Cadac CDC Seven Digital Mixing Console

By: Mel Lambert

Derived from the CDC Six assignable console—reportedly, Cadac's best-selling digital system—the new CDC Seven features dual user screens, 36 channel faders, and the ability to handle 96 simultaneous input sources. The live-performance mixing system utilizes the same proprietary DSP mix platform, operating system, and highly intuitive user interface to be found in several other offerings within the current Cadac product range, allowing operators to move from different configurations without needing to relearn a new paradigm.

In essence, the CDC Seven extends the basic topology of the CDC Six, with its SHARC chips and fast FPGA-based processing by adding a second screen, increasing the number of on-surface motorized faders to 36, and expanding the input count to 96 fully featured channels, along with 56 busses, 48 of which are configurable as group, stereo group, aux, stereo aux, or matrix plus LCR, monitors, and talkback outputs. All of the CDC Seven's channel faders feature stereo metering, with a full-color, user-definable OLED display above each fader for source identification. Overall dimensions of the compact control surface are just 61.2" x 30.1" x 10.2" (WxDxH); it weighs 132lb. Suggested pro-user price is close to $44,000 for the console controller with a CDC PSU 4800 power supply; add-on networked I/O units compatible with AES/EBU and MADI digital formats, plus a 12-port router, range from $2,800 to $6,900.

Because processing latency can have a major impact on both sonic quality and stage-monitor flexibility—artists will be thrown off their perform-ance if there's excessive delay in IEMs and/or wedges—Cadac has innovated its own digital audio networking topology. MegaCOMMS provides total through-system propagation delay at 96kHz, from on-stage inputs to outputs via 490' of coax cable—including all console processing using industry-standard, 32/40-bit floating-point SHARC processors and A-to-D/D-to-A conversion—of a quoted 37 samples, which equates to a remarkably low 400-microsecond delay. Courtesy of an automatic latency management system that manages internal routing and processing delay, all audio samples are said to be synchronized before summing, resulting in phase coherency at all outputs. Adding a MegaCOMMS router expands the network to 3,072 available channels, while the CDC MC Optical bridge extends the maximum connect distance between networked devices up to 6,500'. The console can also be integrated with other network protocols, including AES/EBU, MADI, and Audinate Dante, via add-on Cadac networking bridges.

But the jewel in the CDC Seven console's crown is audio quality. Utilizing custom-designed pre-amplifiers, internal circuitry, and state-of-the art A-to-D and D-to-A converters, all outputs sound clean and pristine, more like the results you might achieve with a recording console than a live-sound board. Once again, Cadac's hard-earned reputation for enhanced sonic fidelity puts high-end processing power in front of users who want to offer CD sound quality—and beyond—during live-performance events. The company's engineering department

A rear view of the console.

states that Cadac digital consoles bear the hallmark of analog origins that can be traced back beyond the J-Type,—which is still in production after nearly 25 years—and the firm's classic recording desks. A combination of analog-emulating algorithms and 24-bit/96kHz Sigma Delta converters is said to offer audio performance that retains the traditional wide dynamic range and low noise floor of analog, while the Seven's automatic latency management manages all internal routing and associated processing latency to ensure absolute phase coherency at all outputs, Cadac states.

## Dual-screen display with innovative user interface

The CDC Seven features dual 23.5", optically bonded display screens running what can only be described as a high-agility user interface, with all controls normally only a couple of clicks away from being vectored to the appropriate command screen and corresponding buttons, encoders, and faders. The second screen lets the user simultaneously display and control several tasks—maybe VCAs on one screen with inputs to each VCA on the other—with instant access to faders and rotary controls that follow the GUI displays on each individual screen. Accessed via these bright, high-contrast screen displays, the console interface is less menu-dependent than traditional live-sound consoles, resulting—I would hazard—in a dramatically reduced learning curve. Encoders located to the right and bot-

tom of both screens work in conjunction with a familiar touch-and-swipe user paradigm. An integrated, precon-figured 64-by-64 Waves interface enables direct multitrack recording to a companion laptop, plus connection to a Waves MultiRack SoundGrid server for operator access via the left-hand touch screen to Waves-brand plug-ins running on the SoundGrid server.

The CDC Seven's control surface literally bristles with display screens and color IDs. In addition to the pair of 16:9, high-definition touch screens, a 6.5" LCD touch screen enables system control, with 40 OLED color displays for input and output labeling, and 20-segment stereo channel metering. A total of 48 of 56 available busses can be assigned as mono or stereo groups, mono or stereo aux, or mono or stereo matrix outputs. The base system, less any connected I/O racks using a variety of digital protocols, features eight mic inputs with 48V phantom power, pad and 1dB

gain steps, and eight line outputs, plus four assignable AES/EBU-format two-channel inputs and four AES/EBU outputs. These analog and digital ports can be used for local signal sources, or to form a compact, self-contained system if a minimum number of I/Os need to be accommodated. The external 2U power-supply chassis can be augmented by a second rackmount PSU with full redundancy.

Each assignable signal path features a four-band, fully parametric EQ section and flexible dynamics, with eight mute groups and 16 VCA groups available to the user, including a useful VCA unfold function that lets you see what sources currently are assigned to the target group for fast adjustment. A total of 16 stereo onboard effects are available, plus a flexible compressor/limiter and a dedicated 31-band graphic equalizer on all outputs—in addition to the "standard" four-band parametric EQ—for possible use on monitor sends, for example. As
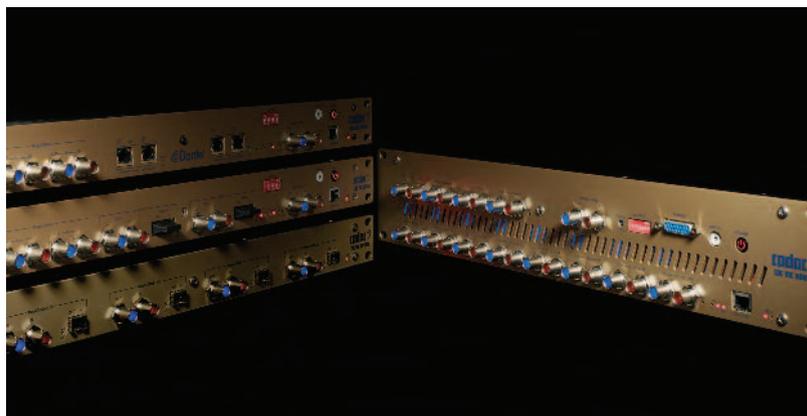
Cadac says its MegaCOMMS digital network allows the audio infrastructure to be designed to meet the requirements of the most challenging applications.

The VCA screen. There are 16 VCA groups and eight mute groups with OLED displays for assignment labeling on the CDC Seven.

would be expected, snapshot automation with save/recall to/from user-defined libraries is standard, together with selectable languages for on-surface labeling; input and output delay also is available on all signal paths.

Utilizing the same operating system developed originally for Cadac's flagship CDC Eight, the Seven is less dependent on scroll-down menus, a feature that dramatically reduces the learning curve. Each high-definition touch screen features digital encoders to the bottom and the right, with corresponding graphics that, in addition to the on-surface control elements, lead to a highly intuitive user paradigm. Since each channel, monitor, VCA, or output fader follows a screen swipe or channel scrolling, the user has unrestricted control at all times to any combination of inputs, outputs, or VCAs displayed on either touch screen. In addition, the stereo metering located to the left of each 100mm fader, and companion OLED display showing color-coded channel names, dramatically streamlines channel navigation; the same OLEDs also denote any VCA assignment for that channel. The smaller touch screen, located to the left of the two main screens, provides quick access to the advanced system controls and automation functions.

Burrowing deeper into the CDC Seven's mixing and DSP capabilities, 96 of 192 available input sources—including the eight local I/Os—feature 24-bit A-to-D and D-to-A converters plus 40-bit floating-point processing at 96kHz sample rates to provide a quoted 20Hz – 44kHz +0.5/-1.5dB frequency response, under 0.005% THD+N at unity gain/10dB input at 1kHz, better than 90dB channel separation, less than -90dBu residual output noise (20Hz – 20kHz) and lower than -127dB residual output noise with 200-ohm source impedance; maximum output is a quoted 21dBu.

MegaCOMMS TDM-based network topology

Cadac's proprietary MegaCOMMS network utilizes a robust, bidirectional time division multiplex (TDM) configuration that allows 128 channels of 24/96 digitized audio, control data, and clock to be carried up to 490' via a pair of conventional RG6 coaxial cables in a parallel topology for redundancy. The phase-aligned clock signal ensures reliable, low-jitter synchronization of all networked hardware elements. The network is said to enable an audio infrastructure that meets the specific requirements for permanent venues or touring systems, using a

range of plug-in I/O cards, stage boxes, and network bridges, plus a dedicated router.

As will be appreciated, combining audio, control, and clock onto a single network dramatically simplifies connectivity, reduces set-up time, and eliminates a major investment in cabling. For larger networks, the MegaCOMMS router provides routing of over 3,072 channels of 24/96 audio with only an additional sample—around 10 microseconds—of propagation delay. For added security, the Seven's control surface, large-format stage boxes, and network bridges support dual-redundant connections, with automatic change-over in the rare event of a cable failure.

Currently available Cadac fixed-format stage boxes include the CDC I/O 3216, a 4U unit equipped with 32 mic inputs and 16 transformer-isolated analog outputs; the CDC I/O 6448, an 11U unit that features 64 mic-level inputs and 48 analog outputs; and the CDC MC AES3, a 2U unit that provides 18 AES3/EBU-format I/Os, equal to 36 digital channels. While up to a maximum of two CDC stage boxes can be connected directly to the rear of the Seven console, as many as 11 MegaCOMMS-capable units can be added via a CDC MC Router. The console automatically detects connected I/O units, with source/channel patching achieved on the touch screen. Remote control of stage-box mic preamps also is featured, along with signal-present, level-clip, phantom-power, and mute indicators for each output.

Other Cadac network bridging devices enable MegaCOMMS to connect via different protocols; these devices feature dual-redundant PSUs and dual-redundant connections to other MegaCOMMS-capable units. Asynchronous sample-rate conversion also is provided to other protocols, such as MADI/AES10 via the CDC MC MADI network bridge or Audinate Dante via the appropriately named CDC MC Dante network bridge. For

example, a Seven console being used to mix a live performance can be easily connected to a broadcast remote truck via a MADI or Dante network bridge. Each pair of MegaCOMMS ports is capable of transmitting 128 bidirectional channels of 96/24 audio.

The CDC MC MADI bridge enables MADI-compliant multichannel sources to be accessed via a MegaCOMMS network at 96kHz or 48kHz sample rates, with up to 64 inputs and outputs that feature sample-rate conversion/SRC on each coaxial and optical port, plus an independent word clock. Dual PSUs make the bridge appropriate for mission-critical installations. Usefully, the unit's coaxial ports light red for Rx/receive or blue Tx/transmit, which can streamline interconnections. The companion CDC MC Dante bridge also runs at either 96kHz or 48kHz sample rates, and can handle up to 64 Audinate Dante I/O ports, with integral SRC and word clock via coaxial ports; dual PSUs are standard, with red/blue lights for Rx/Tx.

For large installations, the CDC MC router features 12 pairs of MegaCOMMS I/O ports—sends and returns—for connection to a dozen devices, including other CDC consoles, stage boxes, or network bridges in a star-type configuration. Depending upon the intended use, the router can be set to single- or dual-redundant star arrays, using one of eight preset routing maps configured with a separate laptop via a standard RJ45 port. Any of the preset maps can be selected either from a front-panel rotary switch or from a dedicated hardware remote. Usefully, the MC router automatically and inaudibly compensates for any changes in audio level in the event that the user adjusts the input gain of any of the connected mic preamps. In this way, a stage box's analog inputs can be shared between a number of consoles, with sources connected to a common set of I/Os to provide multiple mix systems and/or to

The console features 36 faders with stereo metering.

set up fully dual-redundant systems, for example.

External devices can be located some 490' away via CAT6 cabling, up to 6,500' via optical links. Currently, the largest topology that can be created using a MegaCOMMS router would comprise, for example, a single master console surface and up to any combination of 11 other networked devices—including CDC Series consoles and/or MegaCOMMS-compatible I/O devices—to form an integrated audio network.

The CDC Seven's integral Waves interface provides access to not only familiar Waves EQ, dynamics, reverb/ambiance, and related plug-ins, but also a virtual sound-check that records up to 64 audio tracks straight to an external PC or laptop.

A Cadac Remote app for IOS-compatible devices, including iPads, controls key console features from virtually anywhere within a performance venue via a wireless router. Once connected

via a Wi-Fi network, the iPad app automatically detects and selects the active console type, and then provides monitoring in real time of both the input and output metering, as well as EQ adjustments and other major mixing functions. Since the app enables simultaneous use of multiple iPads, individual tablets can be dedicated, for example, to a single mix, thereby allowing on-stage artists to create their own monitor balances via the familiar Apple graphical interface, without changing any current console settings.

Finally, the built-in Waves interface also provides direct connectivity to the Waves MultiRack SoundGrid via a single CAT5e port; audio signals output to the SoundGrid server are processed and returned to the control surface to enable up to 64 channels of Waves plug-ins using a familiar GUI displayed on the console's touch screen, with EQ, dynamics, and reverb, for example, running simultaneously with the CDC Seven's built-in effects. For

THE CADAC LEGACY: A BRIEF COMPANY OVERVIEW

For close to half a century, the Cadac name has appeared on a wide range of leading-edge mixing consoles. From the early recording studio systems developed in the UK during the late-1960s through live-sound consoles used in leading Broadway and West End theaters plus on concert tours, the Cadac brand has become synonymous with setting high benchmarks for creativity and technical quality.

In fact, the company name derives from the first letter of each of the four co-founders' first names: Clive Green, Adrian Kerridge, David Bott, and Charles Billet, with the word "and" providing the last "A." In 1967 Green started working with Kerridge at the latter's Lansdowne Studios in West London, replacing the tube parts in a vintage EMI-brand console with solid-state devices and modifying it for eight-track recording. The following year, Green and Kerridge were asked to provide a console for the then-new Morgan Studios in North London; that first system—and many more in the years that followed—was the start of a long relationship between Cadac and Morgan. In 1984, a sound engineer from Morgan Studios was asked to put on a live show, *Little Shop of Horrors*; as a result, the first Cadac mixer was built for live theatre. The console spec was for "studio-quality audio" and a front-to-back dimension no deeper than a single row of seats.

The company's products soon dominated the theatre market, with reportedly close to 70% of shows using Cadac-brand consoles. They have seen service on multiple theatrical productions around the world, including West End performances of *Billy Elliot*, *We Will Rock You*, *Hairspray*, *Jersey Boys*, *Lion King*, and *Wicked*, in addition to Broadway performances of *13*, *Avenue Q*, *Chicago*, *Guys and Dolls*, *Gypsy*, *Hairspray*, *Mary Poppins*, *Pal Joey*, and *South Pacific*. (The

longest serving Cadac console in London was used on *Phantom of the Opera* from 1984 until 2008, providing 24 years of continuous service.) In addition, Cadac consoles have been used for concert touring by such performers as The Rolling Stones, Van Halen, Franz Ferdinand, Pavarotti, Andrea Bocelli, Status Quo, The Beach Boys, Tom Jones, and Bryan Adams.

Following the retirement of several company founders and a downturn in the market for large-format live-performance applications, Cadac Electronics was purchased by Xianggui Wang, of Soundking Group Company Limited, based in Ningbo, China. The renamed Cadac Holdings Limited started to design and innovate both analog and assignable digital consoles, in addition to developing the MegaCOMMS digital audio network. By allowing phase-aligned clock distribution via embedding markers with the data stream, synchronization of multiple hardware elements can be achieved across the network.

It addition to a small series of analog consoles comprising the compact LIVE1, modular S-Type and high-end J-Type, Cadac's all-digital series comprises: the flagship CDC Eight-32, with dual 24" touch screens and 32 input faders; CDC Eight-16, with a single 24" touch screen and 16 faders; compact CDC four, based on a proprietary DSP mix platform; CDC Six, with 64 input channels and 48 assignable busses and based on the CDC Eight's "high-agility" operating system; and the new CDC Seven, which is derived from the CDC Six, with dual screens and 36 on-surface faders capable of accommodating 96 inputs.

The current CEO is David Kan, with Nick Fletcher—a 25-year veteran of the company—serving as R&D director.

added flexibility, connection to a Waves SoundGrid server can be achieved from a laptop computer, enabling the use of third-party plug-ins during multitrack recording/playback for virtual sound checks using Waves' Tracks software, which provides 64 tracks of 24/96kHz audio. Of course, the Waves plug-in processors are patched in the same way as via the existing Cadac I/O racks, for send/return effects routing, or maybe

patched as inserts. Each of the Seven's input channels feature two ports that can be configured as either mic-input or playback, with global switching at the touch of an on-screen button.

SoundGrid can be configured in different ways to create a flexible mix environment, with a custom Waves app that configures the network; handles I/Os, controllers, and servers; and also patches audio throughout the

system. Any user, anywhere on the SoundGrid network, has access to any of the network's connected I/O devices with a claimed ultra-low latency via ASIO/Core audio drivers. Addition of a SoundGrid DSP server via a single Ethernet cable to the CDC Seven allows 64-track recording/playback, monitoring, and key sign processing to be moved off the console's host computer for enhanced efficiency, particularly with high plug-in counts.

The bottom line

In summary, the new Cadac CDC Seven—and its smaller relative, the CDC Six—packs a lot of easy-to-use mixing power into a small package. With plug-and-play expansion available via the firm's proprietary MegaCOMMS network, users can configure an I/O topology to match the targeted assignment, or grow the system as needs present themselves. The Waves SoundGrid enables flexible, off-board signal processing using industry-standard DSP plug-ins, as has become SOP for complex mixing projects. The 96-input count should accommodate all but the most complex productions, routing to 56 output busses via custom fader layers with full on- and off-board signal processing.

But there are a number of similar console offerings currently on the market that, maybe aside from the low-latency connectivity, can match these technical parameters. Where the CDC Seven scores over that competition, I suggest, lies in its sound; this is a digital console that is remarkably transparent and presents to an audience the nuances of voices and instruments as they really sound. That, dependent upon your point of view, can be a good or a bad thing, although there is no denying that the CDC Seven is a very revealing console; what you input is what you hear at the output. It's a remarkable achievement for any type of console, let alone one designed for live performance; the CDC Seven will reproduce every nuance of a performance, with a clarity and precision that is possibly without equal.

The dual touch screens, intuitive GUI with user-definable color displays, and touch-sensitive motorized faders, lets you reach the right channel, group, monitor, or VCA control within a minimum of key presses, and makes mixing highly interactive. What I like most about the CDC Seven is its extremely intuitive user interface, with sensible sized buttons and graphic displays. None of us is getting any

The Cadac Remote iPad app.

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younger, and the combination of less-than-stellar eyesight and low lighting can make it devilishly hard to interrogate and then select the correct control. The CDC Seven's bright screens, with human-sized graphics, are a joy to use; even the "exit command" button is an easy-to-understand cross-shaped icon. The user doesn't need to be a computer expert to navigate these screens, which are uncluttered by redundant verbiage and micro-graphics; the result is a dramatically shallow learning curve.

Planned enhancements within the upcoming V4.0 software include "Sticky Channels," which enable channels to remain anchored to target faders as the user bank switches between configurations.

My sincere thanks to Ron Lorman, director of operations with Cadac USA, and associate Brian Risner, for a conducted tour of the CDC Seven at Studio Instrument Rentals, Hollywood and patience with my probing questions, as well as providing some high-caliber playback material. 📶

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