HAL System Description

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

HAL is an expert in room combining, paging and distributed audio systems. This groundbreaking architecture is dimensions beyond any solution in any industry. 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 is required to distribute pages and background music to multiple, even hundreds of zones.

Seamlessly interface HAL to your application with web controls and/or a broad variety of peripheral devices including smart Digital Remotes, Remote Audio Devices (RADs), portable or rack automixers, audio I/O and 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.

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

■ HAL1x supports 16 in x 16 out audio, which may be increased up to 512 in x 512 out by adding up to 32 daisy-chained Expanders to a single HAL1x. Add a few to hundreds of more mic inputs with AM Automixers.

■ HAL2 supports 18 in x 18 out audio, of which 2 x 2 are via AES3 on XLR connections.

■ HAL3 supports 4 in x 8 out audio. The 2 "Line-Plus" Inputs accept balanced, or unbalanced left/right monoed.

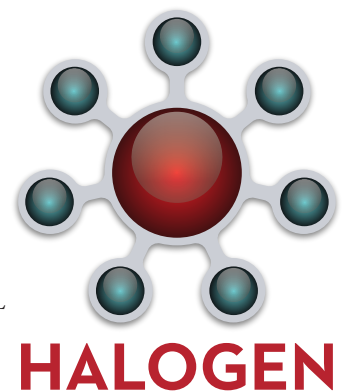■ HAL4 supports 2 in x 2 out audio. The 2 "Mic/Line-Plus" Inputs accept balanced, or unbalanced left/right monoed.

See the "HAL Comparison" on page 2.

Halogen software includes Ethernet control support for third-party control systems such as Crestron®, AMX® and others. Standard TCP/IP set and get ASCII text messages control levels, selectors, presets and toggle software actions. 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 system's software code and buy the hardware only when the install date arrives. Well-documented example programs for AMX®, Crestron® and Stardraw Control™ ease programming.

In version 4.0, Halogen includes support for custom Web Controls using any device with a web browser such as a tablet, smartphone or laptop.

HALOGEN

Now with Customizable Web Controls

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

These Support Packages are installed with Halogen software, or available as separate downloads.
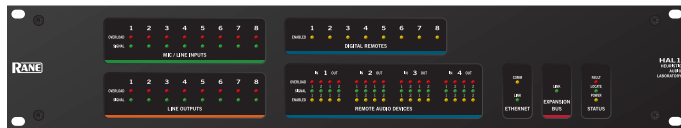
HAL3
Multiprocessor

RANE

HAL Comparison

HAL1x Multiprocessor

- 16 in x 16 out - 8x8 analog & 8x8 digital (RAD ports).
- Up to 4 RADs (without EXP1x), up to 260 RADs (with 32 EXP1s).
- Up to 12 Digital Remotes (without EXPs), up to 268 (with EXPs).
- Four logic inputs, Two relay outputs (more with DR4 or DR5).

Analog Mic / Line Inputs **8**	**8** Analog Line Outputs	
Digital RAD Port Inputs **8**	**8** Digital RAD Port Outputs	
Digital Expansion into HAL1x **512**	**512** Digital Expansion from HAL1x	
Total in the **HAL1x** DSP Brain **528**	**528**	
Inputs	**Outputs**	

Daisy-chain up to 32 EXPanders

EXP1x Remote Audio Expander for HAL1x

- Adds 16 in x 16 out digital (8 more RAD ports) to HAL1x.
- Up to 8 Digital Remotes or RADs in any combination.
- Chain up to 32 EXP1x units to a HAL1x for 512 in x 512 out.

EXP3x Zone Output Expander for HAL1x

- Adds 8 analog line outputs and 8 logic outputs to a HAL1x.
- Adds 6 Digital Remote ports & 2 RAD ports to a HAL1x.
- Chain up to 32 EXP3x units to a HAL1x for 256 outputs.

EXP5x Input Expander for HAL1x

- Adds 12 analog mic / line/ line-plus* inputs to a HAL1x.
- Adds 4 Digital Remote ports to a HAL1x.
- Chain up to 32 EXP5x units to a HAL1x for 384 analog outputs.

EXP7x AEC Expander for HAL1x

- Adds 8 channels of Acoustic Echo Cancelling DSP to a HAL1x.
- Chain up to 32 EXP7x units to a HAL1x for 256 AEC channels.
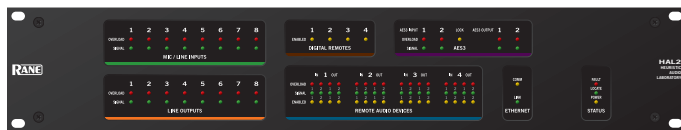
HAL2 Multiprocessor

- 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.

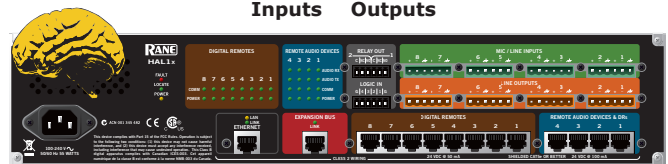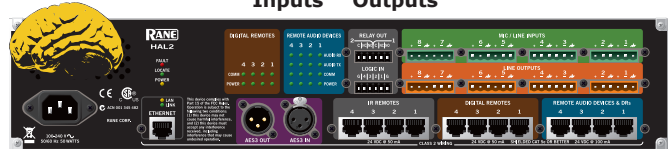|		
Analog Mic / Line Inputs **8**	**8** Analog Line Outputs	
Digital RAD Port Inputs **8**	**8** Digital RAD Port Outputs	
(AES3) Input Channels **2**	**2** (AES3) Output Channels	
Total in the **HAL2** DSP Brain **18**	**18**	
Inputs	**Outputs**	

HAL3 Multiprocessor

- 4 line in x 8 line out - 2x6 analog & 2x2 digital (RAD port).
- Line-Plus Inputs can wire "balanced" or "unbalanced L/R 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**	

HAL Comparison

HAL4 Multiprocessor

▪ 2 Mic/Line/Line-Plus Inputs can wire "mic balanced," "line balanced," or "unbalanced L/R monoed."
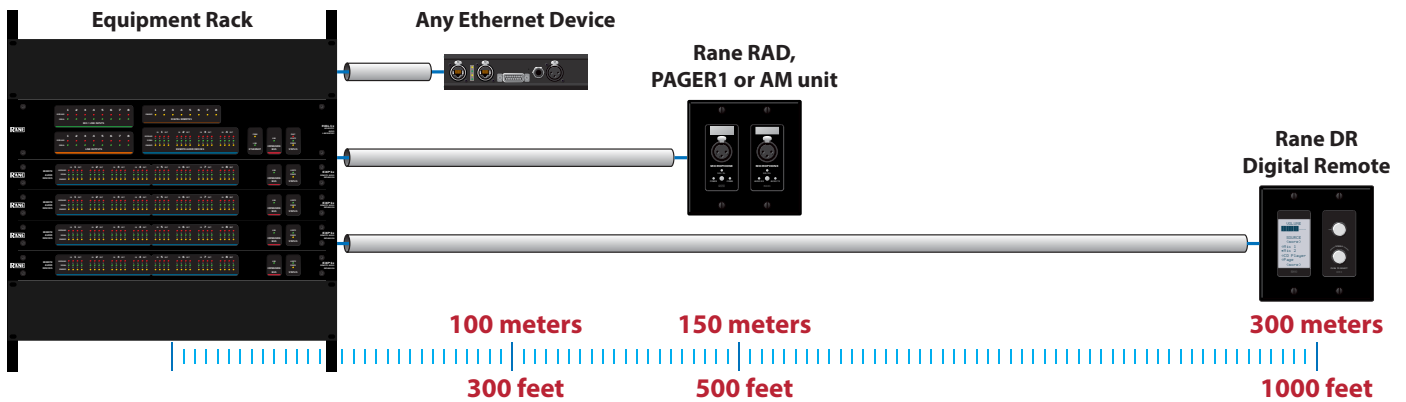
▪ 2 balanced line outputs.

▪ One Digital Remote Port.

Analog Mic/Line-Plus Inputs **2**	**2** Analog Line Outputs
Total in the **HAL4** DSP Brain **2**	**2**
Inputs	Outputs

RAD and DR Cable Lengths

Equipment Rack **Any Ethernet Device**

Rane RAD, PAGER1 or AM unit

Rane DR Digital Remote

100 meters   **150 meters**   **300 meters**

300 feet   **500 feet**   **1000 feet**

Latency

Analog In to Analog Out = 2.39 ms

RAD In to Analog Out = 1.85 ms

HAL2 or HAL3

RAD In to RAD Out = 1.71 ms

Analog In to RAD Out = 2.25 ms

HAL3
Multiprocessor
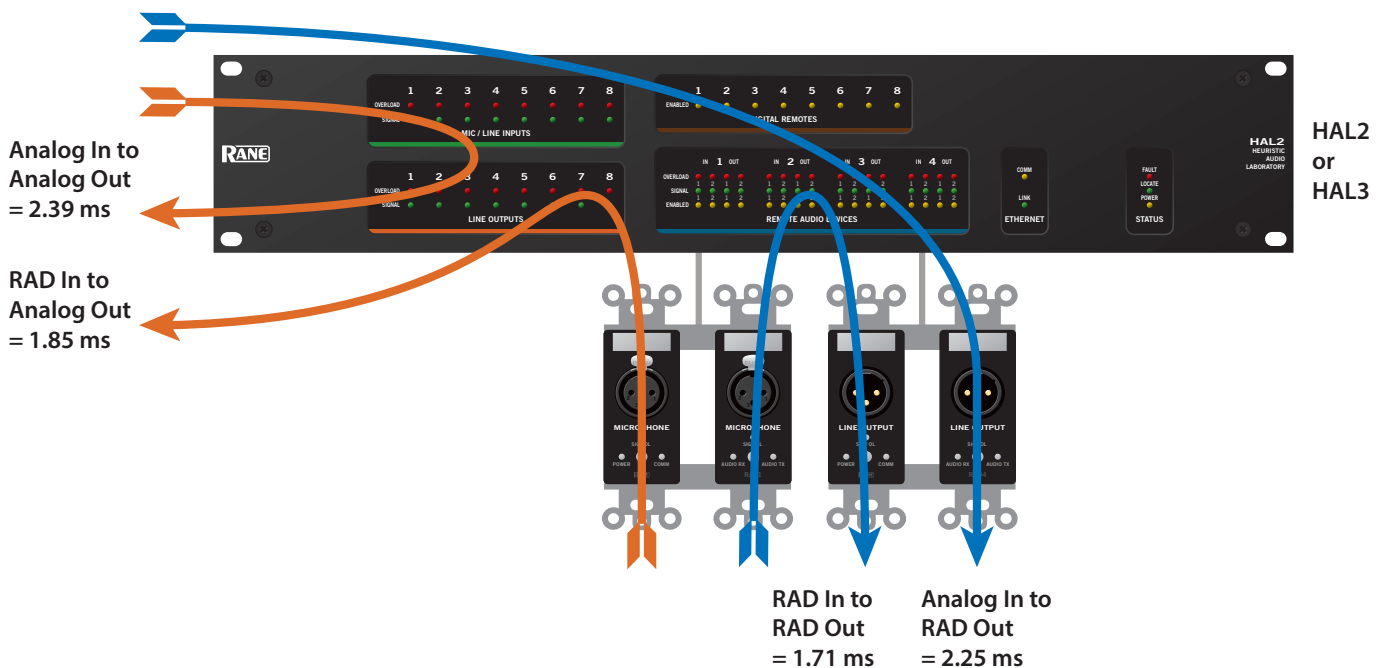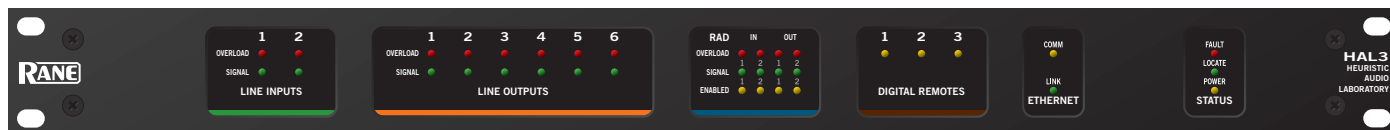
HAL3 Specifications

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 kΩ	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 kΩ	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 kΩ / 600 Ω load
...Frequency Response	20-20k Hz, +0.1 / -0.3 dB		+4 dBu, unity gain, 100 kΩ load
...Dynamic Range	104 dB	max	re +20 dBu, 20 kHz BW, A-weighted, 100 kΩ load
...Interchannel Isolation	104 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 3.
...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	100 meters / 300 feet	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	152 meters / 500 feet	max	Shielded CAT 5e cable or better
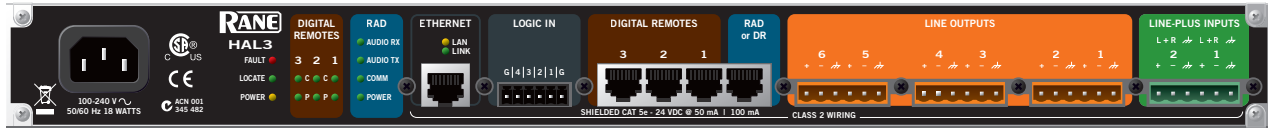
Parameter	Specification	Limit	Conditions/Comments
DR Ports	4		RJ-45 connectors
...Power	24 VDC @ 50 mA	max	Each port
...Length	300 meters / 1000 feet	max	Shielded CAT 5e cable or better
Logic Inputs	4		
...Connector	Mini Euroblock		6-pin, 3.81 mm pitch, Black
...Internal Pull-up	51.1 kΩ, 5.0 V		Protected 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
Unit: Conformity	CE, FCC, cCSAus		
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)

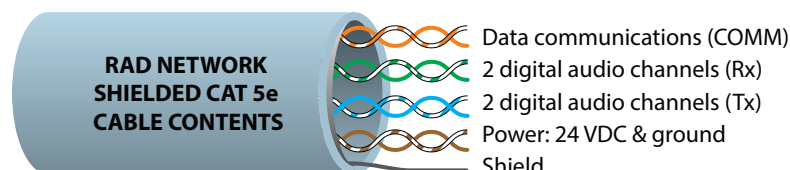# HAL3 Multiprocessor Architects & Engineers Specification

The digital multiprocessor shall be a line-level 4 in x 8 out configuration having four inputs: two analog on plug-in barrier strip that can be either +4 dBu balanced or -10 dBV unbalanced with left (+) and right (-) automatically monoed; and one digital remote audio device port providing up to two digital inputs and two digital outputs; as well as six balanced analog line-level outputs on plug-in barrier strips. Provisions shall be provided for three digital remotes to control source or preset selection, toggle and/or level control located up to 300 meters (1,000 feet) away. In addition there shall be four contact closure logic inputs on a plug-in barrier strip. The remote audio devices shall provide A/D and/or D/A conversion based on AES3 transport to the wall up to 150 meters (500 feet) from the multiprocessor, as well as units for cascadable automatic microphone mixing up to 64 channels, control logic expansion and wall sensors, ambient sensing mics, small amplifiers, and advanced paging stations. All remote audio devices and digital remotes shall connect via shielded CAT 5e (or better) cable to the multiprocessor. Further, all remote audio devices and digital remote devices shall support portable use and hot swapping so that devices may be replaced without shutting down the system, and do so without any audio interference, and that all settings for new devices are automatically downloaded from the multiprocessor along with the correct firmware. The unit shall connect to a computer using standard Ethernet on an RJ-45 connector. All functions shall be designed, configured and controlled by a software program featuring a graphical user interface that allows managing the global tasks of discovering, connecting to, and applying configurations to the remote digital multiprocessor. The hardware-software combination shall automatically check and display the status, location, CAT 5 crimp and wiring integrity, and that audio is flowing to and/or from all peripheral devices. The hardware multiprocessor and the software shall each include Ethernet ASCII text over TCP/IP control support for third-party control systems such as AMX, Crestron and Stardraw Control. The processor shall have an internal 100-240 VAC, 50/60 Hz power supply.

The digital multiprocessor shall be a Rane HAL3 running Rane Halogen software, and using Rane Remote Audio Devices (RADs) and Digital Remotes (DRs).

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 150 meter (500 feet) 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. Except for the RAD16, RAD17, RAD24, AM1, AM2, and PAGER1, all other RADs are available in white, ivory, or black, with a matched Decora® plate cover included.

RAD NETWORK SHIELDED CAT 5e CABLE CONTENTS

Data communications (COMM)
2 digital audio channels (Rx)
2 digital audio channels (Tx)
Power: 24 VDC & ground
Shield

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	Omnidirectional Boundary Layer Mic
RAD18	XLR Mic Input / 1/4" Balanced Line Input
RAD23	XLR Line Input / XLR Line Output
RAD24	One-Watt, Plenum-Rated Amplifier
RAD27	USB Audio Sound Card
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

PAGER1
Paging Station

This RAD has a mic preamp, paging zone(s) [Scenario] selector and an integrated push-to-talk switch. It sits on or can fasten to a tabletop, and accepts any gooseneck microphone (not included).
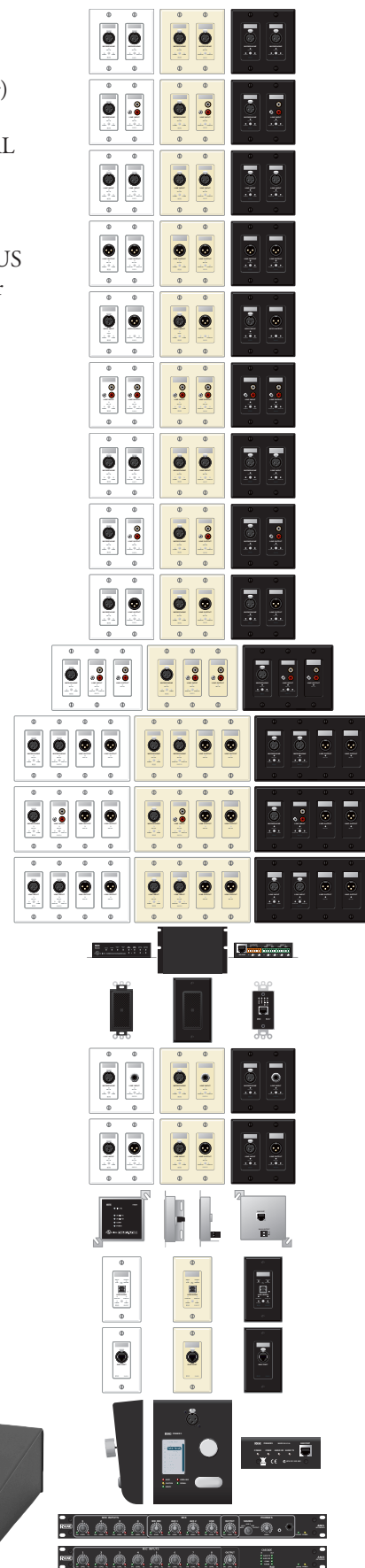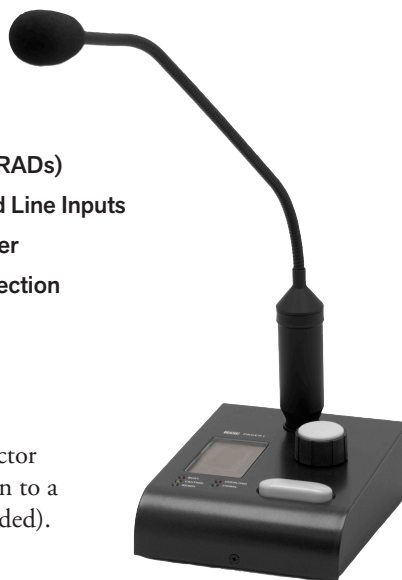
DR Remotes

- Simplify end-user control in HAL systems.
- Home run CAT 5e connection to any HAL up to 300 meters.
- Fit in standard electrical boxes.
- Customizable backlit LCD screens for intuitive labeling.
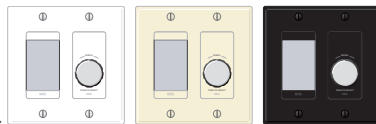- Available in white, ivory or black (Decora® plate included).
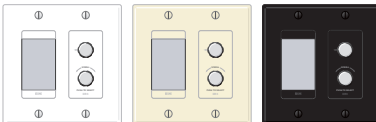
DR1

- Supports Level Control.

DR2

- Single Selector.
- List of Toggles/Commands.

DR3

- Single Level plus Selector.
- Single Level & List of Toggles/Commands.
- List of Levels for either multizone volume control or input mix.

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. The DR4 offers eight logic ins and outs, six IR2 ports (future use) 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 300 meters (1000 feet) away.
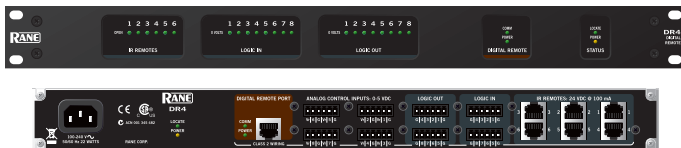
DR5 Switch Controller

The DR5 Digital Remote offers additional logic input and output ports, enabling the use of simple analog level 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 a DR5. It is designed to fit in a standard US dual-gang electrical box.
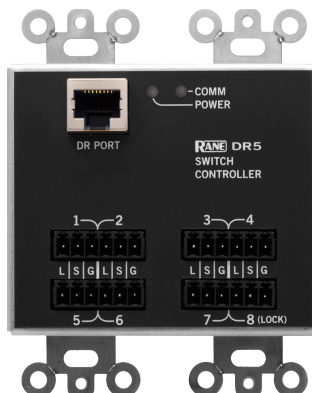
IR2 Infrared Wall Sensors

The Rane IR2 provides 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 IR2 works with Halogen's Room Combine Processor to support custom wall layouts and auto-activation of independent room processors for each possible physical room as walls open and close. Control links to Digital Remotes also combine and separate automatically as wall states change. No presets required.

Halogen Web Controls

Control the Levels, Selectors, Toggles and Commands in any HAL System from any device with a web browser. Halogen 4.0's Web Controls feature allows creation of custom HTML GUI control screens. Define the quantity of control pages, and the layout, labeling and size of each control, and completely test them using your default web browser from within Halogen.

Access any control page from any browser-enabled device on the network with a HAL device. Just open a browser and type in the customizable IP/webpage address for the HTML page – and bookmark it for easy access. Type in the (optional) 6 digit User Access code, and voilà, the trick, she is done! Control your HAL system wirelessly from one or more tablets, smart phones, laptops or desktop computers. The HAL web server is multi-client, allowing control across many devices and many rooms. You can link Rane's wired DR remote controls (DR1, DR2 & DR3) and wireless devices and they'll automatically track each other.

Customers from almost every audio application are asking for "iPad control" and Halogen's Web Controls is the solution. It is not Apple®-centric — no iTunes® store or app installs required. We'll save a lot of space and ink on this page by not listing all the possible devices that support web browsers and wireless Ethernet. Besides, the list will change before the ink dries.
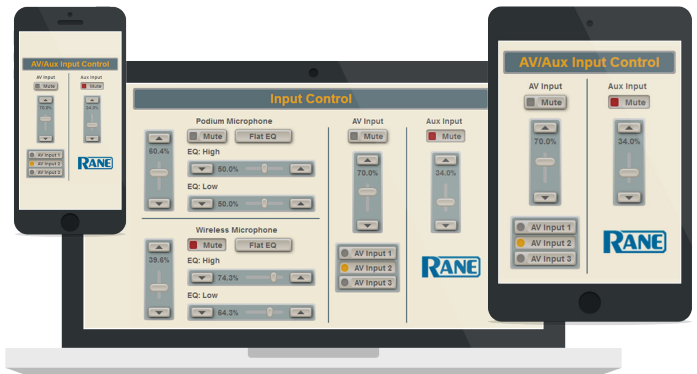
Details of HAL Accessories are found in the HAL System Data Sheet

Example HAL3 Background Music System

HAL3 Multiprocessor
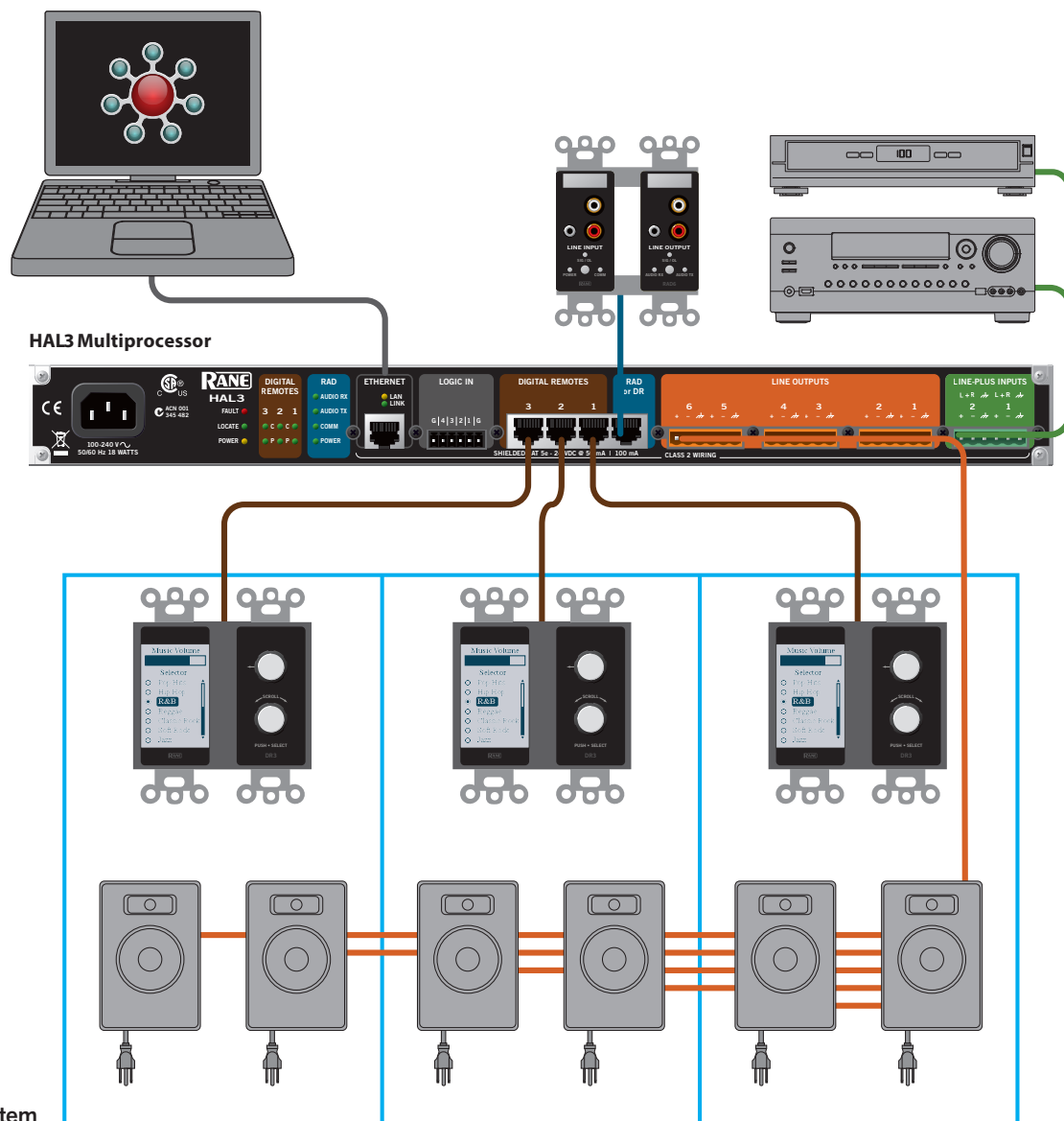
Applications

▪ 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).

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