

HALOGEN 2.0

General Description

Meet HAL, an expert in room combining, paging and distributed audio systems. This groundbreaking architecture is dimensions beyond any other solution. HAL easily guides even novice users through what used to be complex tasks in just minutes. No intricate matrix mixing or presets are required for room combining and paging. No virtual wiring required to distribute pages and background music to multiple zones.

Seamlessly interface HAL to your application with a broad variety of peripheral devices including smart Digital Remotes, Remote Audio Devices (RADs), portable and in-rack automixers, audio I/O and control logic expansion devices, wall sensors, ambient sensing mics, small remote amplifiers, and an advanced Paging Station.

In addition, the HAL Multiprocessor and Halogen software check the status, location, CAT 5 wiring integrity, and that audio is flowing in all peripheral devices, so you know your system is properly connected and ready to go.

HAL is more than just another DSP drag-and-drop system. It has revolutionized system design and installation.

Three HAL multiprocessors provide various audio I/O and control options for both large and small installations.

- HAL1 supports 16 in x 16 out audio, which may be increased up to 80 in x 48 out by adding EXP1 Expanders. More mic inputs can be added with AM1 and AM2 Automixers.
- HAL2 supports 18 in x 18 out audio, of which 2 x 2 come from AES3 on XLR connections.
- HAL3 supports 4 in x 8 out audio, of which 2 “Line-Plus” Inputs accept balanced line, or sum stereo unbalanced lines. See the “HAL Comparison” on page 3.

Halogen software includes Ethernet control support for third-party control systems. Standard TCP/IP set and get ASCII text messages control levels, selectors, presets and toggle actions within Halogen. Since the same Halogen software code runs on both Windows® and within HAL hardware, third-party control developers can test all their code using only the Halogen Windows software. Use only software to test your control systems software code and buy the hardware only when the install date arrives. Well-documented example programs for AMX, Crestron and Stardraw Control ease programming headaches.

Download Halogen and design a system now!
rane.com/hal

AMX, Crestron and Stardraw Control Support Packages are installed with Halogen software, or available as separate downloads.



"HAL1 Multiprocessor" on page 3



"EXP1 Expander for HAL1" on page 3



"NEW! HAL2 Multiprocessor" on page 2



"NEW! HAL3 Multiprocessor" on page 2

"NEW! IR2 Infrared Wall Sensors" on page 5

"NEW! DR4 Logic I/O Remote" on page 6

"NEW! DR5 Switch Controller Remote" on page 7

"NEW! RAD17 Microphone" on page 8

"NEW! RAD24 Amplifier" on page 8

"NEW! Halogen 2.0 Processing" on page 9

NEW! HAL2 Multiprocessor

HAL2 features an 18 x 18 combination analog-digital I/O, plus an assortment of control ports for Rane’s elegant Digital Remotes and new IR2 Infrared Wall Sensing Remotes. The HAL2 applies the versatile Halogen software interface to venues that don’t need extensive expansion. It includes

the same abilities to quickly design room combinations, paging systems, distributed music, and automixers with Rane’s “no virtual wiring needed” approach, but in a smaller I/O configuration to meet smaller budgets. See the full specifications on page 28.



NEW! HAL3 Multiprocessor

The HAL3 furthers this trend with Rane’s “Line-Plus” inputs for an impressive 4/6 inputs by 8 outputs at a price point that fits the budget, but still allows open-architecture processing.

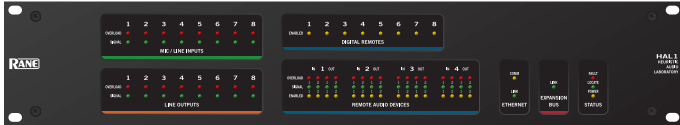
Couple this with one of Rane’s growing army of RADs (Remote Audio Devices) to get a set of analog inputs and/or outputs up to 500 feet away. Specifications are on pagepage 31.



HAL Comparison

HAL1 Multiprocessor

- 16 in x 16 out - 8x8 analog & 8x8 digital (RAD ports).
- Up to 4 RADs (without EXP1), up to 36 RADs (with EXP1s).
- Up to 12 Digital Remotes (without EXP1), up to 44 (with EXP1s).
- Four logic inputs (closure), Two relay outputs.

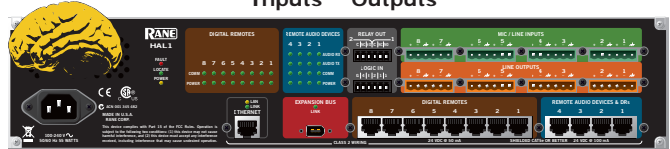


EXP1 Expander for HAL1

- Adds 16 in x 16 out digital (8 more RAD ports) to HAL1 (only).
- Up to 8 Digital Remotes or RADs in any combination.
- Chain up to four EXP1 Units to a HAL1 for 80 in x 48 out.



Analog Mic / Line Inputs 8	8 Analog Line Outputs
Digital RAD Port Inputs 8	8 Digital RAD Port Outputs
Digital Expansion into HAL1 64	32 Digital Expansion from HAL1
Total in the HAL1 DSP Brain 80	48
Inputs	Outputs



Digital Expansion into HAL1 16	16 Digital Expansion from HAL1
--------------------------------	--------------------------------



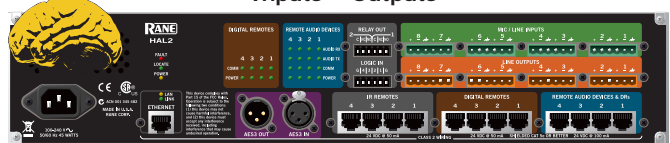
Daisy-chain up to three more EXP1s

NEW! HAL2 Multiprocessor

- 18 in x 18 out - 8x8 analog & 8x8 digital (RAD ports) & AES3 I/O.
- Up to 8 Digital Remotes.
- Four logic inputs (closure), Two relay outputs.
- Four IR Ports for IR2 Wall Sensors.



Analog Mic / Line Inputs 8	8 Analog Line Outputs
Digital RAD Port Inputs 8	8 Digital RAD Port Outputs
(AES3) Input Channels 2	2 (AES3) Output Channels
Total in the HAL2 DSP Brain 18	18
Inputs	Outputs



NEW! HAL3 Multiprocessor

- 4 line in x 8 line out - 2x6 analog & 2x2 digital (RAD port).
- Line-Plus Inputs are configured in Halogen Software: “+4 dBu balanced” or “-10 dBV unbalanced Left/Right Monoed.”
- Up to four Digital Remotes.
- Four logic inputs (closure).



Analog Line-Plus Inputs 2	6 Analog Line Outputs
Digital RAD Port Inputs 2	2 Digital RAD Port Outputs
Total in the HAL3 DSP Brain 4	8
Inputs	Outputs

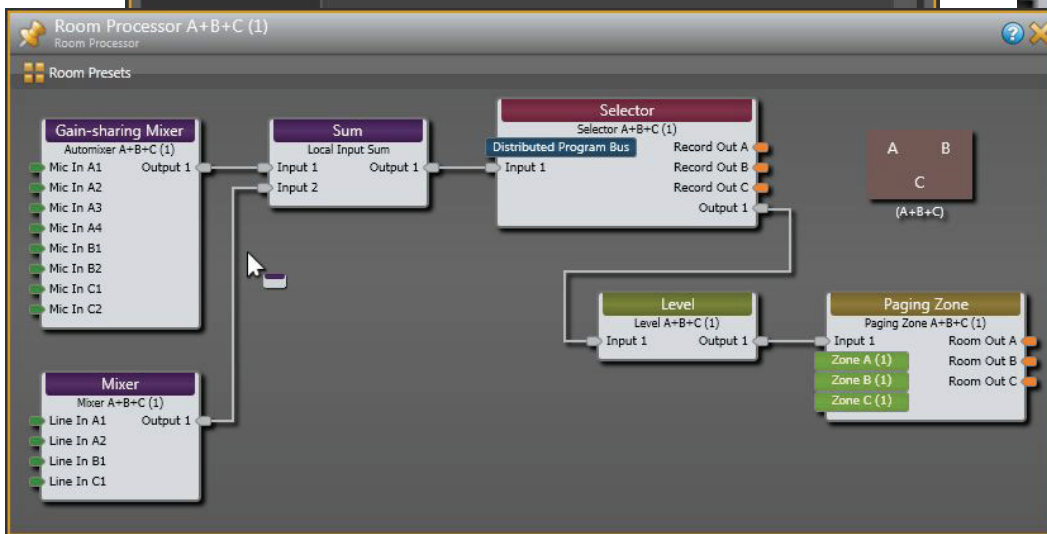
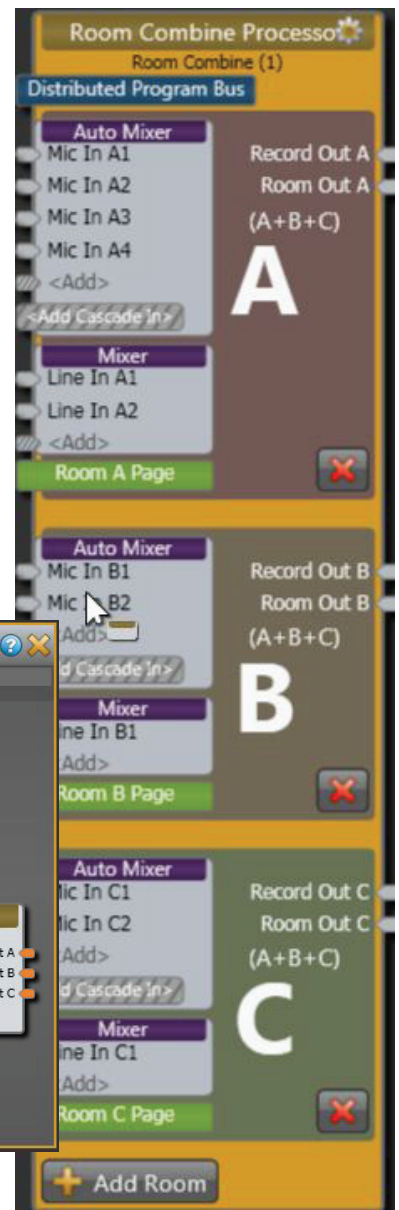
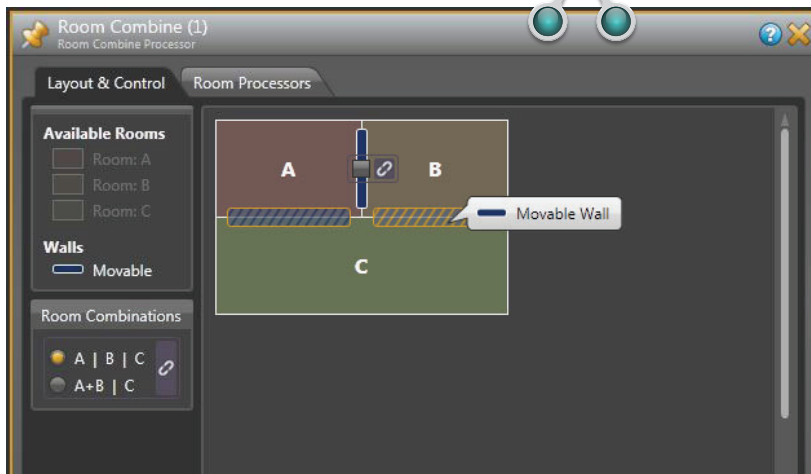
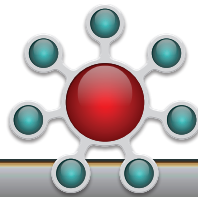


NEW! IR2 Infrared Wall Sensors



Room Combining

The Room Combine Processor supports custom wall layouts and auto-activation of independent room processors for each possible physical room as walls open and close. Control linking between Rane's Digital Remotes to wall open/close toggles and room volumes is exquisitely intuitive. Gain-share auto mix mics in combined rooms and separate the mix automatically as walls close. Use Rane AM2 Automixers to gain-share with both in-room mics and wireless mics when cascaded into a HAL's room combine processor. This means AM2 mixers can be hot-swapped between locations for quick set up for head table discussions. Control links to Digital Remotes also combine and separate automatically as wall states change. No presets required. Easily change signal processing settings as walls open and close, automatically with Rane IR2 Infrared Wall Sensors.



NEW! IR2 Infrared Wall Sensors

The Rane IR2R and IR2S are collectively known as an IR2. They work in pairs as an accessory to Rane HAL products. The IR2S sends infrared, the IR2R receives it. They work as a pair to provide an automatic way to sense the position of a movable wall or door. Mounting brackets and screws are included.

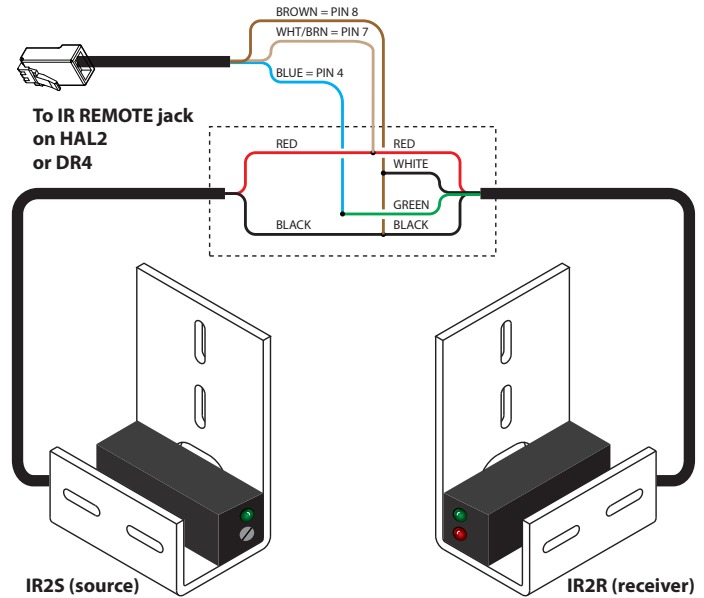
A single CAT 5e cable for each door connects the IR2 pair to a dedicated IR Remote port on the rear of a HAL2 or a DR4. The DR4 connects to any HAL, up to 1,000 feet (305 meters) away. (see page 6). Thus, the IR2 can be 2,000 feet away from a HAL.

When mounted on opposite sides of the door, and wired correctly, green indicators on the IR2R and IR2S are always lit. Only when the door is open and the IR2R is receiving infrared from the sender does the IR2R's red indicator light. Depending on the IR2 mounting height and your eyeglass prescription, these red indicators can usually be viewed from the floor. Note that the HAL need not have a configuration loaded in it for the above functionality to be observed. A powered HAL2 or DR4 is sufficient.

For an IR2 remote to control audio, the IR2 requires a connection to a HAL2, or to a DR4 connected to any HAL. In either case, the HAL must be loaded with a suitable configuration. When doors or movable partitions are opened or closed the IR2 automatically detects this, and the audio system reconfigures itself appropriately and automatically.

Distinguishing the IR2R from the IR2S: An IR2R has two LED indicators while an IR2S has one LED indicator and a sensitivity adjustment. Both the send and receive IR parts have *red* and *black* wires but the receiver also has *green* and *white* wires.

The IR2 is shipped preset for a range of up to 10 feet (3 meters) but may be adjusted for operation of up to 65 feet (19.8 meters). The HAL does not automatically check IR2 wiring errors.



IR2 Specifications

Parameter	Specification	Limit	Units	Conditions/Comments
Infrared Range	65	max	feet	19.8 meters maximum
	The IR2 is shipped preset for a range of up to 10 feet (3 meters).			
Power Supply Requirement				
.....Supply Voltage	10	min	VDC	
	30	max	VDC	
.....Supply Current	30	max	mA	IR2R supply current exclusive of load.
IR2R Load Current	100	max	mA	
Ambient Temperature	70	typ	°C	
Light Immunity	High immunity to ambient light and high intensity strobes.			
Cable Length: Unit to Junction	6 feet / 1.8 meters	typ		Cables included (see wiring diagram).
Cable Length: Junction to IR Port	1,000 max feet / 305 max meters	max		CAT 5e or similar cable with RJ45 (8P8C) at IR Port (3 wires of 26 AWG or better).
Waterproof Rating	NEMA 4X, IP66			
Unit: Agency Listing: CE	Certification by Tri-Tronics®			
Unit: Agency Listing: UL	File No. E143690 (US & Canada)			
Unit: Construction	Steel bracket			
.....Size	2.65"H x 1.75"W x 1.3"D			(6.8 cm x 4.5 cm x 3.3 cm)
.....Weight	3 oz			(.09 kg)
Shipping: Size	3.6"H x 11.75"W x 7.2"D			(9.2 cm x 30 cm x 18 cm)
.....Weight	1 lb 8 oz			(.69 kg)

NEW! DR4 Logic I/O Remote

The DR4 Digital Remote adds additional logic input and output ports to any HAL, enabling simple analog level and logic I/O controls plus IR2 remotes for wall sensing. The DR4 offers eight

logic ins and outs, six IR2 ports and eight analog control input ports for pot-on-a-wall level control. Multiple DR4's can connect to Digital Remote Ports on any HAL, up to 1,000 feet (305 meters) away.



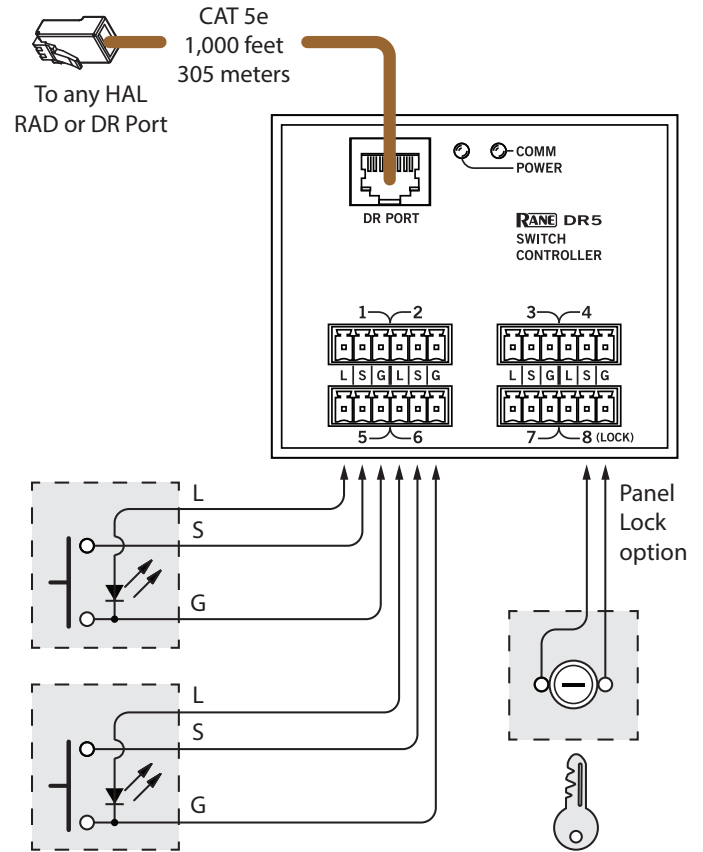
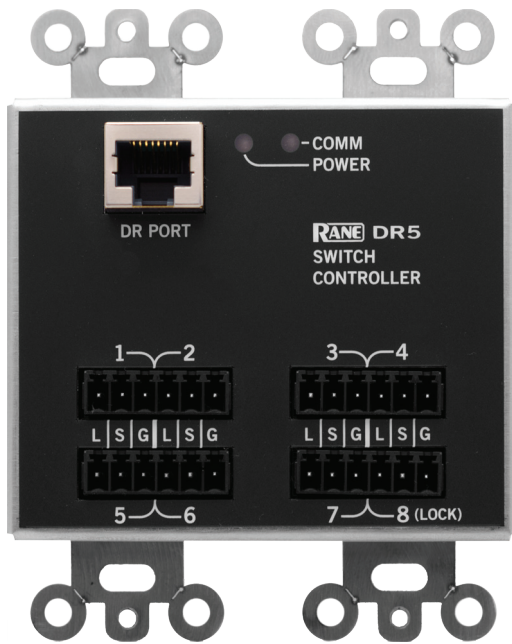
DR4 Specifications

Parameter	Specification	Limit	Conditions/Comments
IR Remote Ports	6		RJ-45 connectors
...Type	Compatible with IR2 remote		Protected to +24 V, reverse polarity protected
...Power	24 VDC @ 60 mA	max	Normal state
...Length	1000 feet / 304.8 meters	max	Shielded CAT 5e cable or better
Logic Inputs	8		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, black
...Internal Pull-up	51.1 kΩ, 5.0 V		Protected to +24 V
...Logic High Input Level	> 2.0 V	min	Normal state
...Logic Low Input Level	< 0.9 V	max	External circuit must sink > 80 μA to assert
Logic Outputs	8 Relay drive, LED or logic level output		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, Black
...Internal Pull-up	1.0 kΩ, 5.0 V		Protected to +30 V, reverse polarity protected
...Sink Current	200 mA	max	Output FET on
...LED Drive Current	2 mA		Output FET off, Driving an LED with Vf = 2.0 V
...Logic High Output Level	4.7 V	min	Output FET off, Output Current = 0 mA
...Logic Low Output Level	0.1 V	max	Output FET on, Sink Current < 200 mA
Analog Control Input	8 ADC inputs for potentiometer control		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, black
...Control Voltage Range	0-5 V / Normal = 5 V	typ	Protected to +24V, reverse polarity protected
...Internal Pull-up	51.1 kΩ		10-20 kΩ, linear taper potentiometer recommended
...A/D Converter	8-bit, 2 kHz sample rate		
Wiring	Class 2		All rear panel terminals
Power Requirement	100 to 240 VAC		50/60 Hz, 18 W max
Ambient Room Temperature	104 °F / 40 °C	max	Maximum external loading
Conformity: Safety			
...NRTL (USA)	UL 60065		cCSAus (CSA file no. 247105)
...CSA (Canada)	CAN/CSA 60065		cCSAus (CSA file no. 247105)
...EU Directive 2006/95/EC	EN 60065		CB Certificate (Nemko)
Conformity: EMC			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2
Unit Size	1.73"H x 19"W x 8.25"D		(4.4 cm x 48.3 cm x 20.9 cm)
...Weight	4.5 lb		(2 kg)
Shipping: Size	6.5" x 20.3" x 13.75"		(9.5 cm x 52 cm x 35 cm)
...Weight	7.5 lb		(3.5 kg)



NEW! DR5 Switch Controller Remote

The DR5 Digital Remote offers additional logic input and output ports, enabling the use of simple analog switch controls in any HAL system. Lighted switch panels for room combine applications are easily integrated into a HAL system using the eight switch inputs and eight LEDs outputs on the DR5. Unlike the HAL and DR4 Logic I/O, the DR5 Logic Out is intended to drive the LED indicator on a room combine panel, and is a writable parameter. The DR5 is designed to fit in a standard US dual-gang electrical box, or mount directly near a room combine panel.



DR5 Specifications

Parameter	Specification	Limit	Conditions/Comments
Switch Inputs	8		Small capsule
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, black
...Internal Pull-up	51.1 kΩ, 5.0 V		Protected to +24V, reverse polarity protected
...Vin High	> 2.0 V	min	Normal state
...Vin Low	< 0.9 V	max	External circuit must sink > 80 μA to assert
LED Outputs	8		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, black
...LED Drive Current	5 mA	typ	Driving an LED with Vf = 2.0 V
...Output High Voltage	5 V	typ	Output On, Current out = 0 mA
Ambient Room Temperature	104 °F / 40 °C		Maximum external loading
Unit Size	4.0"H x 3.3"W x 0.9"D		10.2 x 8.4 x 2.3 cm (fits in 2-gang US electrical box)

HAL System

DSP Hardware with Halogen Software



NEW! RAD17 Microphone

This omnidirectional boundary layer microphone / PZM pressure zone electret microphone handles extreme temperatures and humidity for indoor or outdoor applications. It may be used for ambient noise sensing, surveillance, security, train stations, etc. Sold only in black, but the grill may be painted any color, and finished with any Decora® plate.

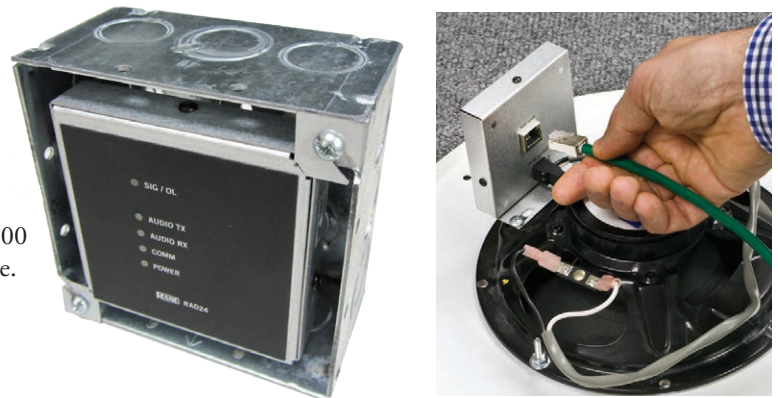


RAD17 Specifications

Parameter	Specification	Limit	Conditions/Comments
Built-in Microphone	Condenser / Electrostatic		Small capsule
...Capsule Sensitivity	6.3 mV/Pa (-44 dBu @ 1 Pa)	max	1 kHz, 1 Pa = 94 dB SPL
...Maximum Ambient SPL	114 dB SPL	max	120 dB SPL max at the microphone, Gain = 26 dB
...Gain Range	26 to 60 dB	typ	In 1 dB steps
...Frequency Response	100 Hz to 10 kHz	typ	±3 dB
Ambient Operating Temperature	-4 to +122 °F		-20 to +50 °C
Unit Size	4.1"H x 1.6"W x 0.9"D		10.4 x 4.0 x 2.3 cm (fits in 1-gang US electrical box)

NEW! RAD24 Amplifier

This one-watt plenum-rated class-D amplifier directly drives an 8-ohm loudspeaker. It installs in a US 4-square gang box, or the flanges can be removed to a ceiling loudspeaker's 70/100 mounting holes (replacing a transformer) or other flat surface.



RAD24 Specifications

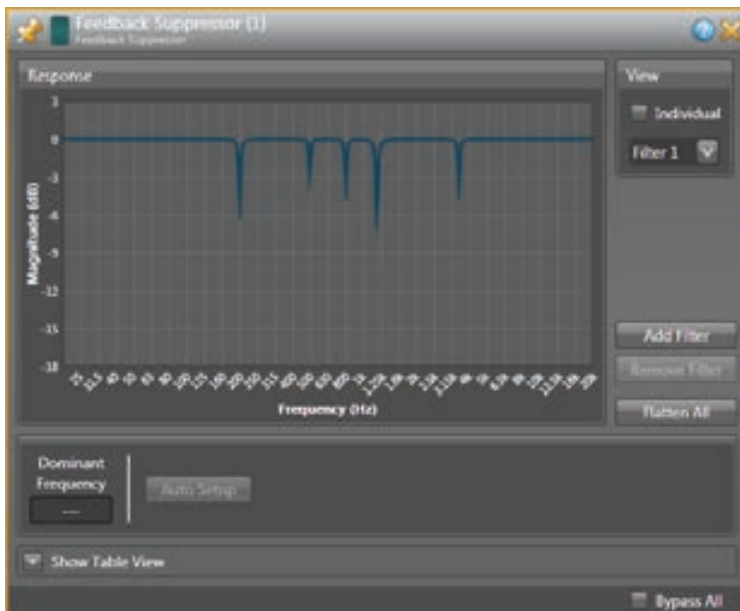
Parameter	Specification	Limit	Conditions/Comments
Amplifier Output	1 Channel		Class D, full bridge, current limited
...Connector	Euroblock		2-pin, 5 mm pitch, black
...Maximum Output Power	1 W (0 dBW)	max	1 kHz, 0 dBFS, 8 Ω, cable = 500 feet, THD < 1%
...Maximum Output Level	11.2 dBu / 2.83 Vrms		1 kHz, 0 dBFS, 8 Ω, cable = 500 feet, THD < 1%
...Frequency Response	20 Hz - 20 kHz, +0 / -1 dB		0 dBFS, 8 Ω
...THD+N	0.1%	max	1 kHz, 0 dBFS, 8 Ω
...Dynamic Range	80 dB	typ	20 kHz BW, re: 11.2 dBu, 8 Ω
...Power Taps	5 selections		1, 1/2, 1/4, 1/8, 1/16 W into 8 Ω
Ambient Room Temperature	104 °F / 40 °C	max	Maximum external loading
Unit Size with mounting tabs	4.0"H x 4.0"W x 1.3"D		10.2 x 10.2 x 3.3 cm (fits in 4" US electrical box)
Unit Size without mounting tabs	3.1"H x 3.1"W x 1.3"D		7.9 x 7.9 x 3.3 cm (mount on loudspeaker or flat area)
Conformity: UL	UL 2043		File number: E193164
Conformity: EMC			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2

NEW! Halogen 2.0 Processing



Ambient Noise Compensator (ANC) Block

The new Ambient Noise Compensation (ANC) DSP block is perfect for retail, restaurants, hotels, busy lobbies, industrial areas, transportation stations and even the cry room in a house of worship. The ANC block automatically adjusts page and/or program music volumes as the room background noise changes. It constantly models the direct and reflected sound between sensing mics (such as Rane’s new RAD17 on page 8) and the loudspeakers to distinguish noise from the loudspeaker content.



Feedback Suppressor Block

Rane’s patented Feedback Suppressor DSP block provides the peace of mind needed when system acoustics and sound system uses encounter a PAG-NAG conflict. The Feedback Suppressor is constantly looking for feedback and automatically deploys notch filters as needed.

2.0 Processing Blocks


Halogen Software

The Halogen software application is your home for designing, configuring, and controlling your HAL audio system. Halogen's easy-to-use graphical user interface simplifies the design and configuration process so much that your only concern will be deciding how to use the extra time you suddenly have!

The Halogen software manages global tasks such as discovering, connecting to, and applying configurations to HAL devices. The interface is divided into two main sections: the Hardware Workspace and the Processing Workspace. Halogen 2.0 helps you choose the best HAL Model to start a new configuration.

Choose HAL Model for new configuration

HAL Model	Inputs	Outputs	Ports
HAL1	8 Mic/Line	8 Line	4 RAD, 8 DR, 4 LogicIn, 2 RelayOut, 1 EXP (Firewire)
HAL2	8 Mic/Line, 2 AES3	8 Line, 2 AES3	4 RAD, 4 DR, 4 IR, 4 LogicIn, 2 RelayOut
HAL3	2 Line-Plus	6 Line	1 RAD, 3 DR, 4 LogicIn, 2 RelayOut



HAL1

Input(s): Eight - selectable from software between:
 One pro quality microphone (Euro) with 24 V phantom power
 One balanced line-level (Euro)

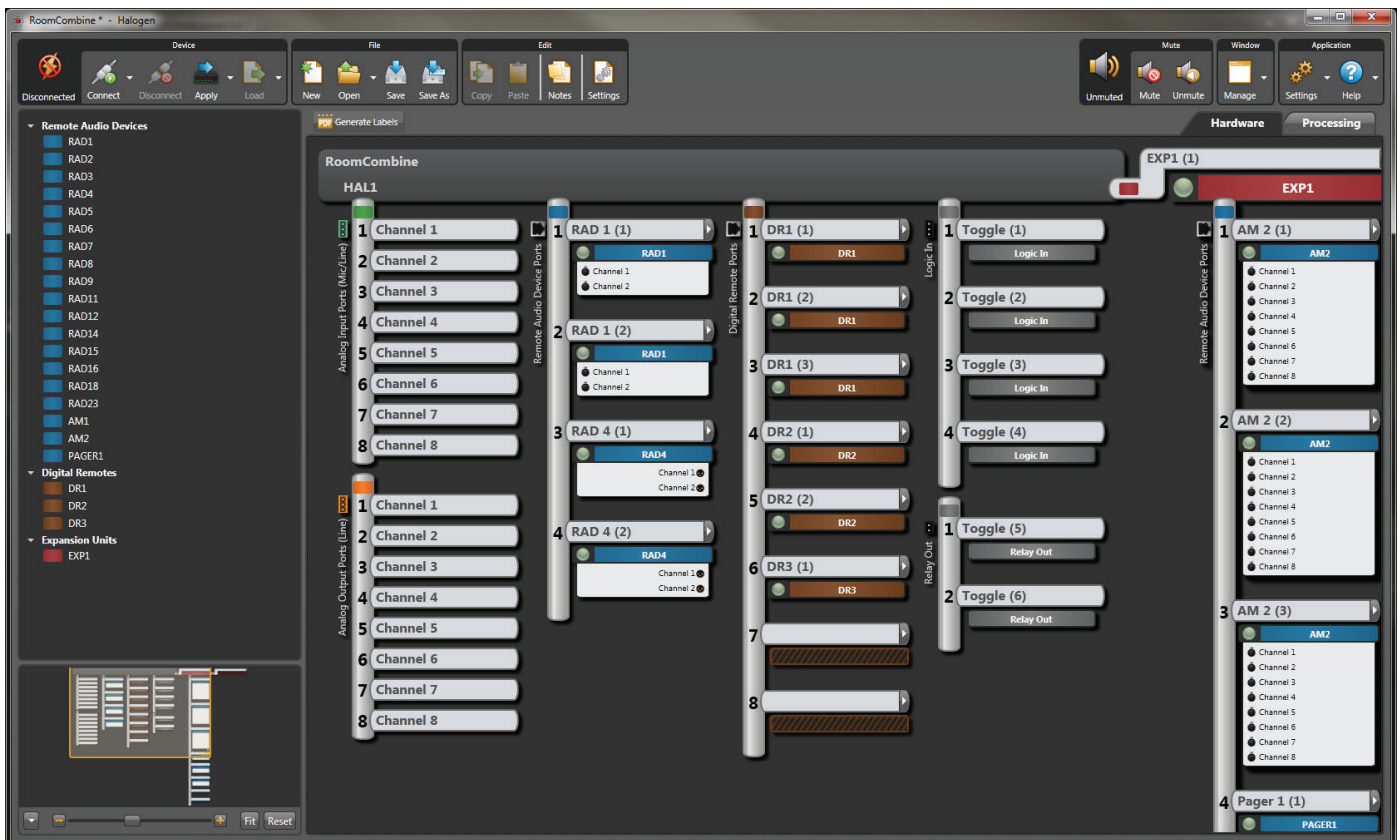
Output(s): Eight - balanced line-level (Euro)

Ports: Four - Remote Audio Device (RJ45)
 Eight - Digital Remote (RJ45)
 Four - Logic In (Euro)
 Two - Relay Out (Euro)
 One - Expansion Bus (Firewire)

Form Factor: 2U rack mount

Hardware Workspace

Specify, configure, and troubleshoot the physical hardware components of your audio system.





Processing Workspace

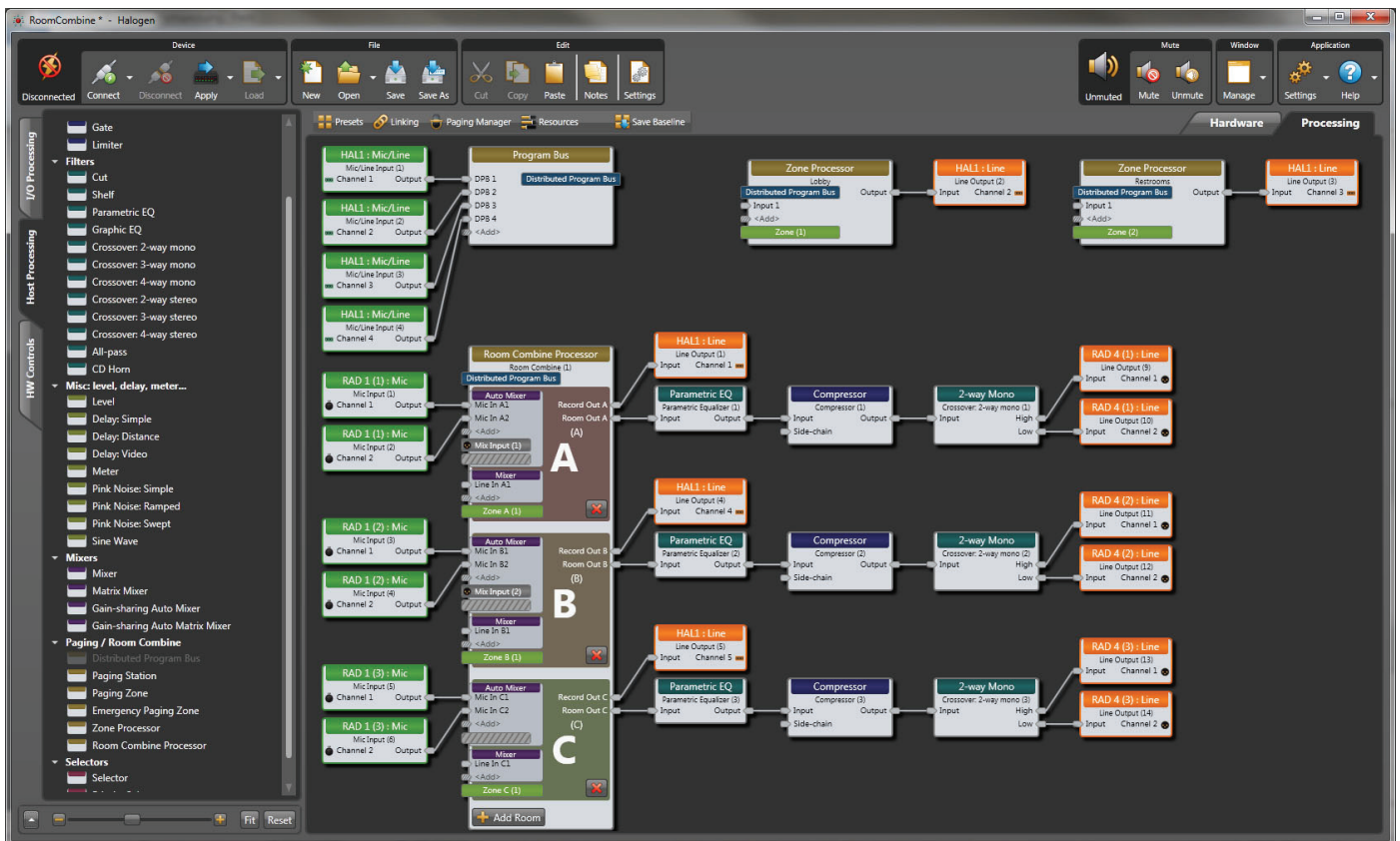
Wire together the audio processing components of your system, adding and configuring standard processing blocks such as equalizers, matrix mixers, compressors, limiters, and so on. Manage and configure control links and presets here. Halogen also provides innovative processing blocks that simplify complex paging and room combine scenarios.

Notice that Halogen separates the hardware view from the processing view of your audio system. A key benefit of this separation is the flexibility it provides when configuring the system's various inputs and outputs. For example, suppose you have a RAD2 in your audio system. You drag the RAD2 device into the Hardware Workspace but then go to the Processing Workspace to configure the RAD2's line input and mic input. This separation of hardware from processing allows you to work with each input and output individually instead of having to work with the hardware device as a single entity. It also allows you to focus on hardware in one place and audio flow and processing in another place—simplifying your job as a result. Brilliant!

Workspace Layout

As you may have noticed, the Hardware Workspace and the Processing Workspace have similar layouts. On the right is the actual workspace itself in which you create your system. Associated with each workspace is a palette of objects on the left, and at the top a toolbar specific to the workspace. To add an entity to your audio system, you drag one or more objects from the palette to the workspace.

A simple way to think of the Halogen workspaces is that you use the Hardware Workspace to create and connect all of your physical hardware, while you use the Processing Workspace to select, configure, and connect the processing blocks and controls.



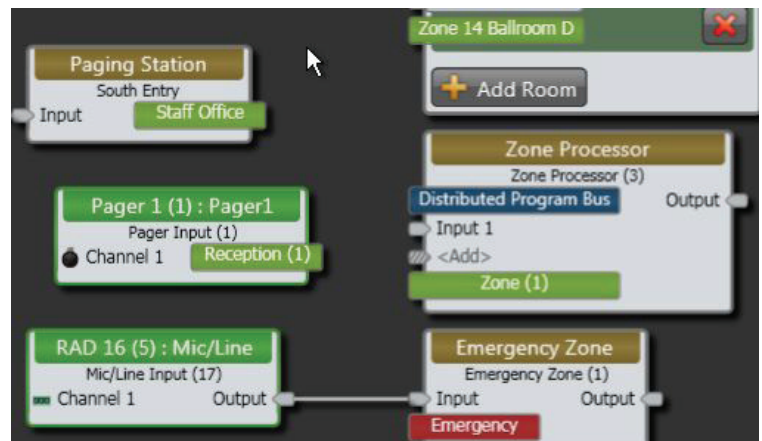
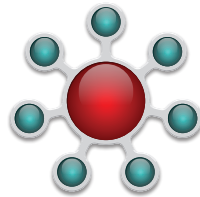
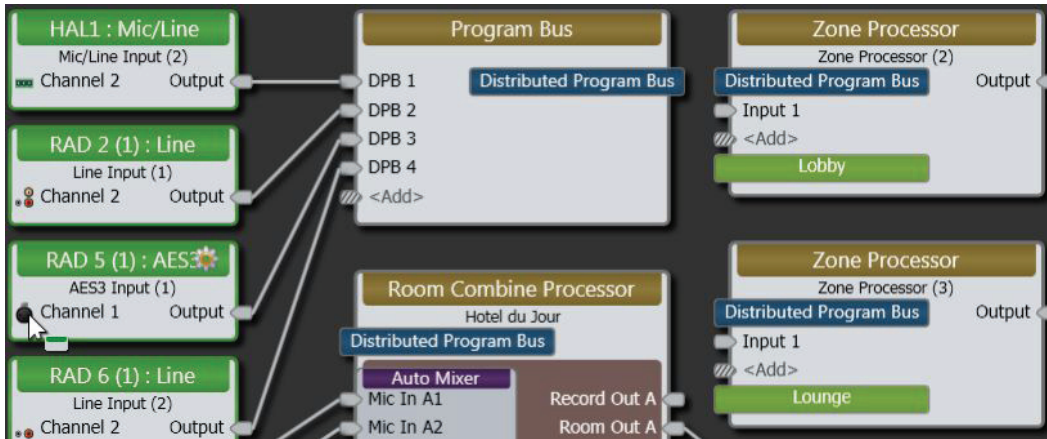
Multizone Paging Systems

DISTRIBUTED PROGRAM BUS

Wiring system-wide background music sources into the single Distributed Program Bus automatically wires all music sources to every output zone. The blue Distributed Program Bus label represents bus output and input to blocks.

PAGING STATION AND ZONES

Paging Station and PAGER1 input DSP blocks automatically connect input page sources (lime green labels) to zones requiring paging. Thus, wiring from all page sources through the Paging Manager to all page zones – including rooms that combine – is automatic. The Paging Manager easily maps all page sources to any combination of zones when using the Paging Zone, Emergency Page, Zone Processor and Room Combine Processor blocks.



Paging Manager
Create and edit paging scenarios

Stations		Scenarios					Zones	
Name	Status	Name	Priority	Number	Status	Name	Status	
Mic Page	Off	Table Ready	50	1	Busy	Entry	Active	
Hostess	Paging	Dining Room	50	2	Ready	Lounge	Active	
		Lounge	50	3	Ready	Dining East	Off	
		Page All	50	4	Ready	Dining West	Off	
						Hallways	Active	
						Ballroom A	Off	
						Ballroom B	Off	
						Ballroom C	Off	

PAGER1 Paging Station

This RAD is a mic preamp with a paging zone(s) [Scenario] selector with integrated push-to-talk switch. Busy, Caution and Ready indicators inform end users when priorities clash. It accepts any standard gooseneck mic (not included) and has built-in selectable 24 V Phantom Power and a 13 dB pad. It normally sits on a desk or table, and has lockdown features for security.



PAGER1 Specifications

Parameter	Specification	Limit	Conditions/Comments
RAD Port	Rear panel with indicators		RJ-45 connector
Mic Input	Accepts any gooseneck mic		
...Connector	3-pin female XLR		Locking tab may be removed
...Phantom Power	24 VDC @ 100 mA		On/off in Halogen software
...Mic Pad	13 dB	max	Set in Halogen software
...Signal & OL Indicators	See RAD Specifications		
Page Indicators	Busy (red), Caution (yellow), Ready (green)		
Unit	All Steel		Lockdown holes in chassis allow securing to a table
...Size	4.5"H x 6"W x 2"D		(11.5 cm x 15.3 cm x 5.1 cm)
...Weight	20 ounces		(567 grams)
Shipping Size	6.25" x 8.5" x 5.5"		(16 cm x 22 cm x 14 cm)
...Weight	1.64 lb		(745 grams)

Digital Remotes

Three Digital Remotes simplify end user control and eliminate installer brain fatigue. Use Digital Remotes for volume control, preset recall, source selection, or resetting or toggling system states. All offer customizable backlit LCD screens for intuitive end user labeling. Home run shielded CAT 5e (or better) connections to a HAL or EXP1 eliminate addressing, external power, and the need to test the cables.

The **DR1** supports Level Control.

The **DR2** offers Single Selector or List of Toggles/Commands behavior.

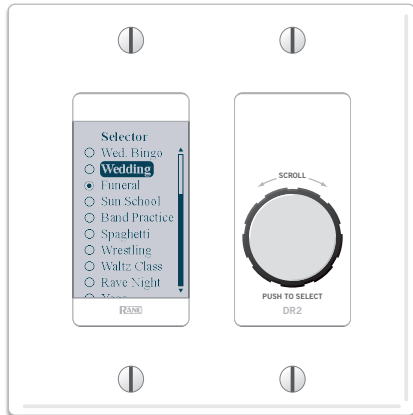
The **DR3** has three behaviors: Single Level & List of Toggles/Commands, List of Levels for either multizone volume control or input source mixing, and Single Level plus Selector.

DR1 Digital Volume Remote

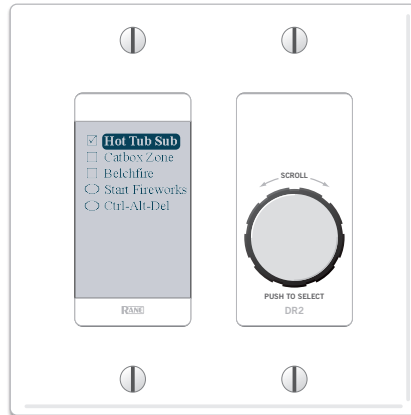


Level Control

DR2 Digital Selection Remote

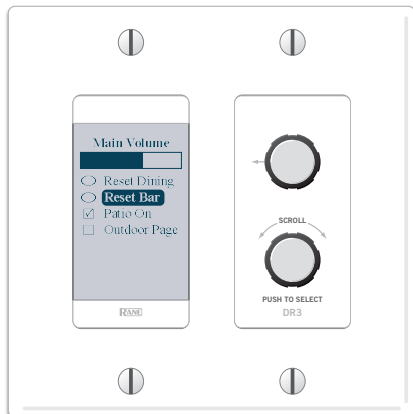


Single Selector

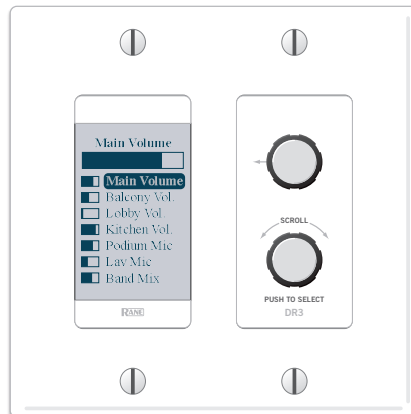


List of Toggles / Commands

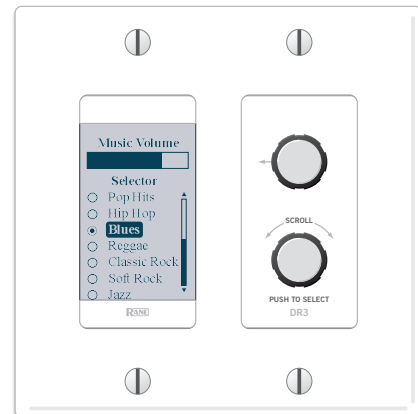
DR3 Digital Volume and Selection Remote



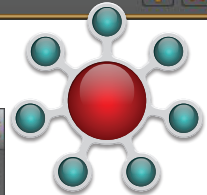
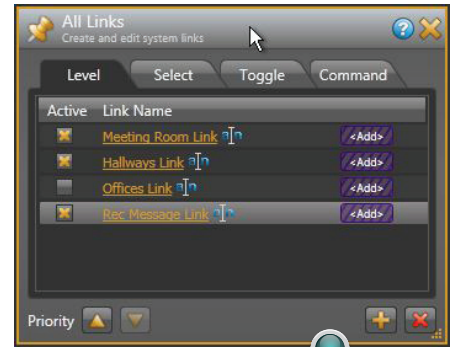
Single Level & List of Toggles / Commands



List of Levels



Single Level & Selector



Control Linking

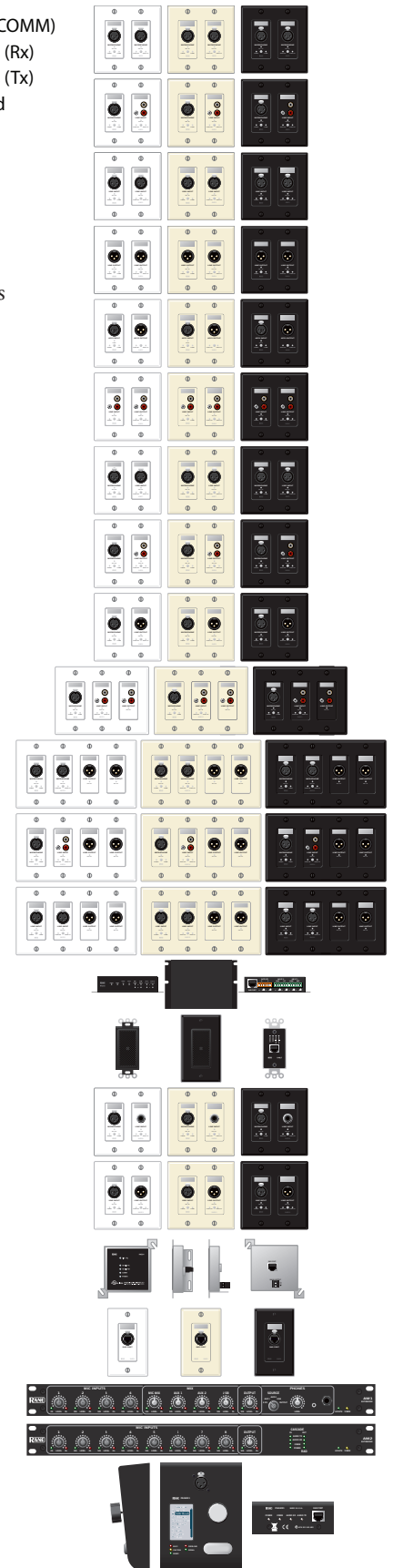
Drag the purple control chain icons atop one another to create links. This screen shows linking a DR1 volume onto the Meeting Room Output Level control. Four Control Link types and behaviors are supported: Level, Select, Toggle or Command. Activation and Priorities work together for incredible flexibility. Link simple analog remote level controls, contact closures and IR remote wall sensors by adding a DR4 Logic I/O Remote (see page 6).

RADs

The entire family of RAD models interface with HAL, for digital conversion at the wall. Each converts analog audio to and/or from 24-bit, 48 kHz digital audio. Shielded CAT 5e (or better) cable and termination transport four digital audio channels – two channels each direction – as well as power, ground and a communications channel, with status indicators at each RAD, HAL or EXP unit, and in Halogen software. HAL auto-checks the CAT 5 crimp and verifies audio. All RADs (and DRs) are both “location-aware” and hot-swappable with 500-foot homerun connections (66% farther than Ethernet). Light sensors dim the RAD indicators in dark rooms. Except for the RAD16, AM1, AM2, and PAGER1, all RADs mount in standard US electrical boxes. These RADs are available in white, ivory, or black, with a matched Decora™ plate cover included.



- RAD1** **Dual XLR Mic Inputs**
- RAD2** **XLR Mic Input / Mini & RCA Mono'ed Line Input**
- RAD3** **Dual XLR Line Inputs**
- RAD4** **Dual XLR Line Outputs**
- RAD5** **AES3 Input / AES3 Output**
- RAD6** **Mini & RCA Stereo Line Input / Stereo Line Output**
- RAD7** **XLR Mic Input / XLR Line Input**
- RAD8** **XLR Mic Input / Mini & RCA Stereo Line Output**
- RAD9** **XLR Mic Input / XLR Line Output**
- RAD11** **XLR Mic In / Mini & RCA Mono'ed Line In / Mini & RCA Stereo Line Out**
- RAD12** **Dual XLR Mic Inputs / Dual XLR Line Outputs**
- RAD14** **XLR Mic In / Mini & RCA Mono'ed Line In / Dual XLR Line Out**
- RAD15** **Dual XLR Line Inputs / Dual XLR Line Outputs**
- RAD16** **Dual Mic-Line Input / Dual Line Output Euroblocks in a Box**
- RAD17** ***NEW!* Omnidirectional Boundary Layer Mic (see page 15)**
- RAD18** **XLR Mic Input / 1/4" Balanced Line Input**
- RAD23** **XLR Line Input / XLR Line Output**
- RAD24** ***NEW!* One-Watt, Plenum-Rated Amplifier (see page 15)**
- RADX** **RAD Port Extension (CAT 5 wall jack for portable RADs)**
- AM1** **Four-Channel Gain-Sharing Automixer with added Line Inputs**
- AM2** **Eight-Channel Gain-Sharing Cascadable Automixer**
- PAGER1** **Mic Preamp with Push-to-Talk and Page Zone Selection (see page 13)**



AM1 and AM2 Automixers as RADs

AM1 Automixer with 4 Mic/Line Ins, 2 Line Ins, USB Audio I/O, Headphone Amp, and RAD Port.



AM2 Automixer with 8 Mic/Line Inputs and Cascadable RAD Port.



The AM1 and AM2 offer an integrated solution providing superior gain before feedback while eliminating operator error with simple controls. The microphone gain-sharing algorithm automatically and appropriately attenuates mics not in use, while maintaining the 3 dB per doubling of mics for different talkers (noncoherent signals), and 6 dB per doubling for the same talker who is directly between two mics (coherent signals). Think of the person wearing a live lavalier or headset, while approaching a live podium mic... no problem!

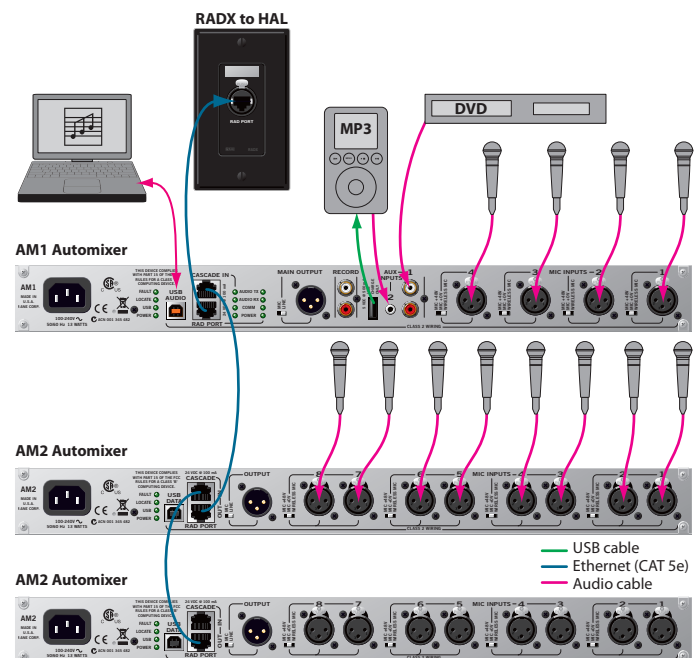
The AM2 makes it easy to set up and manage multiple wired or wireless microphones for up to eight participants. More mics are easily handled by daisy-chaining up to seven more AM2 Automixers, supporting up to 64 gain-shared mics.

The AM1 Automixer enables an operator to quickly set up and manage audio for a multimedia presentation involving up to four participants with microphones (wired or wireless) and several program audio sources (e.g., DVD, Laptop and MP3 player). The USB Audio port can simultaneously play back audio and record the AM1's output, so the same laptop can be both a source and a recording device to document meetings, presentations, trainings, and karaoke nights.

The AM1 or AM2 can be a RAD, sending its digital mono output mix to HAL. Once the AM Output mix is in the HAL DSP, additional signal processing such as EQ and compression can be added. Control of the mix's level using Rane's DR1 or DR3 Digital Remotes is a breeze.

AM Automixers may be installed in a mobile case, and connected when needed via an installed RADX on a wall or podium. This allows occasional panel discussions to use as many mics as necessary, while keeping the number of wall plates minimal.

For more details, see the AM1 and AM2 Data Sheets.



RAD Specifications (all models)

Parameter	Specification	Limit	Units	Conditions/Comments
Cable Length	500 feet / 153 meters			Shielded CAT 5e or better.
Signal Indicator	-50	typ.	dBFS	Unbalanced / balanced output, green LED, peak-reading
Overload Indicators	-0.5	typ.	dBFS	Unbalanced / balanced output, red LED, peak-reading
Conformity: EMC				
...FCC	Part 15B			Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2			Environment E2

RAD1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 15, 18, 23 Specifications

Parameter	Specification	Limit	Units	Conditions/Comments
Microphone Input Specs (Both XLR & Euro RADs)				
Input Impedance	2.16 k	1%	Ω	Balanced, 1.08 k + 1.08 k
Max. Input Level	-17	min.	dBu	Balanced, Gain = 26 dB, <1% THD
Equivalent Input Noise	-121	typ.	dBu	20 kHz BW, $R_s = 150 \Omega$, Gain = 26 dB
Dynamic Range	98	typ.	dB	re: 0 dBFS, 20 kHz BW, A-weighted, Gain = 26 dB
CMRR	-70	typ.	dB	$R_s = 150 \Omega$, 1 kHz, Gain = 26 dB
Frequency Response	30 to 20k	typ.	Hz	+0, -3dB, At All Gain Settings
THD+Noise	0.010	typ.	%	@ 1 kHz, 20 kHz BW, $R_s = 150 \Omega$, Output = -6 dBFS, Gain = 26 dB
Gain Range	26 to 60	typ.	dB	In 1 dB Steps
Phantom Power	+24	4%	V	15 mA Max.
Impedance	1.21 k	1%	Ω	Each Leg
Balanced Line-Level Output Specs (Active Balanced)				
Output Impedance	600	1%	Ω	Each Leg
Max. Output Level	18	min.	dBu	<1% THD, Load = 10 k Ω
Dynamic Range	103	typ.	dB	re: 0 dBFS, 20 kHz BW, A-weighted
Frequency Response	10 to 22k	typ.	Hz	+0, -3dB
THD+Noise	0.017	typ.	%	@ 1 kHz, 20 kHz BW, Output = -6 dBFS
Balanced Line-Level Input Specs				
Input Impedance	22.18 k	1%	Ω	1.09 k Ω + 11.09 k Ω
Max. Input Level	23	min.	dBu	<1% THD
Dynamic Range	102	typ.	dB	re: 0 dBFS, 20 kHz BW, A-weighted
CMRR	-56	typ.	dB	$R_s = 150 \Omega$, 1 kHz
Frequency Response	10 to 22k	typ.	Hz	+0, -3dB
THD+Noise	0.004	typ.	%	@ 1 kHz, 20 kHz BW, $R_s = 150 \Omega$, Output = -6 dBFS
Unbalanced Line-Level Input Specs				
Input Impedance, Mono	20 k	1%	Ω	(RAD2, RAD11 & RAD14)
Max. Input Level, Mono	6	min.	Vrms	<1% THD (RAD2, RAD11 & RAD14)
Input Impedance, Stereo	20 k	1%	Ω	(RAD6)
Max. Input Level, Stereo	3	min.	Vrms	<1% THD (RAD6)
Dynamic Range	96	typ.	dB	re: 0 dBFS, 20 kHz BW, A-weighted
Frequency Response	10 to 22k	typ.	Hz	+0, -3dB
THD+Noise	0.005	typ.	%	@ 1 kHz, 20 kHz BW, $R_s = 150 \Omega$, Output = -6 dBFS
Unbalanced Line-Level Output Specs				
Output Impedance, Stereo	600	1%	Ω	(RAD6, RAD8, RAD11)
Max. Output Level, Stereo	3.3	min.	Vrms	<1% THD, Load = 10 k Ω (RAD6, RAD8, RAD11)
Dynamic Range	98	typ.	dB	Re: 0 dBFS, 20 kHz BW, A-weighted
Frequency Response	10 to 22k	typ.	Hz	+0, -3dB
THD+Noise	0.028	typ.	%	@ 1 kHz, 20 kHz BW, Output = -6 dBFS

All wallplate RADs are available in white, ivory or black



RAD1 Dual XLR Mic Inputs
 RAD1W = white RAD1I = ivory RAD1B = black



RAD4 Dual XLR Line Outputs
 RAD4W = white RAD4I = ivory RAD4B = black



**RAD2 XLR Mic Input /
 Mini & RCA Mono'd Line Input**
 RAD2W = white RAD2I = ivory RAD2B = black



RAD5 AES3 Input / AES3 Output
 RAD5W = white RAD5I = ivory RAD5B = black



RAD3 Dual XLR Line Inputs
 RAD3W = white RAD3I = ivory RAD3B = black



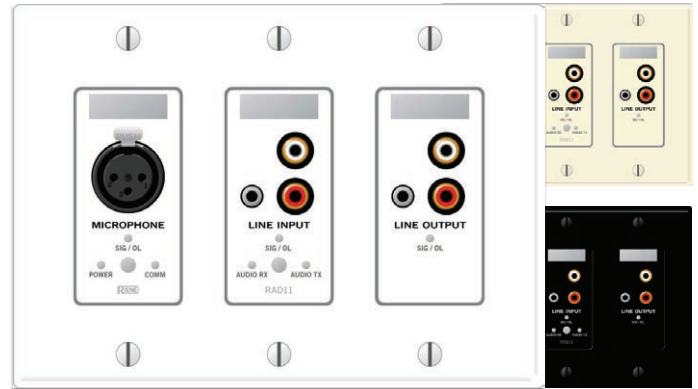
**RAD6 Mini & RCA Stereo Line Input /
 Mini & RCA Stereo Line Output**
 RAD6W = white RAD6I = ivory RAD6B = black

All wallplate RADs are available in white, ivory or black



RAD7 XLR Mic Input / XLR Line Input

RAD7W = white RAD7I = ivory RAD7B = black



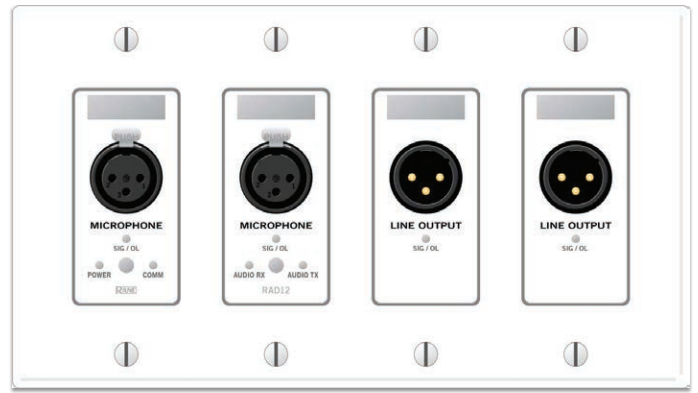
RAD11 XLR Mic Input / Mini & RCA Mono'd Line Input / Mini & RCA Stereo Line Output

RAD11W = white RAD11I = ivory RAD11B = black



RAD8 XLR Mic Input / Mini & RCA Stereo Line Output

RAD8W = white RAD8I = ivory RAD8B = black



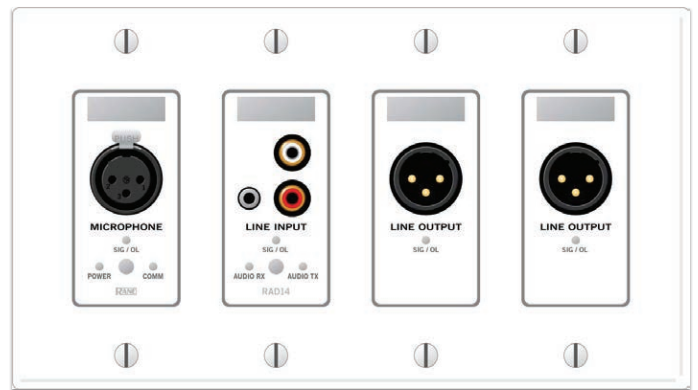
RAD12 Dual XLR Mic Inputs / Dual XLR Line Outputs

RAD12W = white RAD12I = ivory RAD12B = black



RAD9 XLR Mic Input / XLR Line Output

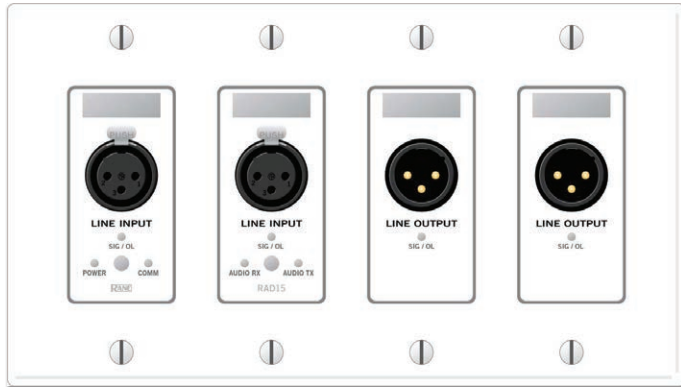
RAD9W = white RAD9I = ivory RAD9B = black



RAD14 XLR Mic Input / Mini & RCA Mono'd Line Input / Dual XLR Line Outputs

RAD14W = white RAD14I = ivory RAD14B = black

All wallplate RADs are available in white, ivory or black



RAD15 Dual XLR Line Inputs / Dual XLR Line Outputs

RAD15W = white RAD15I = ivory RAD15B = black



RAD23 XLR Line Input / XLR Line Output

RAD23W = white RAD23I = ivory RAD23B = black



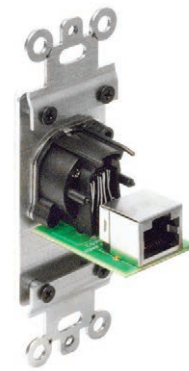
RAD18 XLR Mic Input / 1/4" Balanced Line Input

RAD18W = white RAD18I = ivory RAD18B = black



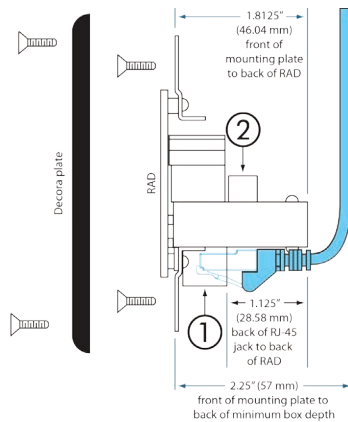
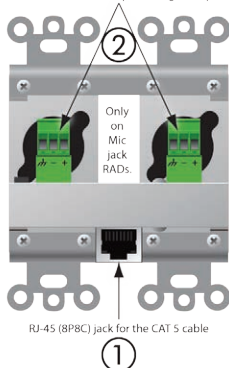
RADX RAD Port Extension

RADXW = white RADXI = ivory RADXB = black
 Distinguish Ethernet RJ-45 from Audio RJ-45 jacks.



RAD Back and Side View

Euroblock connectors to use if paralleling microphone jacks

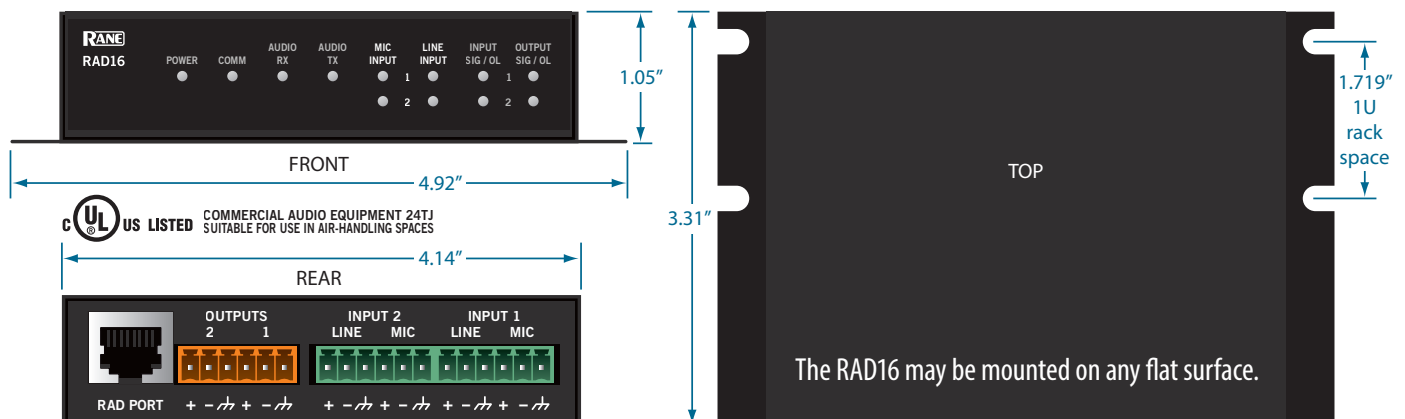


See the new **RAD17 Microphone** on page 8.

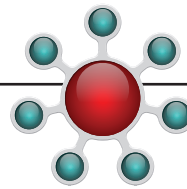
See the new **RAD24 Amplifier** on page 8.

RAD16 Features & Specifications

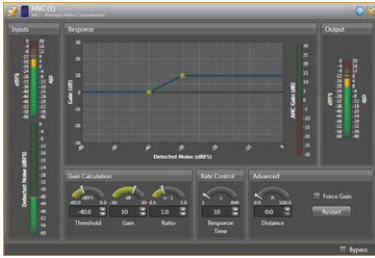
Parameter	Specification	Limit	Units	Conditions/Comments
Input Impedance	2.16 k	1%	Ω	Balanced 1.08 k + 1.08 k
Max. Input Level	-16	min.	dBu	Balanced, Gain = 26 dB, <1% THD
Equivalent Input Noise	-121	typ.	dBu	20 kHz BW, R _s = 150 Ω, Gain = 26 dB
Dynamic Range	96	typ.	dB	re: 0 dBFS, 20 kHz BW, A-weighted, Gain = 26
CMRR	-62	typ.	dB	R _s = 150 Ω, 1 kHz, Gain = 26 dB
Frequency Response	41 to 20k	typ.	Hz	+0, -3dB, At All Gain Settings
THD+Noise	0.008	typ.	%	@ 1 kHz, 20 kHz BW, R _s = 150 Ω, Output = -6 dBFS, Gain = 26 dB
Gain Range	26 to 60	typ.	dB	In 1 dB Steps
Phantom Power	+24	4%	V	15 mA Max.
Impedance	1.21 k	1%	Ω	Each Leg
Balanced Line-Level Input Specs				
Input Impedance	22.60 k	1%	Ω	Balanced 11.3 kΩ + 11.3 kΩ
Max. Input Level	23	min.	dBu	Balanced, <1% THD
Dynamic Range	99	typ.	dB	re: 0 dBFS, 20 kHz BW, A-weighted
CMRR	-52	typ.	dB	R _s = 150 Ω, 1 kHz
Frequency Response	22 to 22k	typ.	Hz	+0, -3 dB
THD+Noise	0.008	typ.	%	@ 1 kHz, 20 kHz BW, R _s = 150 Ω, Output = -6 dBFS
Balanced Line-Level Output Specs (Active Balanced)				
Output Impedance	600	1%	Ω	Each Leg
Max. Output Level	18	min.	dBu	Balanced, <1% THD, Load = 10 kΩ
Dynamic Range	103	typ.	dB	20 kHz BW, A-weighted
Frequency Response	10 to 22k	typ.	Hz	+0, -3 dB
THD+Noise	0.07	typ.	%	@ 1 kHz, 20 kHz BW, Output = -6 dBFS
Conformity: Safety				
...NRTL (USA)	UL 60065			C/UL/US (UL file no. E193164)
...CSA (Canada)	CAN/CSA 60065			C/UL/US (UL file no. E193164)
...Plenum Rating	UL 2043			C/UL/US (UL file no. E193164)
Conformity: EMC				
...FCC	Part 15B			Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2			Environment E2
Unit Size				
...Weight	12 oz			(340 g)
Shipping Size				
...Weight	1 lb			(436 g)



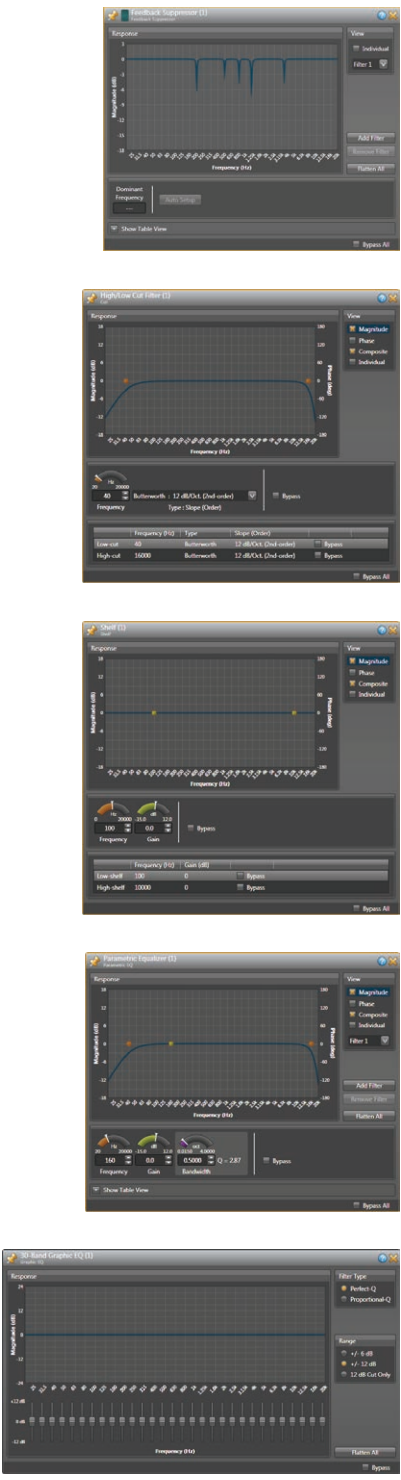
RAD16 Dual Euroblock Mic or Line Input / Dual Euroblock Line Output Available only in black.



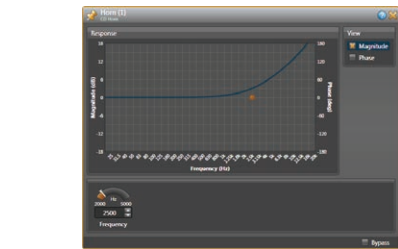
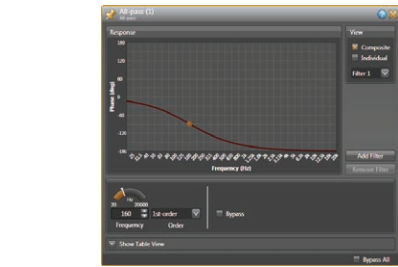
Halogen DSP Parameters



Block	Parameter	Unit	Min	Max	Default
Dynamics					
Ambient Noise Compensator (ANC) <i>NEW!</i>	Threshold	dBFS	-60	0	-40
	Gain	dB	-30	30	10
	Ratio	n:1	0.5	2	1
	Response Time	s	1	600	10
	Distance	ft	0	500	0
Automatic Gain Control (AGC)	Force Gain				Off
	Target	dBFS	-50	-10	-20
	Ratio	n:1	1	10	2
	Max Gain	dB	0	30	15
	Increase Rate	dB/s	1	200	10
	Decrease Rate	dB/s	1	200	100
	Hold Time	s	0	31	3
Compressor	Gain	dB	-12	12	0
	Threshold	dBFS	-60	0	-40
	Ratio	n:1	1	10	2
	Knee	dB	0	20	0
Ducker	Attack	ms	10	250	10
	Release	ms	1	5000	100
	Auto Mode				On
	Gain	dB	-12	12	0
	Threshold	dBFS	-80	0	-68
	Depth	dB	0	80	10
	Attack	ms	0.02	100	0.02
	Release	ms	1	5000	100
	Hold Time	s	0	3	3
	Low-cut	Hz	20	5000	20
Expander	High-cut	Hz	200	20000	20000
	Force duck				Off
	Side-chain Talkover				Off
	Threshold	dBFS	-80	-20	-80
	Ratio	n:1	1	8	2
	Attack	ms	10	250	10
	Release	ms	1	5000	100
	Low-cut	Hz	20	5000	20
	High-cut	Hz	200	20000	20000
	Gate	Threshold	dBFS	-80	0
Depth		dB	0	80	10
Attack		ms	0.02	100	0.02
Release		ms	1	5000	100
Hold Time		s	0	3	3
Low-cut		Hz	20	5000	20
High-cut		Hz	200	20000	20000
Limiter	Threshold	dBFS	-60	0	-6
	Attack	ms	0.02	100	0.02
	Release	ms	1	5000	100
	Auto Mode				On



Block	Parameter	Unit	Min	Max	Default	
Filters						
Feedback Suppressor <i>NEW!</i>	Filter Frequency	Hz	20	20000	ISO centers > 160	
	Filter Gain	dB	-6	0	0	
	Filter Bandwidth	Oct	0.015	4	0.5	
	Dominant Frequency	Hz	20	20000		
	Current Gain	dB	0	12	0	
	Gain Margin	dB	0	12		
	Composite				On	
	Individual				Off	
	Cut	Low-cut Frequency	Hz	20	20000	40
		High-cut Frequency	Hz	20	20000	16000
Magnitude					On	
Phase					Off	
Composite					On	
Individual					Off	
...Type and Slope						1st-order: 6 dB/oct. (1st-order) Linkwitz-Riley: 12 dB/octave (2nd-order) Linkwitz-Riley: 24 dB/octave (4th-order) Linkwitz-Riley: 36 dB/octave (6th-order) Linkwitz-Riley: 48 dB/octave (8th-order) Butterworth: 12 dB/octave (2nd-order) Butterworth: 18 dB/octave (3rd-order) Butterworth: 24 dB/octave (4th-order) Butterworth: 30 dB/octave (5th-order) Butterworth: 36 dB/octave (6th-order) Butterworth: 42 dB/octave (7th-order) Butterworth: 48 dB/octave (8th-order) Bessel: 12 dB/oct. (2nd-order) Bessel: 18 dB/oct. (3rd-order) Bessel: 24 dB/oct. (4th-order)
Shelf		Low Shelf Frequency	Hz	0	20000	100
		Low Shelf Gain	dB	-15	12	0
		High Shelf Frequency	Hz	0	20000	10000
	High Shelf Gain	dB	-15	12	0	
	Magnitude				On	
	Phase				Off	
	Composite				On	
	Individual				Off	
	PEQ	Low-cut Frequency	Hz	20	20000	40
		High-cut Frequency	Hz	20	20000	16000
Parametric Frequency		Hz	20	20000	ISO centers >160	
Parametric Gain		dB	-15	12	0	
Parametric Bandwidth		Oct	0.015	4	0.5	
Magnitude					On	
Phase					Off	
Composite					On	
Individual					Off	
Graphic EQ		Filter Type		Perfect-Q or Proportional-Q		Perfect-Q
	Range		±6, ±12, 12 dB cut-only		±12	
	Gain	dB	12	-12	0	
						Data Sheet - 23



Block	Parameter	Unit	Min	Max	Default
Crossovers					
...Type and Slope	Low : High-cut	Hz	20	20000	500
	High : Low-cut	Hz	20	20000	500
	Gain	dB	-24	12	0
	Delay	ms	0	10	0
	Invert				Off
	Mute				Off
	1st-order: 6 dB/oct. (1st-order)				LR 24 dB/octave
	Linkwitz-Riley: 12 dB/octave (2nd-order)				
	Linkwitz-Riley: 24 dB/octave (4th-order)				
	Linkwitz-Riley: 48 dB/octave (8th-order)				
...2-Way Crossovers	Butterworth: 12 dB/octave (2nd-order)				
	Butterworth: 18 dB/octave (3rd-order)				
	Butterworth: 24 dB/octave (4th-order)				
	Bessel: 12 dB/oct. (2nd-order)				
	Bessel: 18 dB/oct. (3rd-order)				
	Bessel: 24 dB/oct. (4th-order)				
...3-Way Crossovers	Low : High-cut	Hz	20	20000	500
	High : Low-cut	Hz	20	20000	500
...4-Way Crossovers	Low : High-cut	Hz	20	20000	500
	Mid : Low-cut	Hz	20	20000	500
All-pass	Mid : High-cut	Hz	20	20000	2900
	High : Low-cut	Hz	20	20000	2900
	Low : High-cut	Hz	20	20000	100
	Mid : Low-cut	Hz	20	20000	100
	Mid : High-cut	Hz	20	20000	500
	High-Mid : Low-cut	Hz	20	20000	500
	High-Mid : High-cut	Hz	20	20000	4000
	High : Low-cut	Hz	20	20000	4000
	Frequency	Hz	20	20000	160
	Order			1st-order or 2nd-order	1st-order
CD Horn	Add Filters		1	6	1
	Composite				On
	Individual				Off
CD Horn	Frequency	Hz	2000	5000	5000
	Magnitude				On
CD Horn	Phase				Off

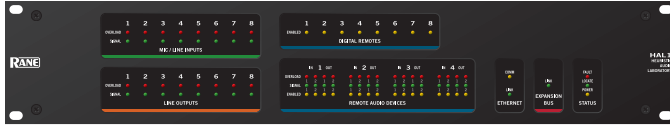
Block	Parameter	Unit	Min	Max	Default
Misc: Level, Delay, Meter, Signal Generator					
Level	User Min	dB	-88	User max	-88
	User Max	dB	User min	12	12
	Gain	dB	-88	12	0
Delay: Simple	Off @ Min				On
	Mute				Off
	Delay	ms	0	Max	0
Delay: Distance	Max Delay	s	0.250005	20	0.250005
	Standard: Distance	ft	0	1000	0
	Standard: Temp.	F	-22	140	72
Delay: Video	Metric: Distance	m	0	300	0
	Metric: Temp.	C	-30	60	22
	Max Delay	ms	250.005	999.999	999.999
Pink Noise: Simple	Metric Units				Off
	Frame Rate				23.976 fps
	...23.976 fps NTSC	fps	0	12	
	...24 fps NTSC	fps	0	12	
	...25 fps PAL	fps	0	12.5	
	...29.97 fps NTSC	fps	0	15	
	...50 fps PAL	fps	0	25	
	...59.94 fps NTSC	fps	0	25	
	...60 fps NTSC	fps	0	25	
	Max Delay	ms	250.005	500.01	500.01
Pink Noise: Ramped	Amplitude (rms)	dBr	-100	0	-20
	Mute				On
	Min Amplitude	dBr	-100	Max -1	-100
Pink Noise: Swept	Max Amplitude	dBr	Min +1	0	0
	Ramp Time	min	0.1	180	
	Mute				On
Sine Wave	Manual Frequency	Hz	20	20000	1000
	Start Frequency	Hz	20	Stop -1	20
	Stop Frequency	Hz	Start +1	20000	20000
	Steps		1	255	100
	Dwell Time	ms	10	2000	20
	Repeat				Off
	Amplitude (rms)	dBr	-100	0	-20
	Mute				On
	Frequency	Hz	20	2000	1000
	Amplitude (rms)	dBr	-100	0	-30
Meter	Mute				On
	no controls	dBFS	-60	0	
		dBr	-40	20	



Block	Parameter	Unit	Min	Max	Default
Mixers					
Mixer	Crosspoint Level	dB	-120	0	0
	Output Level	dB	-120	0	0
	Output User Max	dB	User min	0	0
	Output User Min	dB	-120	User max	-120
	Output Off @ Min				On
	Inputs		2	80	2
	Mute				Off
Matrix Mixer	Crosspoint Level	dB	-120	0	0
	Crosspoint Enable				Off
	Output Level	dB	-120	0	0
	Output User Max	dB	User min	0	0
	Output User Min	dB	-120	User max	-120
	Output Off @ Min				On
	Crosspoints		2	1024	2 in x 2 out
Automixer (Gainsharing)	Mute				Off
	Crosspoint Priority				Off
	Output Level	dB	-120	0	0
	Output User Max	dB	User min	0	0
	Output User Min	dB	-120	User max	-120
	Output Off @ Min				On
	Mute				Off
Matrix Automixer (Gainsharing)	Priority Level	dB	0	60	6
	Crosspoint Priority				Off
	Crosspoint Enable				Off
	Output Level	dB	-120	0	0
	Output User Max	dB	User Min	0	0
	Output User Min	dB	-120	User max	-120
	Output Off @ Min				On
Selector	Mute				Off
	Priority Level	dB	0	60	6
Selectors					
Selector Priority Selector	Input #		2	80	Input 1
	Priority Input #		0	80	None
	Input #		2	80	Input 1
	Detector Threshold	dBFS	-85	0	-60
	Detector Low-cut	Hz	40	400	40
	Detector High-cut	Hz	400	4000	4000
	Detector Hold Time	s	1	60	3
	Detector Ramp Rack	s	0.0	30.0	3.0
Router	Output #		2	80	Output 1

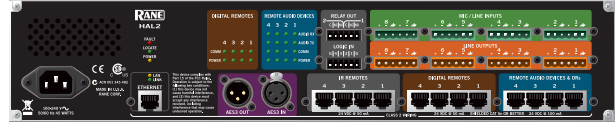


Block	Parameter	Unit	Min	Max	Default
Paging Station (PS)	Scenarios / Talk				Talk Off
PS: Level	User Min	dB	-88	User max	-88
	User Max	dB	User min	12	12
	Gain	dB	-88	12	0
	Off @ Min				On
	Mute				Off
PS: Compressor	Threshold	dBFS	-60	0	-40
	Ratio	n:1	1	10	2
	Gain	dB	-12	12	0
PS: PEQ	Low-cut Frequency	Hz	20	20000	160
	High-cut Frequency	Hz	20	20000	12000
	Filter 1 Frequency	Hz	20	20000	500
	Filter 2 Frequency	Hz	20	20000	3000
	Filter Gain	dB	-15	12	0
	Filter Bandwidth	Oct	0.015	4	0.5
	Magnitude				On
	Phase				Off
	Composite				On
	Individual				Off
Paging Zone	Ducker Depth	dB	0	85	12
	Ramp Back	s	0	10	3
	Page Gain User Min	dB	-88	User max	-88
Emergency Page Zone	Page Gain User Max	dB	User min	12	12
	Page Gain	dB	-88	12	0
	Page Gain User Min	dB	-88	User max	-88
	Page Gain User Max	dB	User min	12	12
	Page Gain	dB	-88	12	0
Zone Processor (ZP)					
ZP: Priority Selector	Priority Input				None
	Input				Input 1
	Threshold	dBFS	-85	0	-60
	Low-cut	Hz	40	400	40
	High-cut	Hz	400	4000	4000
	Hold Time	s	1	60	3
	Ramp Back	s	0	10	3
ZP: Level	User Min	dB	-88	User max	-88
	User Max	dB	User min	12	12
	Gain	dB	-88	12	0
	Off @ Min				On
	Mute				Off
ZP: Paging Zone	Ducker Depth	dB	0	85	12
	Ramp Back	s	0	10	3
	Page Gain User Min	dB	-88	User max	-88
	Page Gain User Max	dB	User min	12	12
	Page Gain	dB	-88	12	0



HAL1 • HAL2 • Specifications

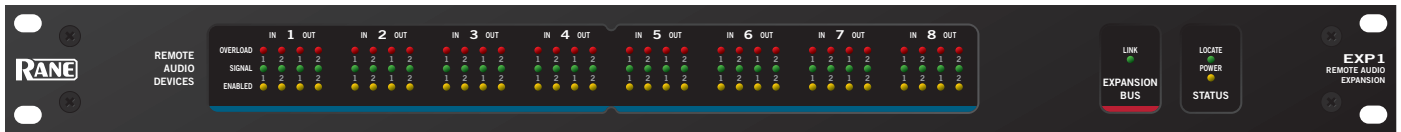
Parameter	Specification	Limit	Conditions/Comments
Analog I/O	8 x 8		
...Input Connectors	Euroblock		4 x 6-pin, 5 mm pitch, Green
...Output Connectors	Euroblock		4 x 6-pin, 5 mm pitch, Orange
...CODEC	24-bit, 48 kHz		
Mic Inputs	Active Balanced		
...Gain Settings	+10 to +60 dB		1 dB steps
...Input Impedance	2.6 kΩ	1%	1 kHz, each leg to ground
...Phantom Power	+48 VDC		10 mA max per input
...Equivalent Input Noise	-127 dBu	max	20-20k Hz, 150 Ω source, 60 dB gain, A-weighted
...THD+N	< 0.008 %	typ	20-20k Hz, +4 dBu, +10 dB gain, 20 kHz BW
...Maximum Input	3 dBV (1.4 Vrms)	typ	Input gain at +10 dB, 1 kHz, < 1% THD+N
Line Inputs	Active Balanced		
...Gain Settings	Unity & +10 to +20 dB		1 dB steps from +10 to +20
...Input Impedance	5.1 kΩ	1%	1 kHz, each leg to ground
...THD+N	< 0.008 %	typ	20-20k Hz, +4 dBu, unity gain, 20 kHz BW
...Maximum Input	20.8 dBu	typ	Input gain at 0 dB, 1 kHz, <1% THD+N
...Frequency Response	20-20k Hz, +0, -.05 dB		+4 dBu, unity gain
...Dynamic Range	109 dB	max	re +20 dBu, 20 kHz BW, A weighted, Rs = 150 Ω
...Interchannel Isolation	104 dB	max	20-20k Hz, +20 dBu, unity gain, channel-to-channel
Outputs	Active Balanced		
...Impedance	200 Ω	1%	Each leg
...Maximum Output	+20.9 / +16.4 dBu	typ	1 kHz, 100 kΩ / 600 Ω load
...Frequency Response	20-20k Hz, +0.1 / -0.3 dB		+4 dBu, unity gain, 100 kΩ load
...Dynamic Range	109 dB	max	re +20 dBu, 20 kHz BW, A-weighted, 100 kΩ load
...Interchannel Isolation	110 dB	typ	20-20k Hz, +20 dBu, channel-to-channel, 100 kΩ load
Indicators			
...Signal	-50 dBFS	typ	Green LED, peak-reading
...Overload	-0.5 dBFS	typ	Red LED, peak-reading
Propagation Delays			See the Latency graphic on page page 33.
...RAD In to RAD Out	1.71 ms	typ	Tested with RAD23
...RAD In to Analog Out	1.85 ms	typ	
...Analog In to RAD Out	2.25 ms	typ	
...Analog In to Analog Out	2.39 ms	typ	
DSP			
...HAL1 Processing Power	9600 MIPS	max	4 DSPs @ 300 MHz each with up to 8 instructions / cycle
...HAL2 Processing Power	4800 MIPS	max	2 DSPs @ 300 MHz each with up to 8 instructions / cycle
...Word Length	32 / 64-bit Floating Point		
...HAL1 Delay Memory	80 seconds	max	
...HAL2 Delay Memory	40 seconds	max	
Computer Interface			
...Type	Ethernet 1000 base-T		Zeroconf service discovery protocol for easy set up
...Cable	Shielded CAT 5e or better		RJ-45 connector
...Length	328 feet / 100 meters	max	Standard Ethernet cable length limit



Specification only applies to HAL1

Specification only applies to HAL2

Parameter	Specification	Limit	Conditions/Comments
HAL1 Expansion Bus	Only on the HAL1		IEEE 1394a (FireWire) connectors
...Audio Channels	64 in x 32 out of HAL1	max	Plus control channel
...Maximum EXP1 Units	4	max	Daisy-chain with FireWire cable included in EXP box
...Type/Connector/Cable	IEEE 1394a, 6-pin		Optional screw locks on HAL and EXP units* (see page 10)
...Maximum Cable Length	15 feet / 4.5 meters	max	Standard IEEE 1394a cable length limit
...Included Cable Length	3 feet / 1 meter		Included cable with EXP unit is not a locking type
...Propagation Delay	0.83 ms	typ	In or Out of Expansion Unit
RAD Ports	4		RJ-45 connectors
...Audio Channels	8 in x 8 out		Each port 2 in x 2 out, plus control channel, 24-bit, 48 kHz
...Power	24 VDC @ 100 mA	max	Each port
...Length	500 feet / 152.4 meters	max	Shielded CAT 5e cable or better
HAL1 DR Ports	8		RJ-45 connectors
HAL2 DR Ports	4		RJ-45 connectors
...Power	24 VDC @ 50 mA	max	Each port
...Length	1000 feet / 304.8 meters	max	Shielded CAT 5e cable or better
HAL2 IR Remote Ports	4		RJ-45 connectors
...Type	Compatible with IR2 remote		Protected to +24 V, reverse polarity protected
...Power	24 VDC @ 100 mA	max	Normal state
...Length	1000 feet / 304.8 meters	max	Shielded CAT 5e cable or better
Relay Outputs	2		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, Black
...Type	COM, NC & NO		
...Limit	2 A, 48 V	max	60 W max switching power
Logic Inputs	4		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, Black
...Type	Internal passive pull-up		Protected to +24 V
...Vin High	> 2.2 V	min	Normal state
...Vin Low	< 1.0 V	max	External circuit sinks > 22 μ A to assert
Wiring	Class 2		All rear panel terminals
HAL1 Power Requirement	100 to 240 VAC		50/60 Hz, 45 W max
HAL2 Power Requirement	100 to 240 VAC		50/60 Hz, 50 W max
Ambient Room Temp.	40 °C	max	Maximum external loading
Conformity: Safety			
...NRTL (USA)	UL 60065		cCSAus (CSA file no. 247105)
...CSA (Canada)	CAN/CSA 60065		cCSAus (CSA file no. 247105)
...EU Directive 2006/95/EC	EN 60065		CB Certificate (Nemko)
Conformity: EMC			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2
Unit: Size	2U, 3.5"H x 19"W x 8.25"D		(8.9 cm x 48.3 cm x 20.9 cm)
...Weight	7 lb		(3.2 kg)
Shipping: Size	6.5" x 20.3" x 13.75"		(11.5 cm x 52 cm x 35 cm)
...Weight	10 lb		(4.5 kg)



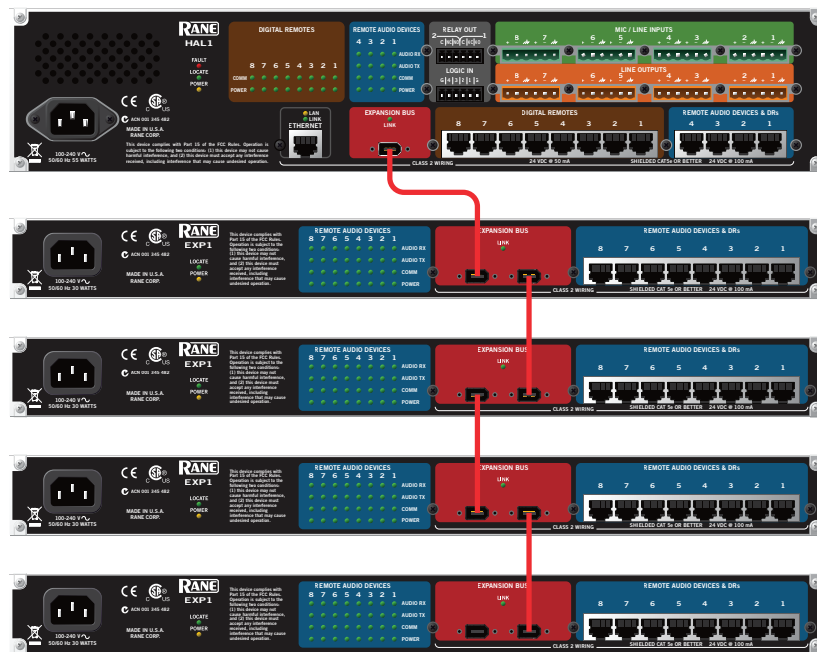
EXP1 Specifications

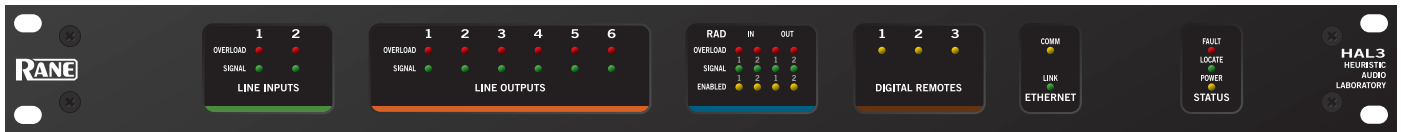
Parameter	Specification	Limit	Conditions/Comments
Expansion Bus	HAL1 required		IEEE 1394a (FireWire) connectors
...Audio Channels	64 in x 32 out of HAL1	max	Plus control channel
...Maximum EXP1 Units	4	max	Daisy-chain with FireWire cable included in EXP box
...Type/Connector/Cable	IEEE 1394a, 6-pin		Optional screw locks on HAL and EXP units* (see below)
...Maximum Cable Length	15 feet / 4.5 meters	max	Standard IEEE 1394a cable length limit
...Included Cable Length	3 feet / 1 meter		Supplied cable is not a locking type* (see below)
RAD / DR Ports	8		RJ-45 connectors
...RAD Audio Channels	16 in x 16 out		Each port 2 in x 2 out, plus control channel, 24-bit, 48 kHz
...RAD Cable Length	500 feet / 152.4 meters	max	Shielded CAT 5e cable or better
...DR Cable Length	1000 feet / 304.8 meters	max	Shielded CAT 5e cable or better
...Power	24 VDC @ 100 mA	max	Each port
Wiring	Class 2		All rear panel terminals
Power Requirement	100 to 240 VAC		50/60 Hz, 30 W max
Conformity: Safety			
...NRTL (USA)	UL 60065		cCSAus (CSA file #247105)
...CSA (Canada)	CAN/CSA 60065		cCSAus (CSA file #247105)
...EU Directive 2006/95/EC	EN 60065		CB Certificate (Nemko)
Conformity: EMC			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2
Unit Size	1U, 1.75" x 19" x 8.25"		(4.4 x 48.3 x 20.9 cm)
...Weight	5 lb		(2.3 kg)
Shipping Size	6.5" x 20.3" x 13.75"		(11.5 x 52 x 35 cm)
...Weight	8 lb		(4.5 kg)

***FireWire Cable Sources**

Northwire NAFW1322-XX where XX is the length in meters. Features screw locks and industrial-grade cable.
northwire.com

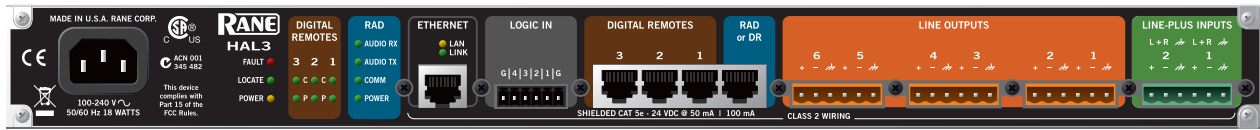
Newnex CFS-66XX-S where XX is the length in meters. Features thumb-screw locks.
newnex.com





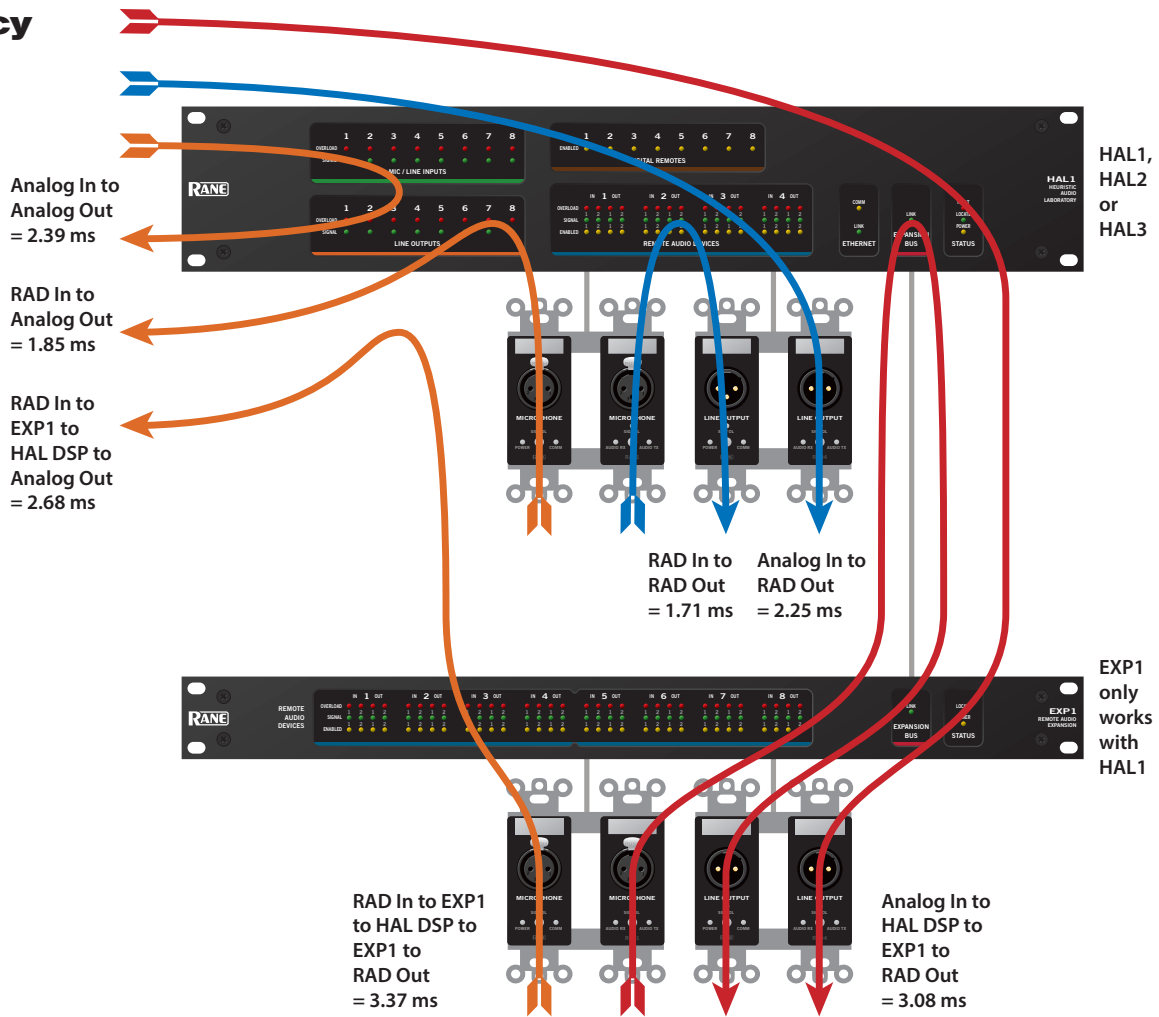
HAL3 Specifications

Parameter	Specification	Limit	Conditions/Comments
Analog I/O	2 x 6		
...Input Connectors	Euroblock		4 x 6-pin, 5 mm pitch, Green
...Output Connectors	Euroblock		4 x 6-pin, 5 mm pitch, Orange
...CODEC	24-bit, 48 kHz		
Line Input: Balanced Mono	Active Balanced Mono		
...Input Impedance	10.0 k Ω	1%	1 kHz, each leg to ground
...THD+N	< 0.01 %	typ	20-20k Hz, +4 dBu, unity gain, 20 kHz BW
...Maximum Balanced Input	20.6 dBu (8.3 Vrms)	typ	Input gain at 0 dB, 1 kHz, <1% THD+N
...Frequency Response	20-20k Hz, +0, -3 dB		+4 dBu, unity gain
...Dynamic Range	95 dB	max	re +20 dBu, 20 kHz BW, A weighted, Rs = 150 Ω
...Interchannel Isolation	100 dB	max	20-20k Hz, +20 dBu, unity gain, channel-to-channel
Line Input: Unbalanced Stereo	Active Balanced Mono		
...Input Impedance	10.0 k Ω	1%	1 kHz, each channel to ground
...THD+N	< 0.01 %	typ	20-20k, L/R combined, +4 dBu, unity gain, 20 kHz BW
...Maximum Unbalanced Input	20.6 dBu (8.3 Vrms)	typ	L/R combined, 1 kHz, <1% THD+N
...Frequency Response	20-20k Hz, +0, -3 dB		L/R combined, +4 dBu, unity gain
...Dynamic Range	95 dB	max	re +20 dBu, 20 kHz BW, A weighted, Rs = 150 Ω
Outputs	Active Balanced		
...Impedance	200 Ω	1%	Each leg
...Maximum Output	+20.9 / +16.4 dBu	typ	1 kHz, 100 k Ω / 600 Ω load
...Frequency Response	20-20k Hz, +0.1 / -0.3 dB		+4 dBu, unity gain, 100 k Ω load
...Dynamic Range	104 dB	max	re +20 dBu, 20 kHz BW, A-weighted, 100 k Ω load
...Interchannel Isolation	104 dB	typ	20-20k Hz, +20 dBu, channel-to-channel, 100 k Ω load
Indicators			
...Signal	-50 dBFS	typ	Green LED, peak-reading
...Overload	-0.5 dBFS	typ	Red LED, peak-reading
Propagation Delays			See the Latency graphic on page page 33.
...RAD In to RAD Out	1.71 ms	typ	Tested with RAD23
...RAD In to Analog Out	1.85 ms	typ	
...Analog In to RAD Out	2.25 ms	typ	
...Analog In to Analog Out	2.39 ms	typ	
DSP			
...Processing Power	2400 MIPS	max	1 DSPs @ 300 MHz each with up to 8 instructions / cycle
...Word Length	32 / 64-bit Floating Point		
...Delay Memory	20 seconds	max	
Computer Interface			
...Type	Ethernet 1000 base-T		Zeroconf service discovery protocol for easy set up
...Cable	Shielded CAT 5e or better		RJ-45 connector
...Length	328 feet / 100 meters	max	Standard Ethernet cable length limit
RAD Port	1		RJ-45 connector
...Audio Channels	2 in x 2 out		Each port 2 in x 2 out, control channel, 24-bit, 48 kHz
...Power	24 VDC @ 100 mA	max	Each port
...Length	500 feet / 152.4 meters	max	Shielded CAT 5e cable or better

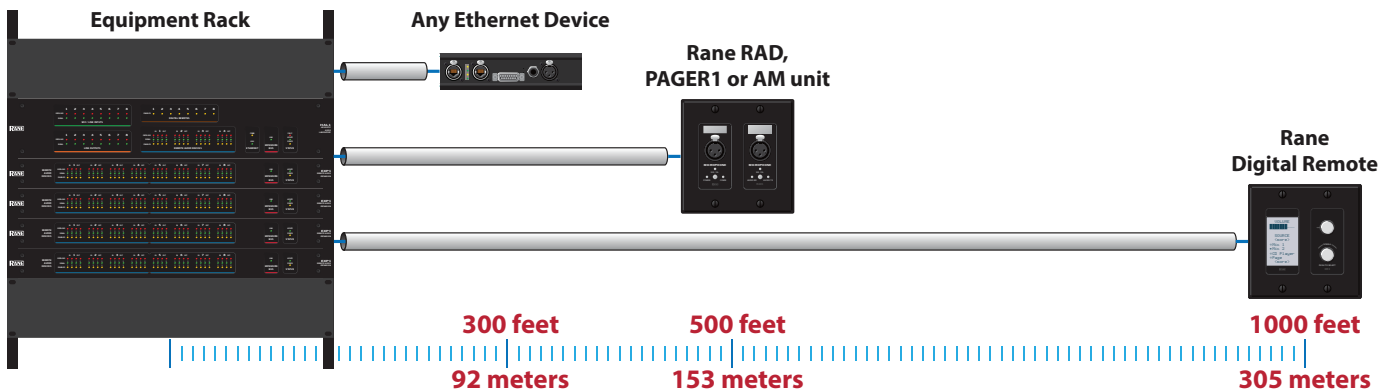


Parameter	Specification	Limit	Conditions/Comments
DR Ports	4		RJ-45 connectors
...Power	24 VDC @ 50 mA	max	Each port
...Length	1000 feet / 304.8 meters	max	Shielded CAT 5e cable or better
Logic Inputs	4		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, Black
...Internal Pull-up	51.1 kΩ, 5.0 V		Protected to +24 V, reverse polarity protected
...Vin High	> 2.2 V	min	Normal state
...Vin Low	< 0.7 V	max	External circuit sinks > 22 μA to assert
Wiring	Class 2		All rear panel terminals
Power Requirement	100 to 240 VAC		50/60 Hz, 18 W max
Ambient Room Temp.	40 °C	max	Maximum external loading
Conformity: Safety			
...NRTL (USA)	UL 60065		cCSAus (CSA file no. 247105)
...CSA (Canada)	CAN/CSA 60065		cCSAus (CSA file no. 247105)
...EU Directive 2006/95/EC	EN 60065		CB Certificate (Nemko)
Conformity: EMC			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2
Unit: Size	1U, 1.73"H x 19"W x 8.25"D		(4.4 cm x 48.3 cm x 20.9 cm)
...Weight	4.75 lb		(2.2 kg)
Shipping: Size	6.5" x 20.3" x 13.75"		(16.5 cm x 52 cm x 35 cm)
...Weight	8 lb		(3.7 kg)

Latency



RAD and DR Cable Lengths

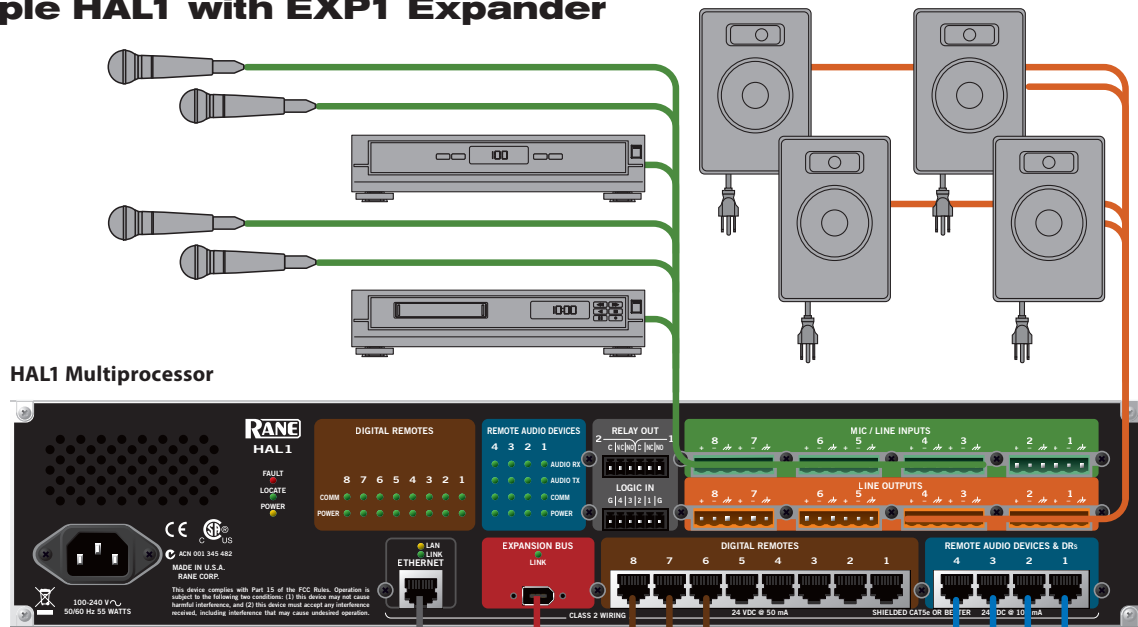


Trademarks

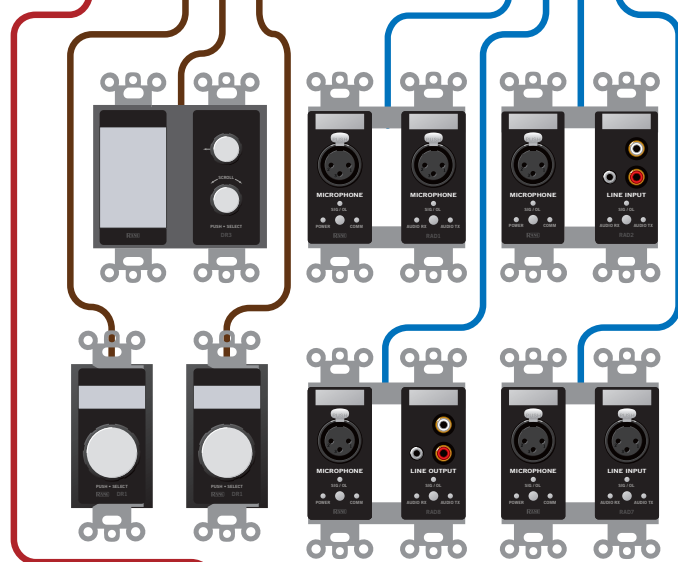
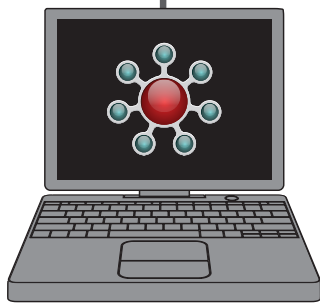
AMX® and the AMX logo are registered trademarks of AMX.
 Stardraw Control is a trademark of Stardraw.com Ltd.
 Crestron® is a registered trademark of Crestron Electronics, Inc.
 Lexan® is a registered trademark of General Electric.

Decora® is a registered trademark of Leviton.
 Windows® is a registered trademark of Microsoft Corporation.
 Mac, Apple and iTunes are trademarks of Apple Computer, Inc.
 Halogen is a trademark of Rane Corporation.

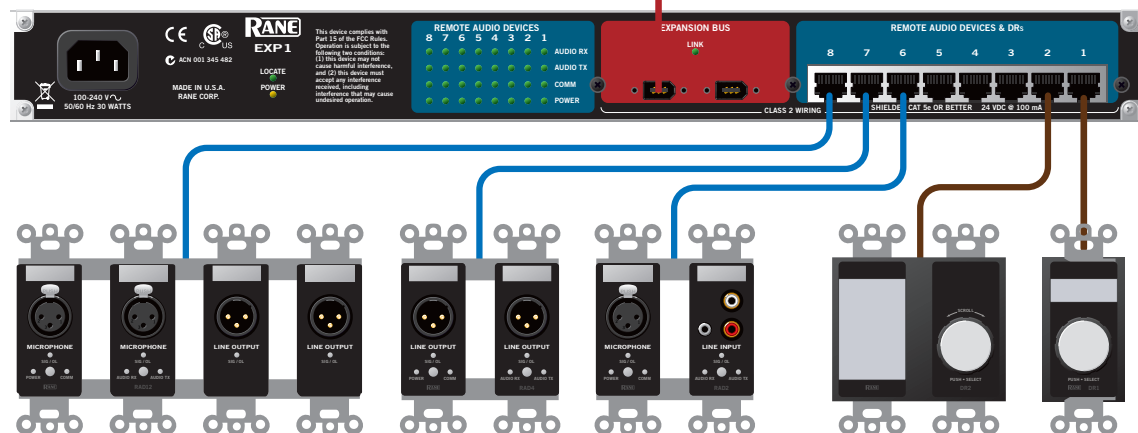
Example HAL1 with EXP1 Expander



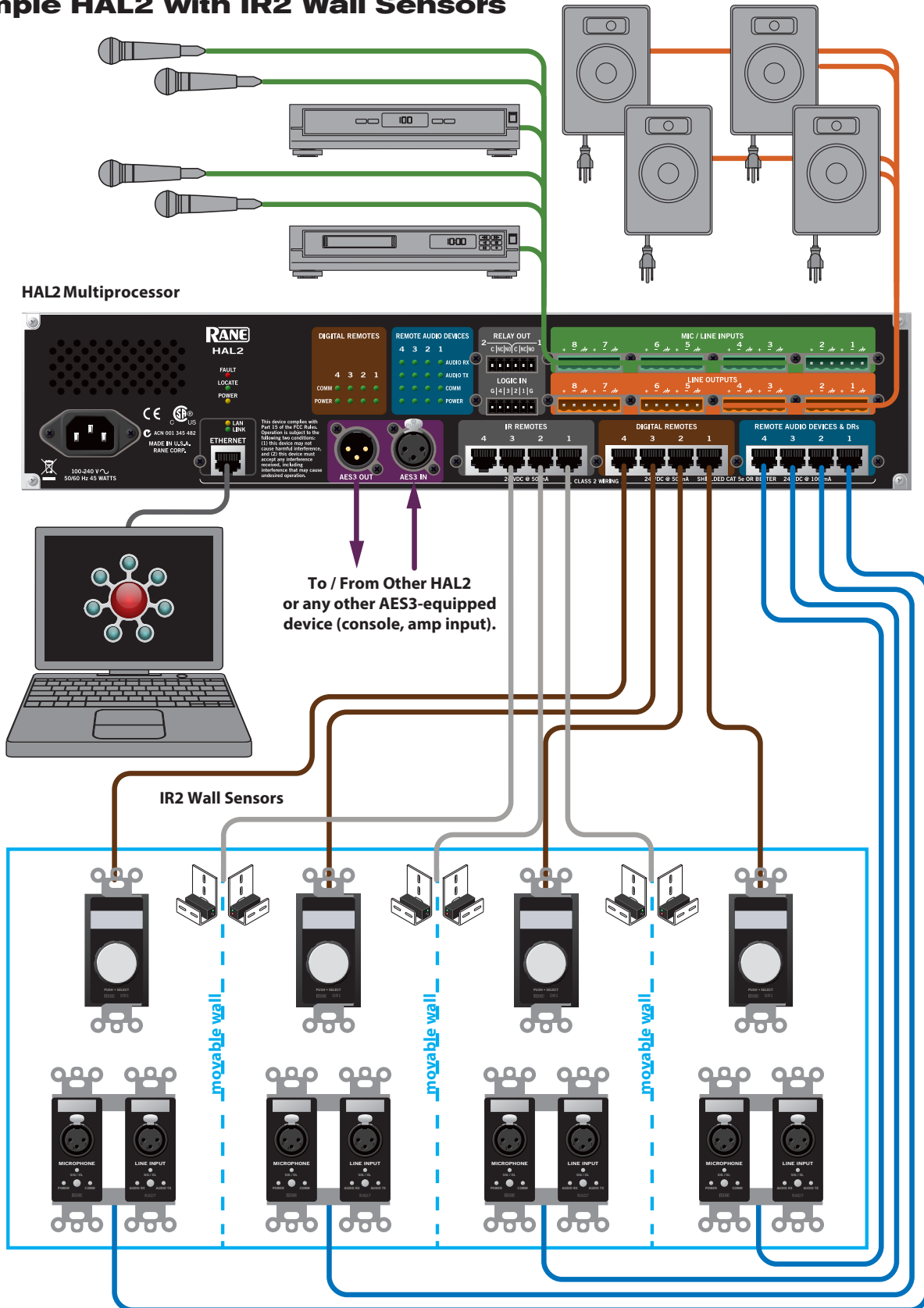
Halogen Software for System Setup



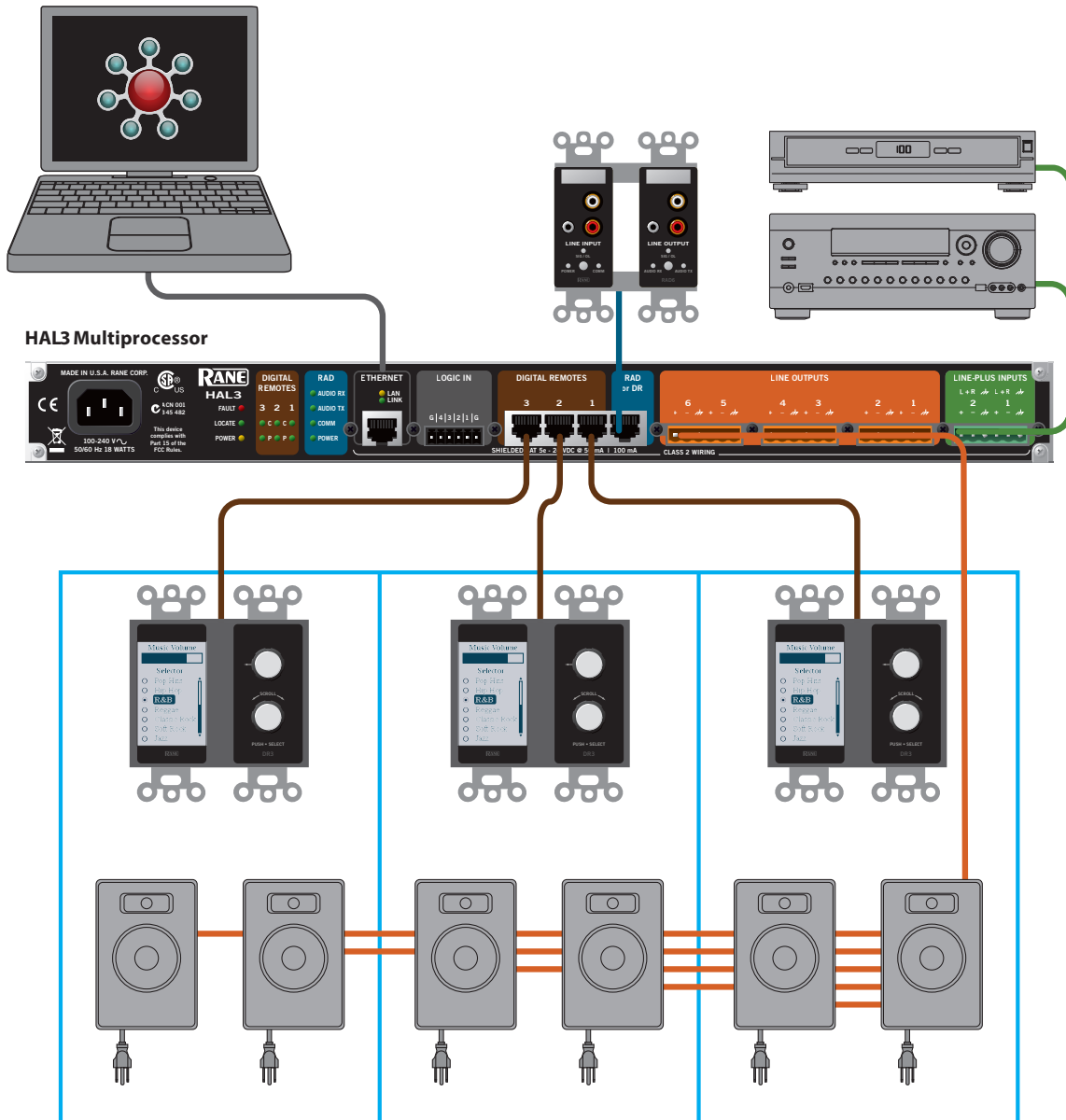
EXP1 Expansion Unit (up to four to a HAL1)



Example HAL2 with IR2 Wall Sensors



Example HAL3 Background Music System



Applications

- 3-zone stereo music system
- 6-zone mono music system
- 3-zone mono 2-way (biamped) music system

Inputs

- The 2 Line-Plus Inputs may be wired as “+4 dBu balanced” or “-10 dBV unbalanced Left/Right Monoed.”
- A RAD can add 2 more mic or line inputs, and 2 more line outputs.
- An AM1 into the RAD port would add 4 gain-shared mic inputs, 2 line inputs and a USB audio input (all mono'ed).
- An AM2 into the RAD port would add 8 gain-shared mic inputs (mono mix).