RHAON: Renkus-Heinz Audio Operations Network

By: Alan Hardiman

If you're looking to set up, manage, and monitor a high-quality performance sound system from a single software interface, look no further. RHAON is a new loudspeaker control system from Renkus-Heinz designed to integrate powered loudspeakers into digital audio networks. Pronounced like "rayon," it is an acronym for Renkus-Heinz Audio Operations Network. It is comprised of a network interface and software-controllable digital signal processing available in the new Class D amplifiers in the company's self-powered loudspeaker systems, and the Rhaon PC-based software, which comes complete with a proprietary graphical user interface.

The system has been developed to afford users complete control over three distinct but interrelated processes: audio distribution, system optimization, and system control and supervision. In researching the product, I found Rhaon to be easy to learn and operate, elegant, and cost-effective. In fact, it would be almost irresponsible of any consultant or contractor not to take a good look at Rhaon before specifying a performance sound system for any new facility or renovation.

For this article, I attended a demonstration of the system at the offices of Renkus-Heinz's Canadian representative, Contact Distribution, where it was configured with two Sygma SG121 two-way powered loudspeakers and two SG12S active subwoofers. Also attending the demo was Martin Van Dijk, senior designer with the consulting firm Engineering Harmonics, which has some 85 projects at various stages of completion around the world, representing a total capital value of around $100 million in multimedia technology. Engineering Harmonics has specified Rhaon systems into both the Wyly Theatre and the Winspear Opera House, two facilities in the new Dallas Center for the Performing Arts slated for completion next year.

Audio distribution

Rhaon amplifier modules are available as options for all Renkus-Heinz self-powered loudspeakers. CF, Sygma SG, PN, and ST series loudspeakers, as well as powered Iconyx digitally steerable arrays, can be Rhaon-empowered. Additionally, a few systems are available only in Rhaon-empowered versions, including bi-amplified two-way systems, tri-amplified three-way systems, and the VerSys networked line array system.

A Rhaon deployment consists of at least one Renkus-Heinz self-powered loudspeaker system connected via a network interface and Cat5 cable (up to 100m) to a PC running the Rhaon application. Systems can be configured to include digital audio sources, such as CobraNet-enabled mixing systems, routed to multiple loudspeaker systems in a distributed sound system, all routed over a CobraNet digital audio network. Up to 64 channels of 24-bit, 48kHz digital audio can be routed through Rhaon.

Developed and licensed by Cirrus Logic, CobraNet technology allows multiple channels of uncompressed high-quality bidirectional digital audio to be transported over standard Ethernet, along with control data. The technology accommodates a wide array of devices from different manufacturers, including mixing consoles, outboard gear, playback equipment, and amplifiers, so a complete performance sound system can be configured around CobraNet. To date, CobraNet technology has been licensed by more than 40 manufacturers.

Ralph Heinz, Renkus-Heinz's senior vice-president, notes in a white paper that "CobraNet was first used in the background music system of Disney's Animal Kingdom in 1997. Today, [it] is installed in thousands of government hearing rooms, stadiums, convention centers, houses of worship, and touring shows."

Using the Rhaon GUI software, input-output routing is straightforward. Drag-and-drop execution permits easy assignment of Rhaon-empowered loudspeakers to CobraNet devices upstream.

With a CobraNet implementation, ground loops, crossed signals, polarity reversals, and other wiring errors are things of the past. A less obvious advantage of CobraNet over conventional audio distribution systems is that bulky conduit and heavy gauge wire pulls are eliminated, resulting in dramatically reduced installation and troubleshooting costs. "There are no grounding or cable-loss issues with network cable, and it's much less expensive to install than copper when significant numbers of audio channels are required. Generally, on large projects, conduits cost less to install if the electrical contractor performs the work, as opposed to the audio-visual contractor," Van Dijk says.
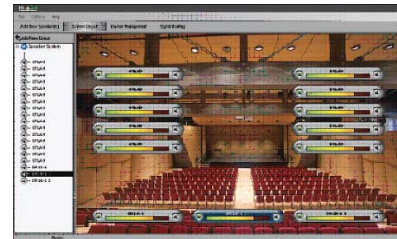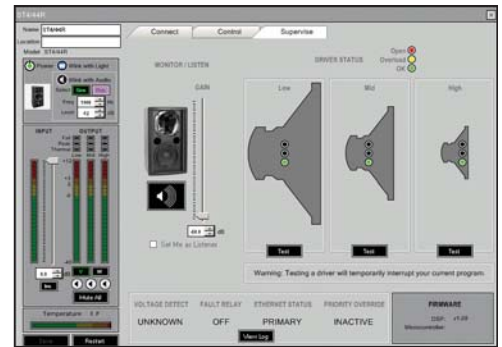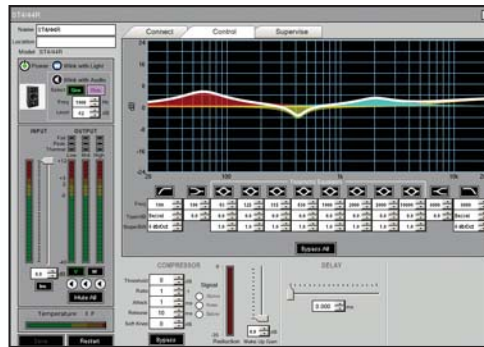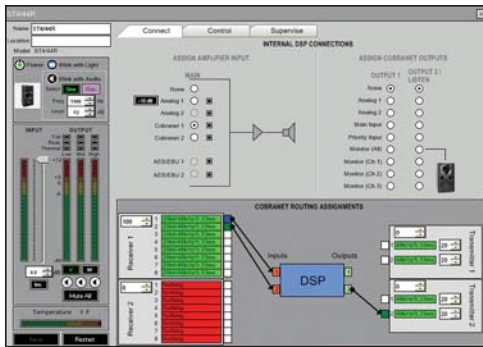
Incidentally, installers should exercise caution in selecting cable for audio purposes. "Standard Cat5 Ethernet cable is not particularly friendly compared to normal audio cable. Its maximum pull rating of 25lbs. has been a limiting factor," he says. "If you pull harder than 25lbs. on a typical Cat5 cable, you've exceeded its rating and it is no longer guaranteed to work. Also, the standard Cat5 connector is far too fragile for portable audio applications. Four years ago, Neutrik developed a Cat5 connector—the EtherCon—that handles like an XLR, but it's only within the last two years that Belden has developed a portable Ethernet cable that handles like a microphone cable and is strong enough for field use."

While CobraNet makes for perhaps the most elegantly integrated audio distribution system, its use with Rhaon is optional. The Rhaon GUI operates with analog audio and AES/EBU digital audio as well as CobraNet. AES/EBU digital audio inputs on XLR connectors and analog inputs on both Phoenix and looping XLR male and female connectors afford the system installer additional flexibility. When the AES/EBU inputs are used, the analog and CobraNet inputs are automatically disabled. Rhaon also incorporates an auto-override feature that works in conjunction with an independent alarm system for applications requiring fail-safe switching for life safety functions.

When the analog or digital inputs are used in a non-CobraNet implementation, the Ethernet component of the system is used only for bi-directional data transmission in Rhaon's system optimization, control, and supervision routines.

System optimization

Optimizing a loudspeaker system is a two-step process. The system must first be set up correctly at the factory, its driver-alignment delay, equalization, crossover filtering, and gain tweaked for best performance according to its design criteria. Rhaon-empowered systems include an advanced overdrive protection scheme programmed at the factory to

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reduce the onboard limiter threshold at frequencies that may cause over-excursion of the connected transducer. Thermal regulation is also provided through an internal feedback system that lowers overall gain and, if necessary, limiter thresholds to prevent amplifier over-temperature shutdown above 210° Fahrenheit (98° Celsius).

Renkus-Heinz uses advanced tools, such as AFMG's EASERA Pro acoustic

Opposite page: A Renkus-Heinz RHAON-empowered PF1-500 amplifier. This page: Four screen views of the software, including a graphical representation of a loudspeaker system (bottom right).

measurement software, to ensure that every parameter is optimized prior to shipping. To maintain system integrity, this first level of factory programming is not accessible to the user, remaining protected as a baseline point of departure for subsequent adjustment.

During and after installation, the system may be adjusted at a user-accessible second level to compensate for non-linearities in the acoustical environment of the venue. Through the Rhaon GUI on a PC at a fixed location, or on a wireless tablet PC connected to a LAN PC while walking the hall, the user has access to eight bands of parametric EQ, high and low cut and shelving filters, up to 340 milliseconds of delay, and a soft-knee compressor-limiter. Setups resulting from this second-step processing can be password-protected and recalled in seconds whenever the system needs to be reconfigured for different purposes.

"With bi-directional communication and operator control of the Rhaon module's onboard DSP, the self-powered loudspeaker becomes a 'smart box' that is able to respond to user input," says Heinz. "This gives the system operator the ability

to optimize each loudspeaker's transfer function for its specific location and application. For example, a front fill loudspeaker typically requires a small amount of delay to time-align its output to the main array, plus some equalization and perhaps level adjustment. With Rhaon, all of these can be performed at each individual loudspeaker, using the same audio channel that is being sent simultaneously to the rest of the system. Delays could be adjusted precisely to the location of each loudspeaker, instead of using an approximation that averages the distances of several loudspeakers. Similarly, the top and bottom rows of a Rhaon-empowered line array can have different EQ settings applied within the loudspeaker. Top rows typically require some HF boost to compensate for air absorption. Bottom rows normally need the opposite, because they are so close to the audience. With Rhaon, both of these adjustments can be made inside the loudspeaker without sending a separate audio channel to the array."

He emphasizes that "the DSP functions available through Rhaon are 'technical.' They are not designed to alter the audience experience as shaped by the mix engineer. Their purpose is to make sure that everyone in the audience hears what the mix engineer intends them to hear."

Once system optimization is complete, the PC can be disconnected if desired and the system run in a more or less conventional fashion. The Rhaon GUI really shines, however, when it is used for remote control and supervision of the performance sound system.

Remote control and supervision

The range of control extends from simply turning the system on and off, to completely reconfiguring the entire system for different building functions. Input signals to each Rhaon module are remotely selectable from among two CobraNet inputs and two non-CobraNet inputs. Internal pink-noise or sine-wave generators can be selected, along with their amplitude and sine-wave frequency. A wink function illuminates a bright blue LED tally located on the front grille of each loudspeaker system to facilitate confirmation of each loudspeaker location.

Rhaon thus permits the operator to monitor every amplifier channel and loudspeaker on the network remotely with confidence. True power metering, temperature indication, fault logging, and operator alerts are provided through the Rhaon GUI, functions that are particularly critical when amplifiers are not located in a central equipment room, where they can be readily monitored and serviced—after all, amplifiers tend to fail far more frequently than loudspeakers. Input clip and output load impedance are both monitored; load-impedance monitoring enables the Rhaon amplifier module to alert the operator in the event that a driver fails.

"Regarding amplifier failures in general, my experience with

thousands of them I have sold over the past 30 years is that amplifiers in powered loudspeaker systems tend to fail far less frequently than stand-alone units in central equipment rooms, precisely because they are optimized more closely to the requirements of the particular loudspeakers they are paired with," notes Bill Coons, director of Contact Distribution. "And if a problem does arise in a Rhaon amplifier or loudspeaker, it can sometimes be immediately addressed by remotely adjusting controls, such as gain levels or compressor-limiter parameters, via the GUI."

The Rhaon GUI

The Rhaon GUI is a fairly simple project-based application. At launch, the operator can press the "scan network" button to check all network interfaces for settings that have changed since the current project was last saved.

Each loudspeaker system is identified by a separate icon and can be labeled for convenience. Identification of the physical loudspeaker can be verified using the wink function to illuminate the blue LED tally on its front grille. The operator can use a digital photo of the venue as background wallpaper on the main screen, then drag and drop the loudspeaker icons onto their appropriate locations for easy reference.

Loudspeakers can be grouped for control of muting, gain, and on-off-standby mode on a group-wide basis. Up to four levels of grouping and sub-grouping are provided to facilitate control in terms of absolute values (e.g., gain), or values relative to other groups or sub-groups in the system. This permits relative levels between different groups to be maintained for correct imaging and balance while the overall level of the system is raised or lowered as necessary.

A number of digital audio networking products have appeared alongside CobraNet during the past decade, including Peavey's MediaMatrix, Harman's HiQnet, Yamaha's mLan, Aviom's A-Net, Digigram's EtherSound, and BSS Soundweb. With Rhaon, however, the loudspeaker system at the end of the line is finally included in the network.

"This is a specialized product with a lot of potential. For fixed installations, it allows us to deliver the signal digitally in a completely amplified box. Currently, not many manufacturers do this. In most other cases you're looking at an analog signal with RS422 interface for control," Van Dijk says.

"Engineering Harmonics worked with Renkus-Heinz after developing our analog designs for the Dallas projects. We went with Rhaon because it's a modern solution that is a good long-term investment. In Dallas, the life cycle of the project was really long—we began working on the project in late 2003. Consequently, we felt that by commissioning time in 2009, the Rhaon product would be mature. And here it is." 🔊

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