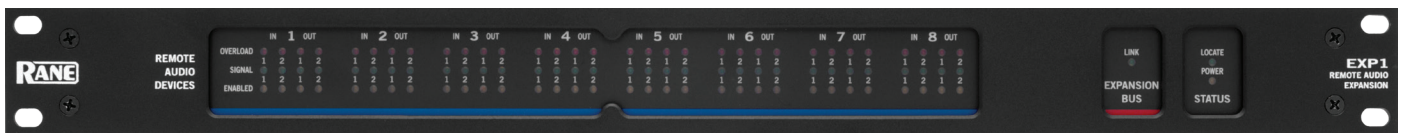




HAL1 Multiprocessor



EXP1 Expander for HAL1

## 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.

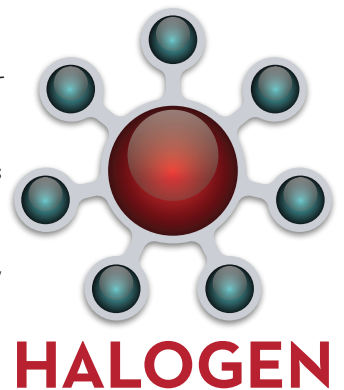
In addition, the HAL Multiprocessor and Halogen software check the status, location, CAT 5 wiring integrity, and that audio is flowing in all peripheral devices, so you know your system is properly connected and ready to go.

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 2.

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. See the HAL System Data Sheet for screenshots and processing block descriptions.



# HALOGEN

**Download Halogen and design a system now!**

[rane.com/hal](http://rane.com/hal)

Well-documented example programs for AMX, Crestron and Stardraw Control ease programming headaches. These Support Packages are installed with Halogen software, or available as separate downloads.



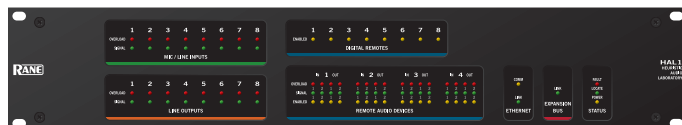
# HAL1 Multiprocessor EXP1 Expander



## 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.

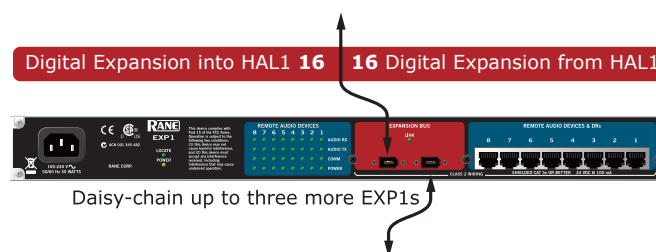
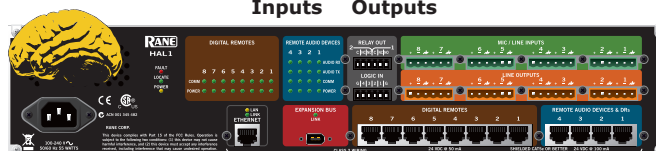


### EXP1 Expander for HAL1

- 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.

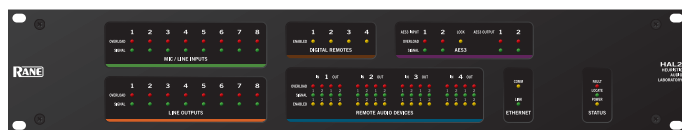


Analog Mic / Line Inputs <b>8</b>	<b>8</b> Analog Line Outputs
Digital RAD Port Inputs <b>8</b>	<b>8</b> Digital RAD Port Outputs
Digital Expansion into HAL1 <b>64</b>	<b>32</b> Digital Expansion from HAL1
Total in the <b>HAL1</b> DSP Brain <b>80</b>	<b>48</b>
<b>Inputs</b>	<b>Outputs</b>

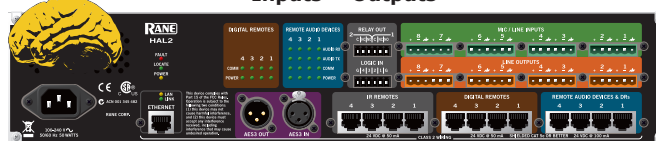


### NEW! HAL2 Multiprocessor

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



### 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 <b>2</b>	<b>6</b> Analog Line Outputs
Digital RAD Port Inputs <b>2</b>	<b>2</b> Digital RAD Port Outputs
Total in the <b>HAL3</b> DSP Brain <b>4</b>	<b>8</b>
<b>Inputs</b>	<b>Outputs</b>

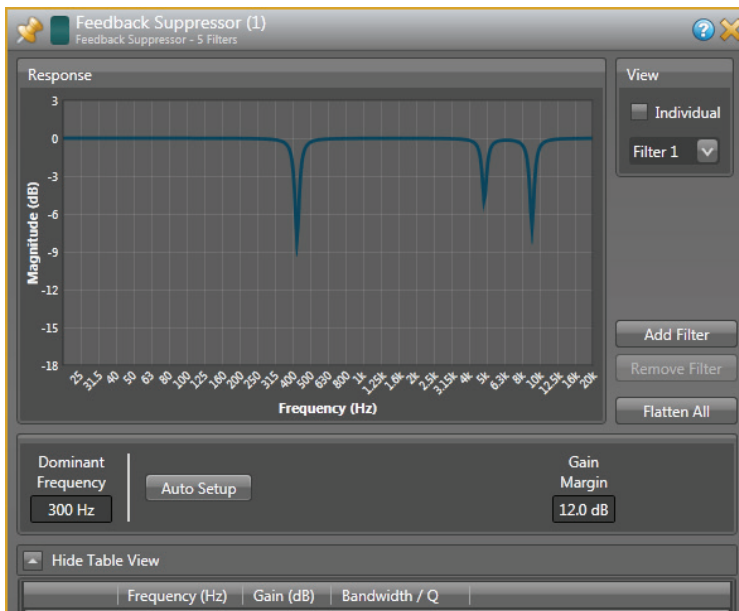


## NEW! Halogen 2.0 Processing



### Ambient Noise Compensator (ANC) Block

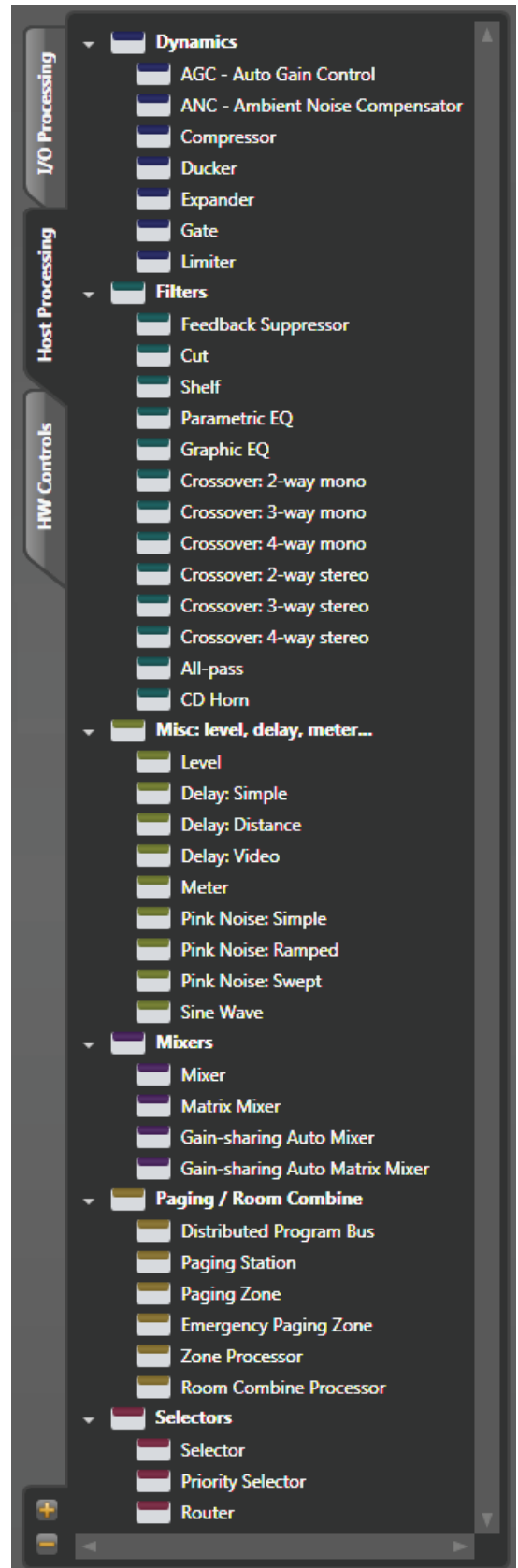
The new Ambient Noise Compensation (ANC) DSP block is perfect for retail, restaurants, hotels, busy lobbies, industrial areas, transportation stations and even the cry room in a house of worship. The ANC block automatically adjusts page and/or program music volumes as the room background noise changes. It constantly models the direct and reflected sound between sensing mics (such as Rane's new RAD17 on page 3) and the loudspeakers to distinguish noise from the loudspeaker content.

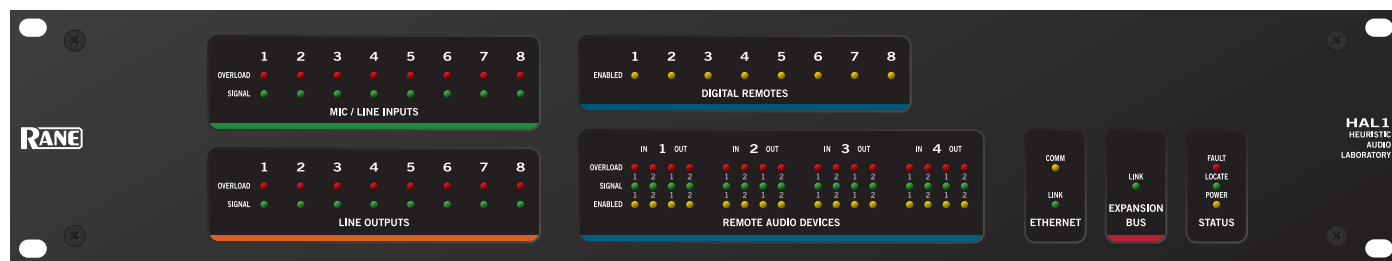


### Feedback Suppressor Block

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.

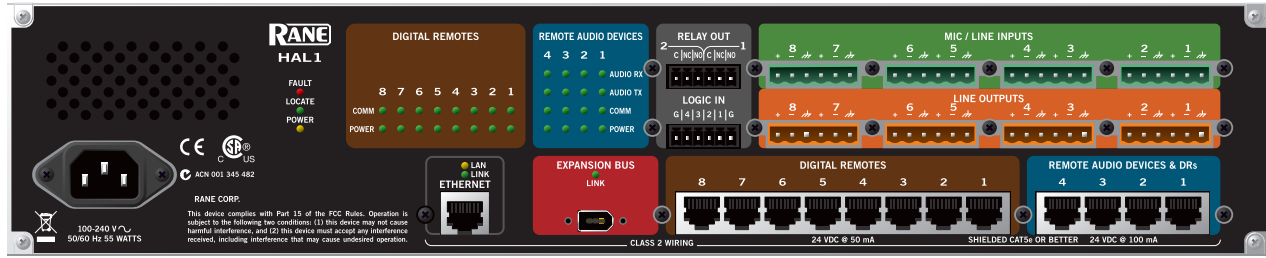
## 2.0 Processing Blocks





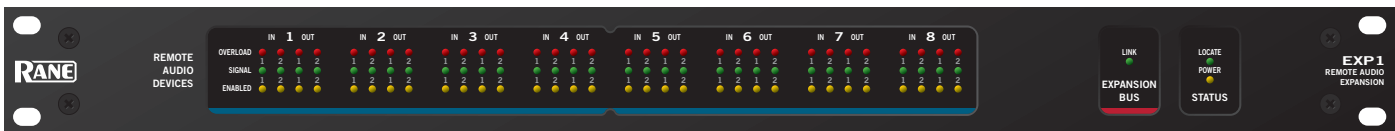
## HAL1 Specifications

Parameter	Specification	Limit	Conditions/Comments
<b>Analog I/O</b>	8 x 8		
...Connectors	Euroblock		4 x 6-pin, 5 mm pitch, Green = Inputs, Orange = outputs
...CODEC	24-bit, 48 kHz		
<b>Mic Inputs</b>	Active Balanced		
...Gain Settings	+10 to +60 dB		1 dB steps
...Input Impedance	2.6 k $\Omega$	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 $\Omega$ 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
<b>Line Inputs</b>	Active Balanced		
...Gain Settings	Unity & +10 to +20 dB		1 dB steps from +10 to +20
...Input Impedance	5.1 k $\Omega$	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 $\Omega$
...Interchannel Isolation	104 dB	max	20-20k Hz, +20 dBu, unity gain, channel-to-channel
<b>Outputs</b>	Active Balanced		
...Impedance	200 $\Omega$	1%	Each leg
...Maximum Output	+20.9 / +16.4 dBu	typ	1 kHz, 100 k $\Omega$ / 600 $\Omega$ load
...Frequency Response	20-20k Hz, +0.1 / -0.3 dB		+4 dBu, unity gain, 100 k $\Omega$ load
...Dynamic Range	109 dB	max	re +20 dBu, 20 kHz BW, A-weighted, 100 k $\Omega$ load
...Interchannel Isolation	110 dB	typ	20-20k Hz, +20 dBu, channel-to-channel, 100 k $\Omega$ load
<b>Indicators</b>			
...Signal	-50 dBFS	typ	Green LED, peak-reading
...Overload	-0.5 dBFS	typ	Red LED, peak-reading
<b>Propagation Delays</b>			
...RAD In to RAD Out	1.71 ms	typ	See the Latency graphic on page page 7.
...RAD In to Analog Out	1.85 ms	typ	Tested with RAD23
...Analog In to RAD Out	2.25 ms	typ	
...Analog In to Analog Out	2.39 ms	typ	
<b>DSP</b>			
...HAL1 Processing Power	9600 MIPS	max	4 DSPs @ 300 MHz each with up to 8 instructions / cycle
...Word Length	32 / 64-bit Floating Point		
...HAL1 Delay Memory	80 seconds	max	
<b>Computer Interface:</b> 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



Parameter	Specification	Limit	Conditions/Comments
<b>HAL1 Expansion Bus</b>	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
<b>RAD Ports</b>	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
<b>HAL1 DR Ports</b>	8		RJ-45 connectors
...Power	24 VDC @ 50 mA	max	Each port
...Length	1000 feet / 304.8 meters	max	Shielded CAT 5e cable or better
<b>Relay Outputs</b>	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
<b>Logic Inputs</b>	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 $\mu$ A to assert
<b>Wiring</b>	Class 2		All rear panel terminals
<b>Power Requirement</b>	100 to 240 VAC		50/60 Hz, 50W max
<b>Ambient Room Temp.</b>	40 °C	max	Maximum external loading
<b>Conformity: Safety</b>			
...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)
<b>Conformity: EMC</b>			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2
<b>Unit: Size</b>	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)
<b>Shipping: Size</b>	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
<b>Expansion Bus</b>	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)
<b>RAD / DR Ports</b>	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
<b>Wiring</b>	Class 2		All rear panel terminals
<b>Power Requirement</b>	100 to 240 VAC		50/60 Hz, 30 W max
<b>Conformity: Safety</b>			
...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)
<b>Conformity: EMC</b>			
...FCC	Part 15B		Class B Device
...EU Directive 2004/108/EC	EN 55103-1, EN 55103-2		Environment E2
<b>Unit Size</b>	1U, 1.75" x 19" x 8.25"		(4.4 x 48.3 x 20.9 cm)
...Weight	5 lb		(2.3 kg)
<b>Shipping Size</b>	6.5" x 20.3" x 13.75"		(11.5 x 52 x 35 cm)
...Weight	8 lb		(4.5 kg)

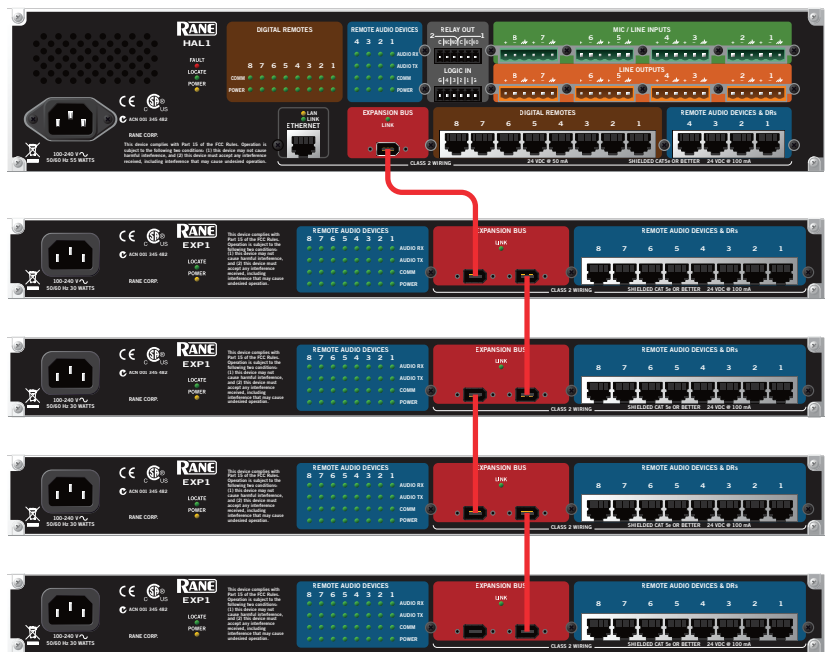
### \*FireWire Cable Sources

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

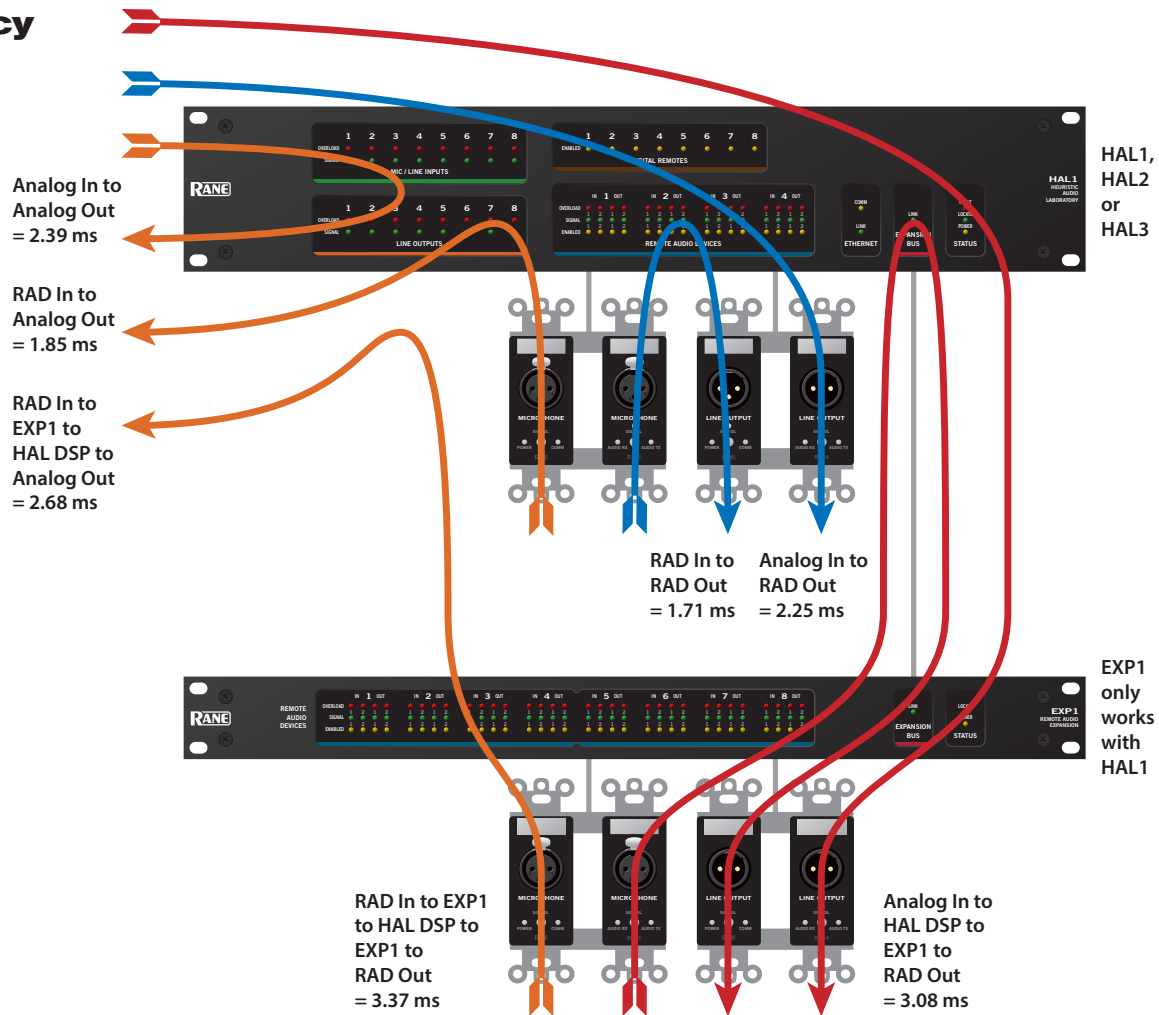
[northwire.com](http://northwire.com)

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

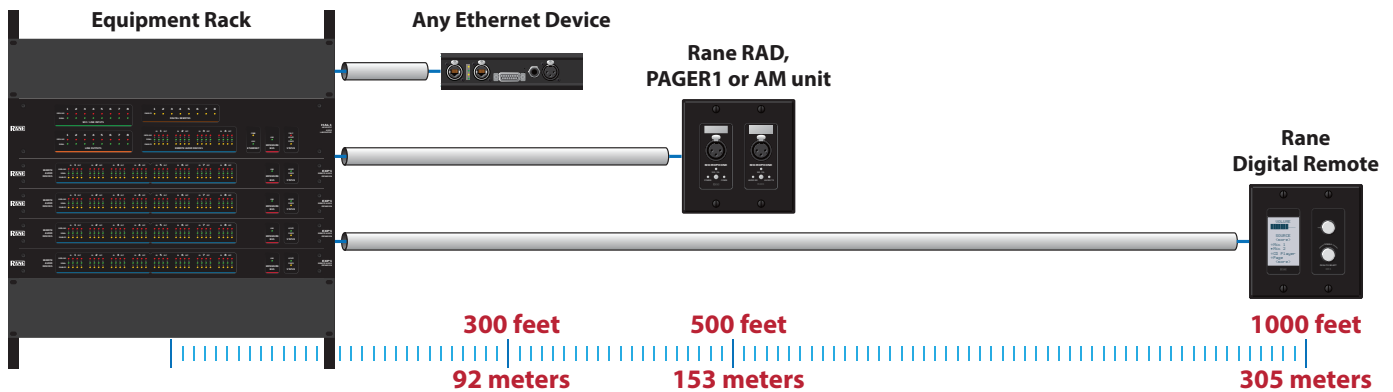
[newnex.com](http://newnex.com)



### Latency



### RAD and DR Cable Lengths



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# HAL1 Multiprocessor EXP1 Expander



## Example HAL1 with EXP1 Expander

