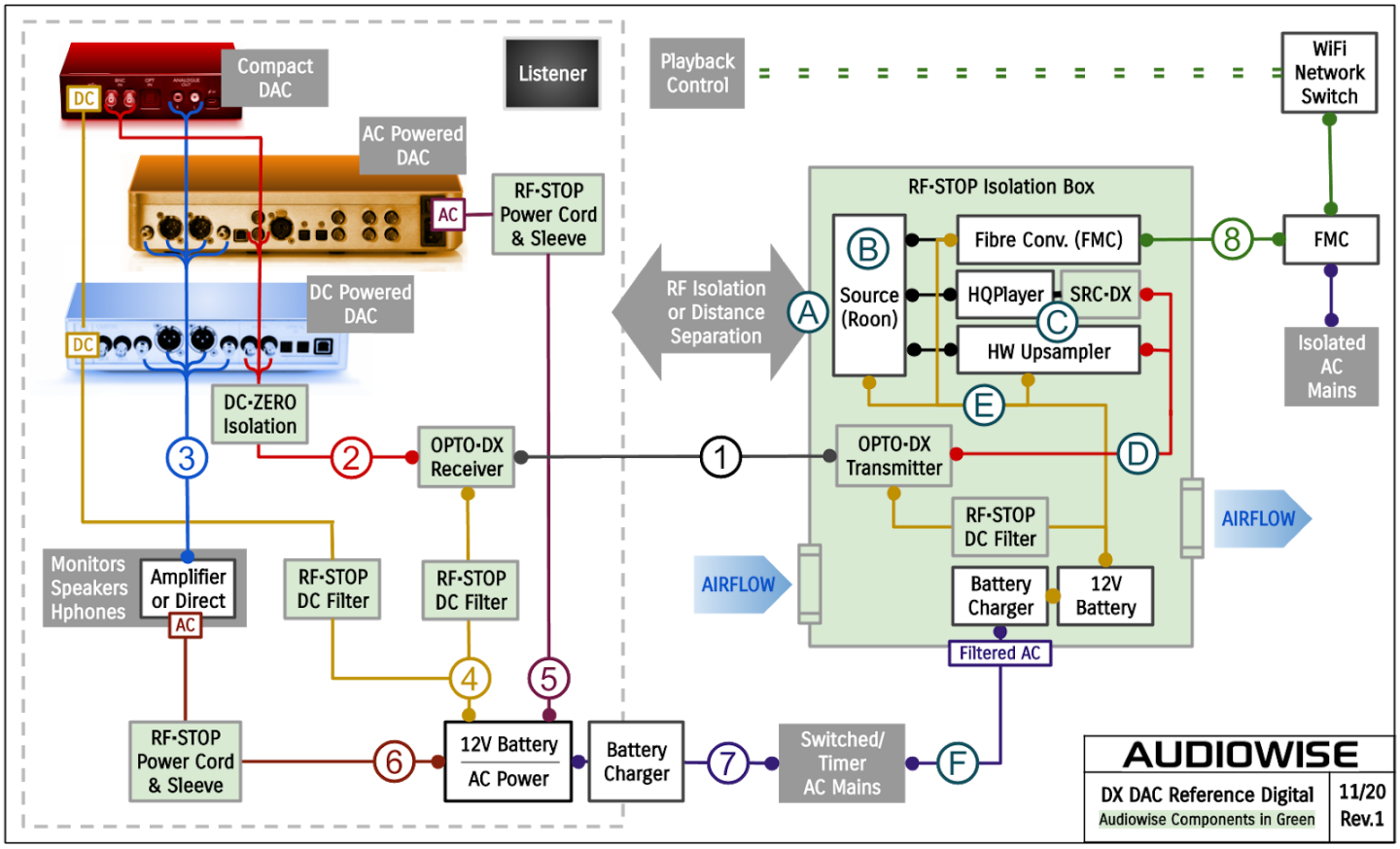
The choice of the Chord DX signal interface allowed use of OPTO•DX's all-analog (no re-clocking) optical modulation supplemented with noise blocking filters on the BNC inputs. My system design also incorporates features to fully isolate power and radiated RF noise. Early on I realized that the AC mains affected the sound during the course of a day ..no matter if I used isolation transformers, tricked out power bars or power regenerators. The final solution was to avoid AC by using batteries and DC powered components with added RF filtering. Additionally, I confirmed the real effects of radiated RF noise—the bane of digital audio—so I developed RF•STOP Isolation Box and the same Faraday technology used to shield digital components was used for power cable isolation sleeves.

So, my reference system is an amalgam of all these products into endgame DAC isolation that, IMO, is the best sounding digital reproduction system on offer. A bold statement but I've heard the magic of total transparency from the highest end DACs and, although my system may not have an integrated luxury aesthetic, it's highly cost-effective at revealing a DACs absolute best sound. My approach to electromagnetic isolation uses boxes and wires and rules of connection that is akin to the electromechanical isolation required of a turntable and stylus to extract the best sound from vinyl.

I am providing my reference system for DX DACs as an annotated connection drawing plus a costed component summary with supplier links. This is a living document that will be extended to include USB DACs early next year. I will be posting a measurement summary and updates via my blog. My system can be configured a-la-carte or adopted in-toto for maximum enjoyment; however, the incredible dynamic range and prodigious amounts of detail offered does require the best quality speakers, headphones and analog cables.

-- Dan Mance

ANNOTATED DRAWING



Ⓐ	• Install digital components into a RF•STOP Isolation Box to eliminate radiated RF/EM noise effects at the DAC. • Organize components for optimal ventilation. Use mezzanine shelving and active cooling as required. *OR* • Separate the digital components and DAC as much as practical. Locate digital components on another rack. • Note that RF•STOP Isolation Box provides the electromagnetic equivalent of 500 meters distance separation.
Ⓑ	• Source is an Intel NUC or other small computer system configured with Windows, Mac or Linux. • A high performance CPU is not required - iCore 5 is sufficient. A low power/thermal profile is important. • Use Roon or other audio software for playback of local and network/cloud content.
Ⓒ	• Upsample to 16Fs using a HW Upsampler or use HQPlayer SW Upsampler to achieve the same/better performance. Do not use Roon DSP settings. • Use SRC•DX to convert USB output to dual coaxial (DX). Use a USB 2.0 cable with ferrite chokes.
Ⓓ	• Connect the DX signal to OPTO•DX Transmitter using Dual Coaxial Cables.
Ⓔ	• Inside RF•STOP, supply 12V DC from a battery to OPTO•DX Transmitter, Source, FMC, and HW Upsampler. • Use a LiFePO4 (preferred) or Li-Ion battery for ultra low noise. A 120Ah battery provides 10+ hours of power. • Digital components are reliable with a range of voltages and 12V DC is the most compatible. • Avoid AC powered components. Use battery integrated AC power to avoid AC Mains connection during playback. • Filter the OPTO•DX Transmitter power path with an RF•STOP DC Filter for noise free optical modulation.
Ⓕ	• Supply power to the RF•STOP battery charger with a timed or mechanical switch to avoid connection to AC Mains during playback. • Use AC Filtering and RF•STOP Filtered Power Cable to minimize radiated RF noise leakage into the audio environment.

①	• Connect OPTO·DX Transmitter/Receiver with OPTO·DX optical cables of convenient length (1.5 meters). • Use Premium Grade to reduce modal dispersion. • For configurations not using RF·STOP Isolation Box, consider the longest possible optical cable for maximum separation distance (5+ meters).
②	• DX coaxial cables from OPTO·DX Receiver to DAC should use well shielded Belden 1694A or better. Use a short length to reduce antennae effects. • Connect DX to DAC via DC·ZERO Signal DC Isolation BNC adapters to eliminate signal/DC ground loops.
③	• Connect analog audio output from the DAC to an amplifier/monitors (line level) or directly to speakers/headphones using well shielded and well regarded analog interconnect/speaker cables. • Chord DX DACs are single ended designs so the RCA output provides the most transparent sound quality. Hence for balanced downstream components, use RCA-XLR adapters like the Neutrik NA2MPMM. • Chord HugoTT2 is the most transparent when set to High Gain mode.
④	• Supply compatible 12V DC battery power to DC powered DACs and OPTO·DX Receiver. • Choose a LiFePO4 (vs Li-ion) battery for the lowest electrochemical noise. • Use RF·STOP DC Filter to further reduce RF noise and to RF isolate each DC power path.
⑤	• Supply AC power to AC powered DACs from well isolated AC mains or from a battery with integrated AC. • Use a quality power cable or RF·STOP Filtered Power Cable in combination with a RF·STOP Sleeve.
⑥	• Supply AC power to monitor speakers and amplifiers from well isolated AC mains or from a battery with integrated AC. • Use well shielded power cables or RF·STOP Filtered Power Cables in combination with RF·STOP Sleeves.
⑦	• Supply power to the battery charger with a timed or mechanical switch to avoid connection to AC Mains during playback. Battery charge times of 4-6 hours are typically sufficient for a full day of operation. • Use AC Filtering and RF·STOP Filtered Power Cable to minimize RF noise leakage into the audio environment.
⑧	• Connect to the network with a pair of Ethernet Fibre Media Converters (FMC). One FMC is located inside RF·STOP at the Source, the other is located at the network switch. • Use a convenient length of industry standard optical fibre compatible with the FMC. • Locate network equipment on isolated AC Mains away from all audio components and use RF·STOP Filtered Power Cable to minimize RF noise leakage. • Control Music playback using Application Remote Control (Roon Remote, etc.) or Operating System Remote Desktop.

COMPONENT SUMMARY

It's assumed that customers will have an existing inventory of components, cables and misc. items that can be repurposed to a reference system. An inventory of such items is described below.

Component	Price (USD)
CABLES (AC, DC, Powerbars, Digital, Interconnects, Speaker, Misc.)	TBD
DAC (Chord Electronics HugoTT2)	$5,495
DAC (Chord Electronics Dave)	$10,900
PLAYER (Roon - Annual Subscription)	$119
SOURCE (Intel NUC w/Win10 Pro & 1TB Storage)	$650
SOURCE (Audiophile Low Noise Source)	TBD
AMPLIFIER (Misc)	TBD
TRANSDUCER (Monitors, Speakers, Headphones)	TBD

Required components for a **HQPlayer + TT2 + Headphones** configured reference digital system are provided below with total cost based on published list prices. Links to manufacturer sites or online retailers are valid at time of publication. Use this as a template for your own configuration or existing inventory. Note that accessory cabling or connectors may be required for a final working system. Contact Dan at Audiowise with any questions.

Component	Qty	Price (USD)
BATTERY (Dakota Lithium 12v 10Ah)	1	$99
BATTERY (Goal Zero Yeti 200X)	1	$400
CABLES (DC GhentAudio Star Quad)	4	$82
CABLES (DIGITAL Belden 1694A BNC Coax)	2	$35
MISC (TP-Link MC200CM Fibre Media Converter w/10meter MM Fibre)	2	$60
MISC (TRIPP LITE UltraBlok428)	1	$40
UPSAMPLER (Signalyst HQPlayer Desktop License)	1	$255
DC-ZERO (Pair)	1	$295
OPTO-DX (1.5m Premium Optical / 1 pair coax)	1	$930
RF-STOP (DC Filter)	3	$195
RF-STOP (Large Isolation Box)	1	$3,995
RF-STOP (Filtered Power Cord)	3	$82
SRC-DX (With 2 Patch Coax)	1	$465
Total		**$7,828.00**

For more information, please contact Dan Mance via email: dan@audiowise.ca or voice/text: +1 905 407 8144