

CODE IS THE FLOOR. STANDARD IS THE CEILING.

Scope: Luxury residential distributed audio architecture — source platforms, matrix amplifiers, in-ceiling and in-wall speakers, subwoofer and bass management, DSP and room correction, speaker wire and wiring standards, zone topology and rack sizing, keypads and control, streaming services and library, speaker placement geometry, pre-wire discipline, codes and standards — heard, placed, and held before the drywall closes. Residential-only posture throughout. NEC 640/725; CEDIA RP-22; NJ UCC NJAC 5:23 / Bergen County AHJ.

§01 SOURCE PLATFORMS

- One source platform per home — select Sonos S2, Crestron DM NAX, Savant IP Audio, Control4 Triad, or Bluesound BluOS as the single streaming backbone; mixing two primary platforms in the same residence creates credential, app, and scene management conflicts that compound at every service call; the platform is specified before rough-in, not chosen at commissioning.
- Sonos S2 platform — Sonos Port (\$499, PORT1US1BLK) as network streamer with DAC, RCA line-out, and 12V trigger for existing amps; Sonos Amp Gen 2 (\$699, AMP1US1BLK) at 125W per channel at 8Ω, HDMI eARC, RCA sub pre-out, 1U rack-mount; Sonos Amp Multi (2026) 8-channel / 4-zone, 125W per channel, GaN PFFB topology, Wi-Fi 6, USB audio; Era 300 six-amplifier spatial audio speaker for music rooms and Dolby Atmos zones where passive in-ceiling is not appropriate; Crestron, Control4, Savant, and Lutron IP/TCP drivers published; S2 app required for all current Sonos hardware.
- Crestron DM NAX (Network AV Audio over IP) — AES67 standard with Crestron proprietary extensions; up to 32 DM NAX devices and 256 audio output zones per system; DM-NAX-AMP-X300 (1U half-rack) configurable 4×75W Lo-Z, 2×150W bridged, or 1×300W bridged, plus 70V/100V Hi-Z; DM-NAX-2XLRI-1G PoE XLR input wall plate with +48V phantom; DM-NAX-AUD-IO PoE stereo analog I/O bridge; full per-zone DSP matrix mixing and PEQ on all outputs; AES67 Dante interop via Dante Controller; SIMPL Windows, C#, and RESTful API control; Sonnex line end-of-sale May 2021 — DM NAX is the replacement path.
- Savant IP Audio platform — IP Audio 125 (PAV-SIPA125SM-10): 4 amplified stereo zones at 125W per channel at 8Ω plus 1 analog and 1 optical pre-out, 2U, AVB over Ethernet, Savant Music (MirageOS) built in, up to 3 units linked via MOTU-AVB switch for 18 zones; Pro Audio 4 (SMA-5000): 4 amplified zones at 50W per channel at 8Ω, 2 pre-amp zones, passive cooling, 4 IR ports, 2 RS-232; native Savant Pro App control; AVB-certified switch required for multi-unit deployments.
- Control4 Triad platform — Triad One (\$700, TS-SAMP1-100): single-zone, 100W per channel at 4Ω, 24-bit/192 kHz, 10-band parametric EQ, AirPlay via ShairBridge, Control4 SDDP; note 2–4 second encoding delay on analog inputs — do not specify as the sole source where lip sync matters; Triad 8-Zone Power Amplifier (AMP-8D-150): 8 zones, 50W per channel at 8Ω (8 channels driven), ICEpower modules, 5-band PEQ per zone, 1 RU, Phoenix speaker connectors; Control4 T4 Series touchscreens (8" and 10") as primary audio interface.
- JBL Synthesis and Lyngdorf processors as source hubs — JBL Synthesis SDP-58: 16-channel AV preamplifier, Dolby Atmos / DTS:X / Auro-3D, Dirac Live with Bass Control, Dante networking (16 channels on single Cat5e/Cat6), Roon Ready, AirPlay 2, Spotify Connect, TIDAL Connect, 16×XLR balanced outputs; Lyngdorf MP-50: 16-channel, RoomPerfect full-room correction, Roon Ready, AirPlay, Tidal Connect, 16×XLR; MP-60 2.1 is current flagship with HDMI 2.1 and higher DAC output; for estates where theater and whole-house share one processor, the MP-60 pre-amp outputs feed the distributed zone amplifiers.

§02 MATRIX AMPLIFIERS

- Matrix amp sized at 70% load maximum — never drive the amplifier beyond 70% of its rated channel count at minimum impedance; an 8-zone amplifier driving 4Ω loads on all zones simultaneously must be rated for 4Ω on all channels driven; derate accordingly when paralleling or using volume controls with multiple speakers; document the load calculation in the project closeout file.
- Sonance DSP 8-130 MkIII (SKU 93538) — 8-channel, 130W RMS per channel at 8Ω, 145W at 4Ω, 300W bridged at 8Ω per zone pair; 24-bit/96 kHz DAC; SonARC v2 10-band PEQ per zone with hundreds of Sonance-matched EQ presets; fanless Class D at 93% efficiency; 1U full rack; IP (Ethernet), IR, and 12V trigger control; Crestron, Savant, and Control4 drivers published; NEC 640 Class 2 Lo-Z residential.
- Sonance DSP 2-150 MkIII (SKU 93542) — 2-channel, 150W RMS per channel at 8Ω, 224W at 4Ω, 473W bridged mono at 8Ω; 24-bit/96 kHz; fanless; 1U half-rack; SonARC v2; bridgeable; specified for high-power primary listening zones (master suite, great room) where 150W per channel is required, or for driving large-format in-wall speakers (Paradigm CI Elite E80-IW) and in-wall subwoofers in discrete cabinet configurations.
- NAD CI 8-150 DSP — 8-channel, 150W per channel at 8Ω (all channels driven, 0.02% THD), 180W at 4Ω, 280W bridged at 8Ω; HybridDigital NCore; 4Ω stable throughout; browser-based DSP calibration; loop-through inputs; universal AC; 2U; active fans — install in conditioned space or provide dedicated rack ventilation: highest per-channel power of anv 8-zone residential matrix at this tier.

QC GATE — VERIFY BEFORE CLOSE-IN

- ☐ Home-run topology confirmed — every speaker location has dedicated cable run from distribution closet to speaker; no daisy-chain or multi-tap wiring; all cable runs are labeled with zone and speaker number; no shared cables between zones.
- ☐ Speaker placement confirmed before drywall — brackets installed; speaker locations marked on framing; signed layout drawing on file; 50% of speaker locations confirmed by listening test before drywall; 100% of speaker locations confirmed by listening test before drywall.

8Ω, Class D-3 with 15,000V ESD and 2,400V surge protection, 2U, RCA inputs, Phoenix connectors (14 AWG), signal-sensing turn-on; Episode Response Series EA-RSP-8D/12D/16D-100: 100W per channel at 4Ω, IP-controlled DSP, On-G enabled, matrix switching built in; Crestron DM-NAX-AMP-X300 for AES67 / Dante interop; Sonance DSP 8-130 MkIII (SKU 93538) or DSP 2-150 MkIII (SKU 93542) for high-power primary listening zones; JBL Synthesis SDP-58 or Lyngdorf MP-50/60 for discrete cabinet configurations; NAD CI 8-150 DSP for 8-channel, 150W per channel at 8Ω (all channels driven, 0.02% THD), 180W at 4Ω, 280W bridged at 8Ω; HybridDigital NCore; 4Ω stable throughout; browser-based DSP calibration; loop-through inputs; universal AC; 2U; active fans — install in conditioned space or provide dedicated rack ventilation: highest per-channel power of anv 8-zone residential matrix at this tier.

§06 SPEAKER WIRE AND WIRING STANDARDS

- Wire gauge by run length and impedance — Restrepo standard: 8Ω load ≤25 ft: 14 AWG preferred; 8Ω 26–50 ft: 14 AWG; 8Ω 51–100 ft: 12 AWG; 8Ω >100 ft: 10 AWG preferred; 4Ω ≤25 ft: 12 AWG preferred; 4Ω >50 ft: 10 AWG; 70V Hi-Z any run: 14 AWG; guideline: wire resistance must not exceed 5% of speaker impedance for the total run (both conductors); measure actual pull length from amplifier terminal to speaker terminal.
- NEC Article 640 and 725 — 640.6 wiring methods: for systems ≤25V and ≤100W per zone, Class 2 wiring (Article 725 Part III) applies; 70V/100V systems: Class 3; all in-wall speaker cable must be CL2 or CL3 rated; plenum (return-air) spaces: CMP or CL2P/CL3P required (NEC Article 800 / NFPA 262); never use lamp cord (SPT-1/SPT-2), zip cord, or unrated speaker wire in wall or ceiling cavities — violates NEC 725 and NJAC 5:23; 725.136: Class 2/3 wiring separated from line voltage by 2 inches minimum in same enclosure, 6 inches if unenclosed.
- Approved wire brands — Liberty 14-2-OFC: 14 AWG, oxygen-free copper, CL2/CL3, standard distribution-closet-to-speaker run; West Penn 25227B: 12 AWG, 2-conductor, CMP plenum-rated, for HVAC-adjacent plenum ceiling runs; Belden 5T00UP: 10 AWG, 2-conductor, bare copper, CL2, 27.8A per conductor, long runs >75 ft at 8Ω or 4Ω loads; Wirepath WP-MAS Series: 12 AWG and 14 AWG CL2/CL3, Restrepo value-tier projects.
- Termination methods — banana plugs: preferred for amplifier-side binding posts; dual-banana at 3/4" spacing for Sonos Amp custom jacks; standard single banana for NAD, Sonance, Episode; Phoenix/screw terminal connectors: standard on Sonance DSP, Episode, NAD CI 8-150, Triad 8-zone — strip 3/8", tin conductor, tighten to manufacturer torque; accepts 12 AWG; five-way binding posts (JBL Synthesis SCL-3/SCL-4): use spade lugs (insulated, tinned copper) for reliable high-power contact; spring-clip terminals (Revel C763): minimum acceptable, not preferred when binding posts are available.
- Cat6A for control and streaming endpoints — Cat6A required for all network audio runs (DM NAX, Savant AVB, Roon endpoints, Sonos network); terminate with RJ-45 Cat6A keystone jacks (Belden REVConnect or equivalent); do not use Cat5e for new construction; runs >100 m between distribution points: specify OM3 or OS2 fiber with PoE media converter at endpoint; managed switch: Cisco CBS350 or equivalent L2 with IGMP snooping, QoS DSCP, and VLAN segmentation for DM NAX; Savant AVB requires AVB-certified switch (Savant MOTU-AVB).
- Rack AC requirements — dedicated 20A circuit (audio, separate from control equipment) and dedicated 20A circuit (networking) per distribution closet rack; rack-mount power conditioning (Furman or equivalent) with surge protection, EMI filtering, and voltage regulation; if any component has an active fan (NAD CI 8-150, Episode EA-AMP-8D-70A, Anthem MRX-1140), install rack in conditioned space or provide dedicated ventilation; ambient rack temperature must remain below 95°F / 35°C; fanless Class D amplifiers (Sonance DSP, Savant Pro Audio 4, Episode RSP series) may be installed in structured media panels — verify max BTU against panel rated dissipation.
- Single-color cable standard: black jacket on every low-voltage run — speaker wire, Cat6A, control, shade, lighting, audio, and security all pull black on every Restrepo project; color-by-function cable schemes are deliberately rejected — no trade crew maintains a color assignment consistently past day one and mismatched re-pulls in year three produce a service liability that label discipline prevents and jacket color does not; black bundles read smaller in the wall cavity and in the rack; one color stocked means one color pulled and one color serviced for the life of the home; confirm all ordered cable is black-jacketed before the pull crew mobilizes.

§07 ZONE TOPOLOGY AND RACK SIZING

- Hub-and-spoke home-run wiring required — every speaker location receives its own dedicated uninterrupted cable home run from the distribution closet to the speaker back-can or wall bracket; no in-wall daisy-chain; no Y-splitters; no loop connections through volume controls between zones; hub-and-spoke enables per-zone impedance control, independent DSP processing, and reliable fault isolation; daisy-chain wiring creates parallel impedance loads the amplifier cannot independently control.
- Zone classification — primary listening (great room, master suite, library, music room): 100–150W per channel at 8Ω, full PEQ plus room correction; secondary listening (kitchen, dining, formal living): 50–100W per channel, PEQ per zone; ambient (primary bath, powder room, hallway): 25–70W per channel, basic gain trim; utility/value (mudroom, closet, guest bath): 25–50W, none required; outdoor

§10 SPEAKER PLACEMENT GEOMETRY

- Speaker placement before drywall — all speaker locations confirmed and brackets installed before board goes up; coordinate with architect, interior designer, and GC framing plan; center of each speaker marked on framing with chalk line; no placement decisions made in the field during rough-in without a signed layout drawing from the integrator; post-drywall speaker repositioning requires patching and painting that cannot be made invisible.
- Universal spacing geometry — ambient listening (SPL ≤70 dB): one in-ceiling stereo pair per 100 sq ft, speakers 7–8 ft apart, tweeters aimed toward primary listening area; primary listening (SPL ≤85 dB): one stereo pair per 60 sq ft or one high-sensitivity speaker per 80 sq ft; avoid placing in-ceiling speakers within 18 inches of a wall boundary — creates bass reinforcement peaks and comb filtering; if placement near a wall is required, engage boundary compensation switch (Revel C763/C563) or apply –2 to –3 dB low-shelf below 200 Hz in zone DSP.
- Formal living room and great room — formal living: one stereo pair of 8" in-ceiling (VP82R, Paradigm E80-R, or Revel C763) per seating area; ceiling height 8–10 ft ideal; REL S/812 in floor corner fed from main amp high-level Speakon; full PEQ plus Dirac Live or SonARC preset required; great room / open plan: two stereo pairs minimum for >600 sq ft; stereo pairs at kitchen island and main seating as separate zones; Paradigm Defiance X12 or X15 at wall midpoint; RoomPerfect (Lyngdorf) ideal for variable-position listening.
- Master suite and library — bedroom: one stereo pair of 6.5–8" in-ceiling, tweeter aimed toward head of bed, volume max limited to 70% of amplifier output in programming; master bath: one stereo pair VP62R, moisture-resistant grilles, IC-rated back-can for insulated ceiling (NJ best practice, not code); library: preferred in-wall bookshelf configuration (Sonance R1 or B&W CWM7.5 S2) at ear level in seated position; library shelving with books is excellent natural diffusion — specify with client as visual feature and acoustic benefit; Lyngdorf MP-50 with RoomPerfect signed by integrator.
- Theater/media room LCR and CEDIA RP-22 — in-wall LCR: Sonance R1/R2, JBL Synthesis SCL-3, or Triad Gold InWall; JBL Synthesis SCL-3 with SR2 subwoofer, signed calibration sheet; subwoofer: JBL SSW-1 or Paradigm Defiance X15, front-wall placement; surround and height channels per CEDIA/CTA-RP22 v1.2 (September 2023) immersive audio design guidelines; performance level tiers L1–L4; target SPL 105 dB(C) at 2/3 room depth for screen speakers; 115 dB(C) for LFE; ambient noise floor and reverberation time targets per RP-22.
- Outdoor patio interface — outdoor zone home run from distribution closet in 3/4" minimum EMT or Schedule 40 PVC conduit through exterior slab/wall; terminate at junction box at patio equipment location; outdoor-rated keypad (Lutron Maestro WR or equivalent) at patio entry point for convenient volume access; Sonance Landscape SLS subwoofer and amplifier (SR 2-125) rack-mounted in distribution closet; plan conduit sleeve from structure through foundation slab; reference Vol 20 sleeve and landscape audio discipline; Sonance SLS landscape on dedicated zone bridged from Crestron DM NAX.

§11 PRE-WIRE DISCIPLINE

- Home-run topology mandatory — every speaker location receives its own dedicated, uninterrupted cable from the distribution closet; no exceptions; in-wall daisy-chain is without written direction (see Section 13); install speaker mounting bracket (Sonance VP bracket, Paradigm mounting ring, B&W back-can, JBL sealed wood back-box) before drywall; JBL SCL-3/SCL-4: sealed wood back-box is a structural component of the speaker system — fasten to adjacent framing, not to drywall alone.
- Pre-construction bracket installation checklist — (1) bracket centered on the mark from the framing plan; (2) bracket plumb and level in ceiling plane; (3) wire pulled through bracket opening with service loop secured; (4) model number spec sheet taped inside back-can for future reference; (5) center of speaker marked on framing with chalk so drywall installer preserves the location; Sonance Invisible Series: stiffening ring must be fitted into the cavity and rough opening precisely dimensioned per Sonance installation template — mark center on stud with chalk before board goes up.
- Cat6A pre-wire — two Cat6A home-runs minimum at every keypad location (Lutron Sunnata, Crestron Horizon), every matrix amplifier location, and every touchscreen location — Cat A active, Cat B coiled and labeled SPARE for future touchscreen or IP-device conversion; any keypad location may later be upgraded to a touchscreen or IP-based device — the second Cat6A is the difference between a faceplate swap and opening the wall; label Cat A with the same zone designation as the audio home run serving that room; label Cat B as Z##-ROOM-KP-SPARE; pull Cat6A for DM NAX edge devices

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