

SPORTS SOUND

Loudspeaker System
Design Reference Guide



Recommended Effective Operating Distances

Reference: 96 dB

Model	Description	Feet		30	40	50	60	70	80	90	100	150	160	170	180	190	200	210	220	230	240	250	300+
		Meters		9	12	15	18	21	24	27	30	46	49	52	55	58	61	64	67	70	73	76	90+
R.15COAX	2-way, Coaxial; LF: 1 x 6", HF: 1 x 1"	32' / 10m																					
R.35COAX*	2-way, Coaxial; LF: 1 x 10", HF: 1 x 1.25"	52' / 16m																					
R.25-94Z	2-way, LF: 1 x 8", HF: 1 x 1"	49' / 15m																					
R.35-3896*	3-way; LF: 1 x 8", MF: 2 x 2.35", HF: 1 x 1"	83' / 25m																					
R.5COAX66/99**	2-way, LF: 1 x 12", HF: 1 x 1"	60' / 18m																					
R.5-66/94/99Z**	2-way, LF: 1 x 12", HF: 1 x 1"	90' / 27m																					
R1-64/66/94**	2-way, LF: 1 x 12", HF: 1 x 1"	148' / 45m																					
R.5HP	3-way; LF: 1 x 12", MF: 1 x 2", HF: 1 x 1"	150' / 46m																					
R.5-66/96MAX	2-way; LF: 1 x 12", HF: 1 x 1.4"	150' / 46m																					
R2-64/66/94MAX	3-way; LF: 2 x 12", MF: 1 x 2", HF: 1 x 1.4"	205' / 61m																					
R2-52Z	3-way; LF: 2 x 12", MF: 2 x 2", HF: 1 x 1"	205' / 61m																					
R2-52MAX	3-way; LF: 2 x 12", MF: 2 x 2", HF: 1 x 1"	252' / 77m																					
R2-77/94/694/474**	3-way; LF: 2 x 12", MF: 1 x 2", HF: 1 x 1"	157' / 48m																					
R6-51BIAMP	3-way; LF: 6 x 12", MF: 6 x 2", HF: 6 x 1"	452' / 138m																					
R6-51MAX	3-way; LF: 6 x 12", MF: 6 x 2", HF: 6 x 1"	622' / 189.6m																					
R6-BASSHORN	1-way; LF: 6 x 12"	452' / 138m																					
R6-BHMAX	1-way; LF: 6 x 12"	622' / 189.6m																					
RMG-200A	1-way; MF: 1 x 2"	240' / 73m																					
R.5-V2200	1-way; MF: 2 x 2"	315' / 96m																					
RSH-462	1-way; MF: 4 x 2"	715' / 218m																					

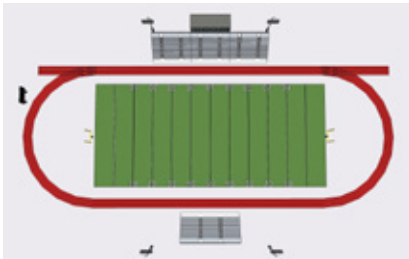
96 dB SPL with no atmospheric effects

* Voicing switch in Music position

** Average Max SPL considered or Max SPL of the lowest output device

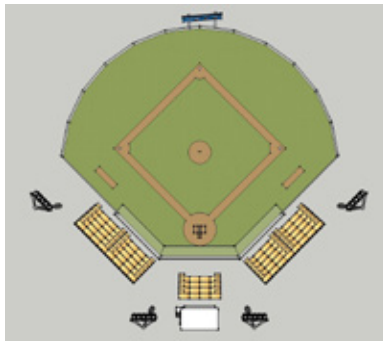
Contents

Football



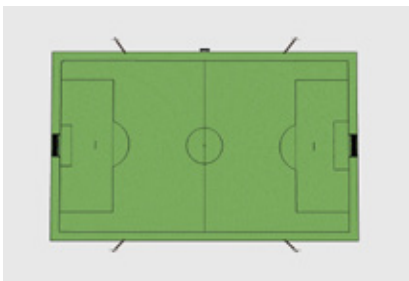
Football Field 'Press Box'	Page 4
Football Field 'Lighting Poles'	Page 5
Football Field 'Scoreboard'	Page 6

Baseball



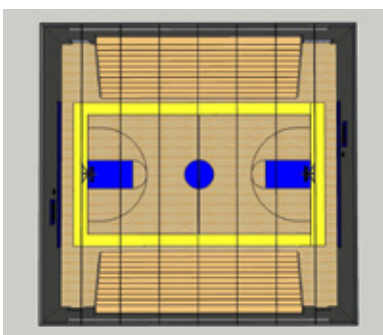
Baseball Field 'Press Box'	Page 7
Baseball Field 'Lighting Poles'	Page 8

Soccer



Soccer Field 'Pole Mount - Sideline Coverage'	Page 9
Soccer Field 'Pole Mount - Sideline and Field'	Page 10
Soccer Field 'Scoreboard'	Page 11

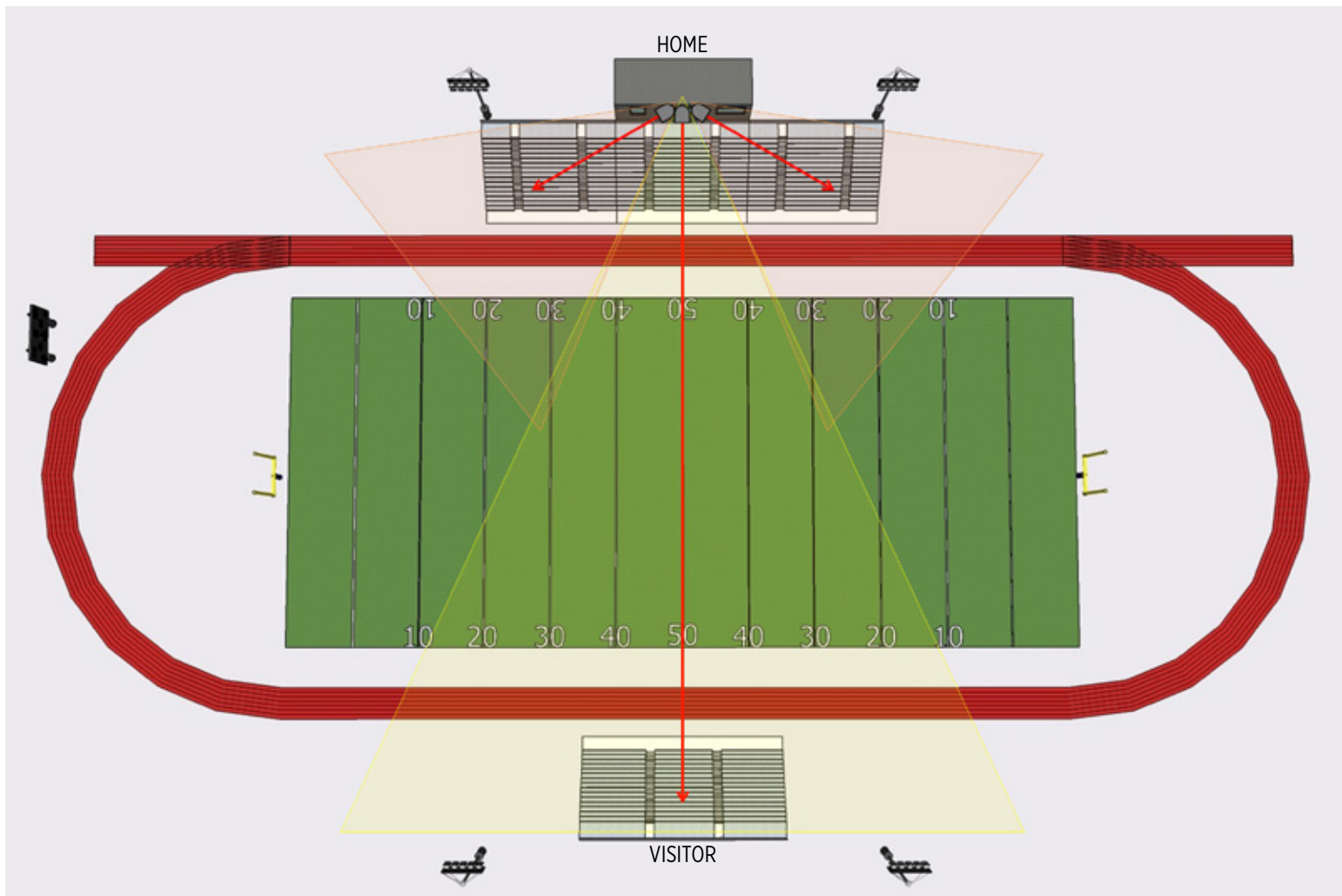
Basketball



Basketball Court 'General Coverage'	Page 12
Basketball Court 'Enhanced Court Coverage'	Page 13

Product Specifications	Page 14
Technical Considerations 'Amplified Loudspeaker Controllers'	Page 15

Football Field 'Press Box'



Installation Description:

- The loudspeakers are mounted on the roof of a press box, preferably at least 16 feet above the highest row of seating.
- The bleachers are assumed to be 20 feet tall at the back row.
- An array of two to four loudspeakers to address the home seating, plus an R2-52Z or R2-52MAX in the center to provide crossfield coverage.

Option A:

- One (1) R2-52MAX (visitor coverage)
- Three (3) R.5-96MAX (home coverage)
- High SPL and best musicality. Addresses larger bleacher areas while projecting uniformly over farther distances.
- One (1) ALC-1604D*

Option B:

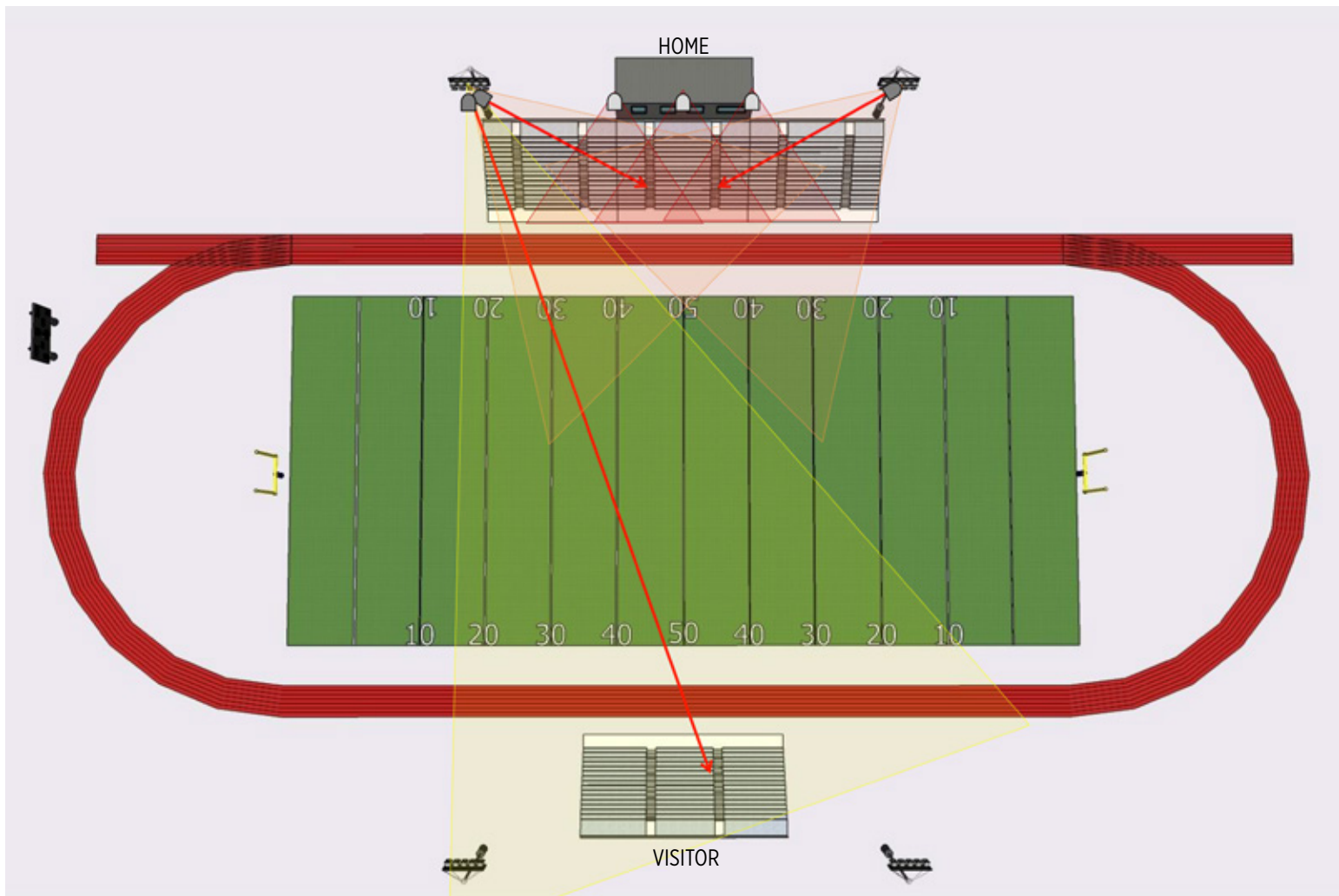
- One (1) R2-52Z (visitor coverage)
- Two (2) R.5-94Z (home coverage)
- Moderate SPL for use in venues with shorter bleachers (i.e., the length of the bleachers does not exceed the 30-30 yard line).
- One (1) ALC-404D*

Option C:

- One (1) R2-52Z (visitor coverage)
- Two (2) R2-94Z (home coverage)
- Two (2) R.5-94Z (center of home)
- Very articulate three-way performance and enhanced LF to the home seating section, while providing more even coverage to wide sections of the home stands.
- One (1) ALC-1604D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Football Field 'Lighting Poles'



Installation Description:

- The loudspeakers are pole mounted at least 25 feet above the back row.
- The bleachers are assumed to be 20 feet tall.
- Because the loudspeakers are mounted at a higher point, this system provides more even home seating coverage than the Football Field 'Press Box' design.
- A single R2-52Z or R2-52MAX provides crossfield coverage.
- Additional matching compact loudspeakers on the press box (Extra Coverage- red triangles) will help reduce artificial echoes. This can be added to either Option A or B.

Option A:

- One (1) R2-52MAX (visitor coverage)
- Two (2) R.5-96MAX (home coverage)
- Higher SPL and enhanced musicality for venues where the light poles are up to 240 feet apart.
- One (1) ALC-1604D*

Option B:

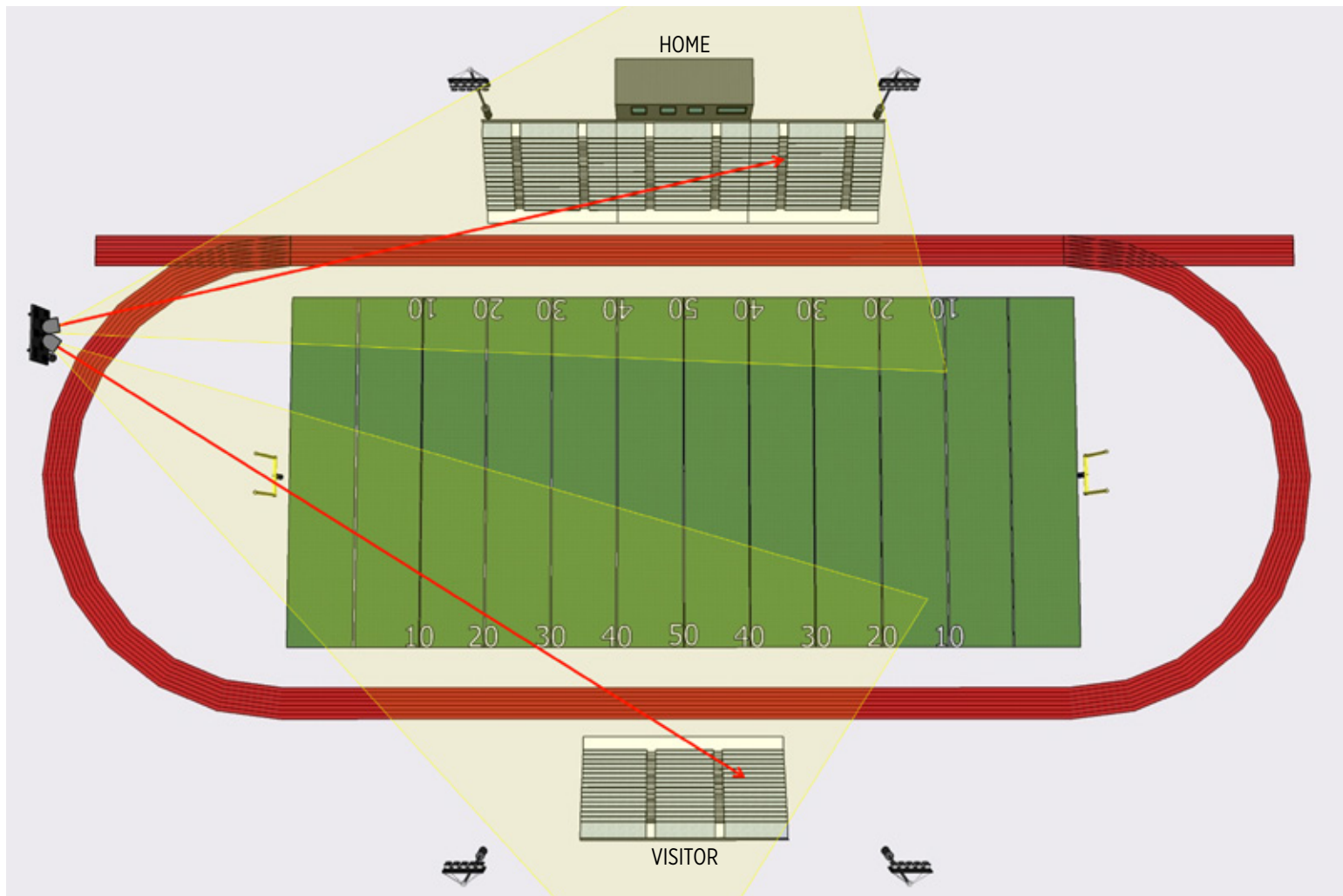
- One (1) R2-52Z (visitor coverage)
- Two (2) R.5-94Z (home coverage)
- Moderate SPL for use in venues with shorter bleachers and light poles up to 180 feet apart.
- One (1) ALC-404D*

Extra Coverage:

- Three or Four (3-4) R.35-3896 (additional home stands coverage)
- Additional signal-delayed coverage of the home stands helps reduce artificial echoes.
- One (1) ALC-404D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Football Field 'Scoreboard'



Installation Description:

- R2-52Z or R2-52MAX loudspeakers are mounted to the scoreboard 25 feet above the ground.
- The bleachers are assumed to be 20 feet tall at the back row.
- Atmospheric effects such as wind, diffraction, and excess high frequency attenuation are more likely to be noticed in this design.
- If the length of the home or visitor bleachers exceeds the 20-20 yard line, additional R2-52Z loudspeakers should strongly be considered for one or both sides.

Option A:

- Two (2) R2-52MAX
- Best coverage for shorter bleacher sections from a scoreboard location.
- One (1) ALC-1604D*

Option B:

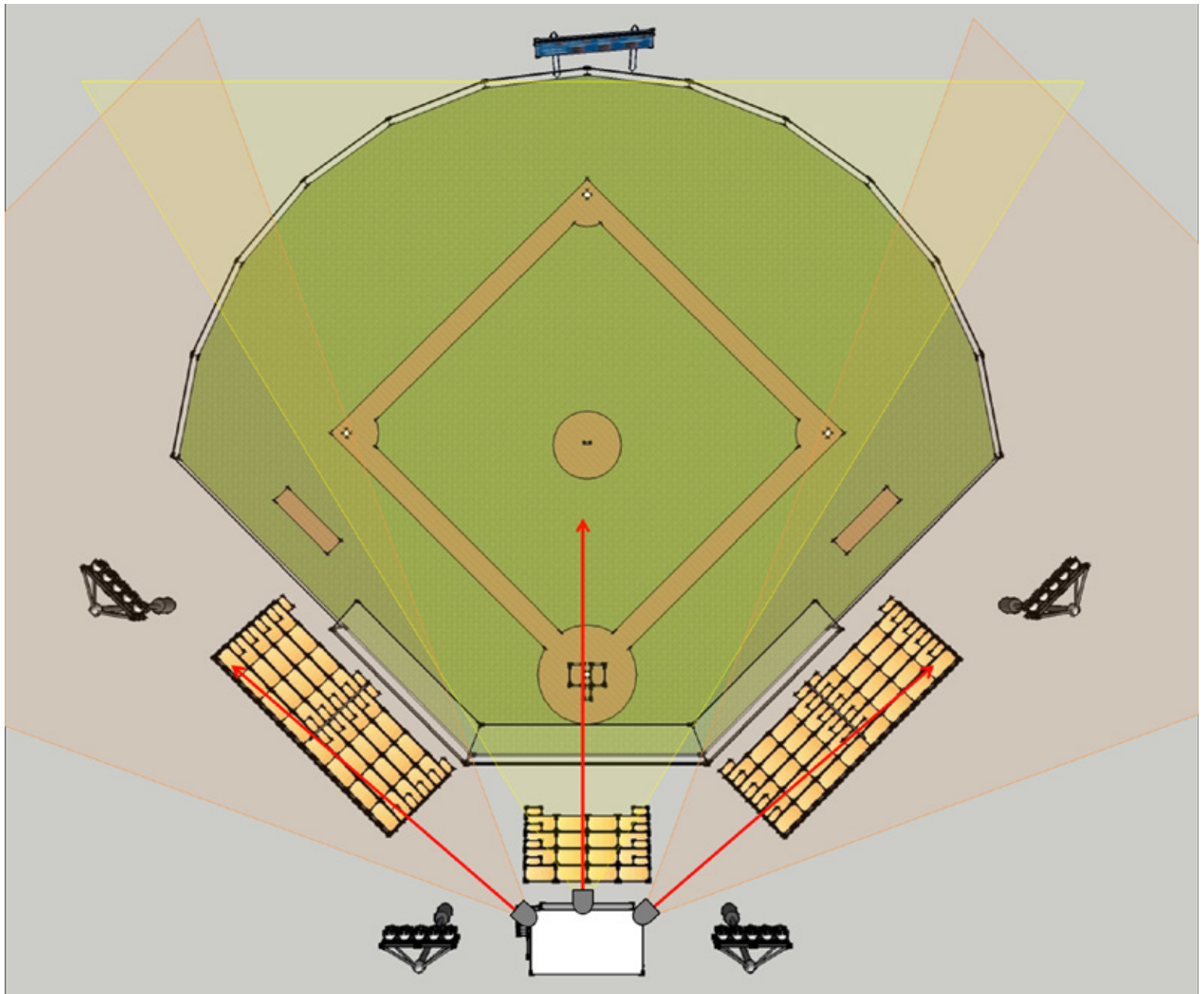
- Two (2) R2-52Z
- Good coverage for shorter bleacher sections from a scoreboard location.
- One (1) ALC-404D*

Option C:

- Three (3) or Four (4) R2-52Z
- The additional R2-52Z loudspeaker(s) provides enhanced SPL at long distances or covers longer bleachers.
- One (1) ALC-1604D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Baseball Field 'Press Box'



Installation Description:

- Three (3) loudspeakers mounted on the top of an 18-foot tall press box.

Option A:

- Three (3) R.25-94Z
- Good SPL to the infield and the seating, with good speech articulation.
- One (1) ALC-404D*

Option B:

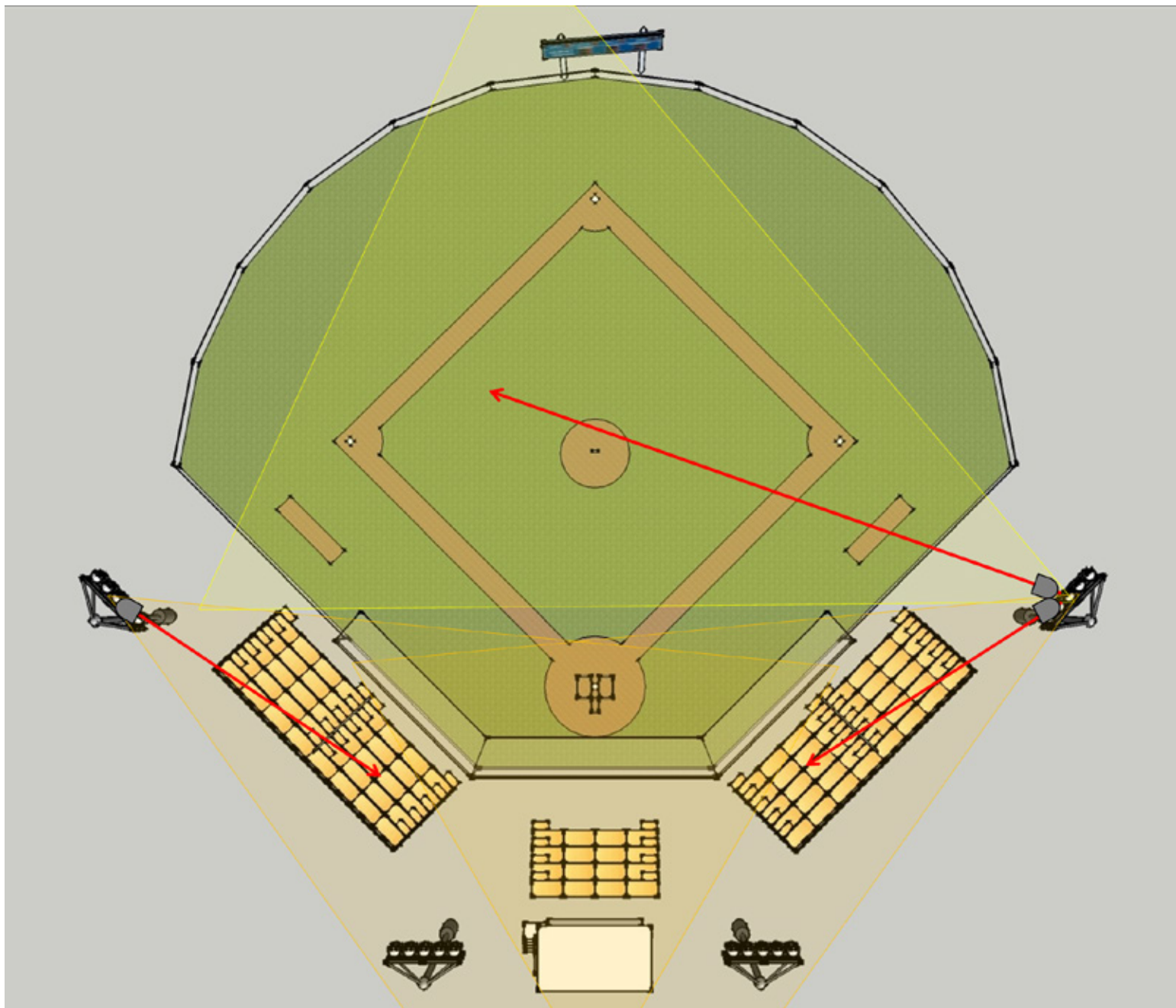
- Three (3) R.5-94Z
- Enhanced SPL and pattern control with better bass extension. Coverage extends up to 160 feet.
- One (1) ALC-404D*

Option C:

- Three (3) R.5-96MAX
- All of the benefits of Options A and B with greater musicality, higher SPL and the ability to address the entire field.
- One (1) ALC-3202D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Baseball Field 'Lighting Poles'



Installation Description:

- Three (3) loudspeakers pole mounted at a height of 30 feet, and up to 90 feet away from the press box.
- Additional matching compact loudspeakers on the press box (*not shown*) will help reduce artificial echoes.

Option A:

- Three (3) R.35-3896
- Good SPL to the infield and the seating, with good speech articulation.
- One (1) ALC-404D*

Option B:

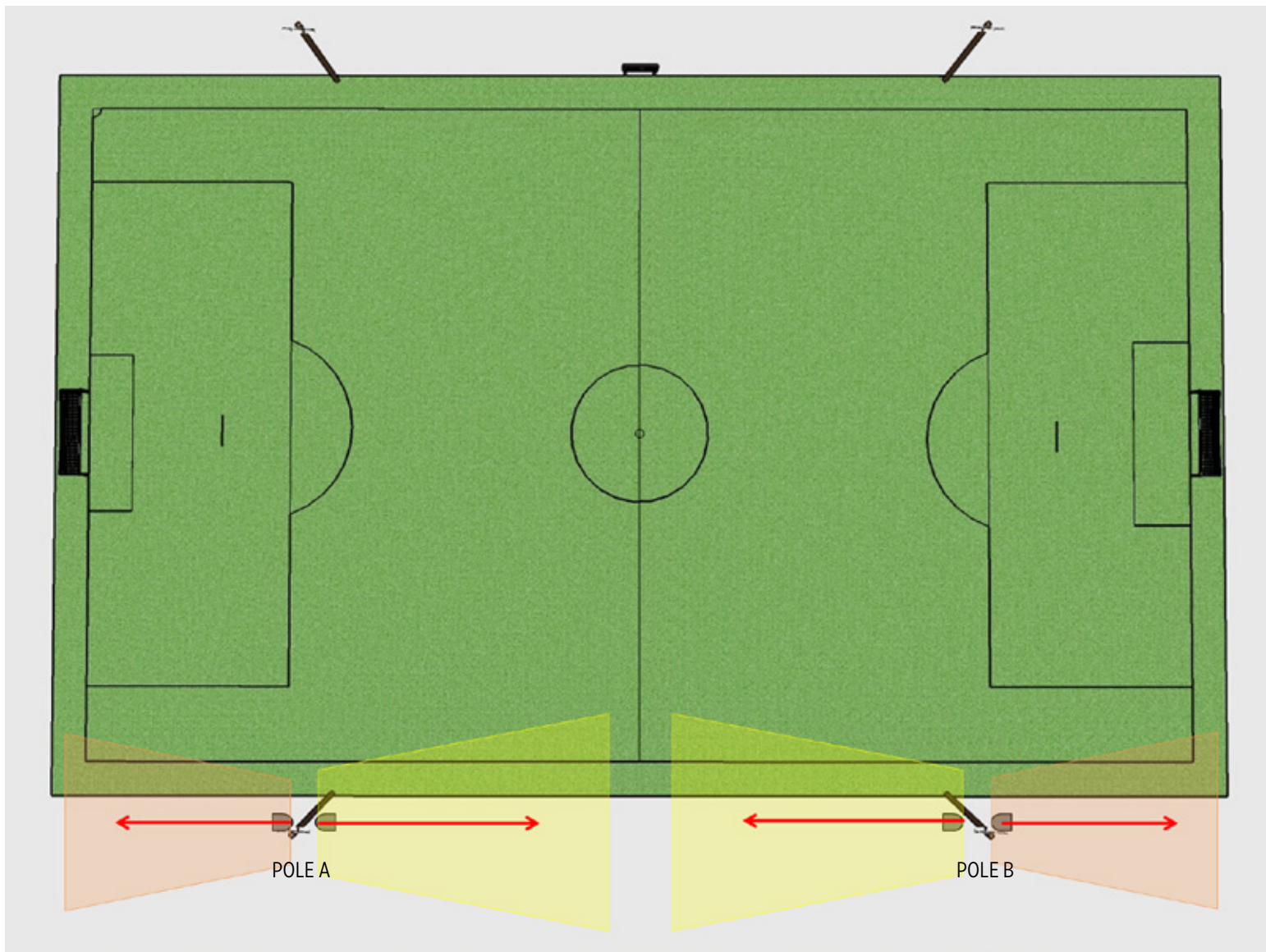
- Three (3) R.5-94Z
- Enhanced SPL and pattern control with better bass extension.
- One (1) ALC-404D*

Option C:

- Three (3) R.5-96MAX
- All of the benefits of Options A and B with greater musicality and higher SPL.
- One (1) ALC-3202D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Soccer Field 'Pole Mount - Sideline Coverage'



Installation Description:

- The loudspeakers are pole mounted 50 feet above the ground on light poles about 180 feet apart.
- Each loudspeaker aims down sharply to focus on an individual zone, minimizing coverage overlap.
- Seating may be on the ground or small bleachers.
- Alternative Coverage (two to three (2-3) loudspeakers - not shown): If mounting heights must be low and not aimed as sharply down, use only one (1) signal-delayed loudspeaker on "Pole B" aimed away from "Pole A". Or, use a larger model on "Pole A" to address the full "Pole B" zone (no loudspeakers on "Pole B").

Option A:

- Four (4) R.25-94Z
- Good voice articulation and good musicality.
- One (1) ALC-404D*

Option B:

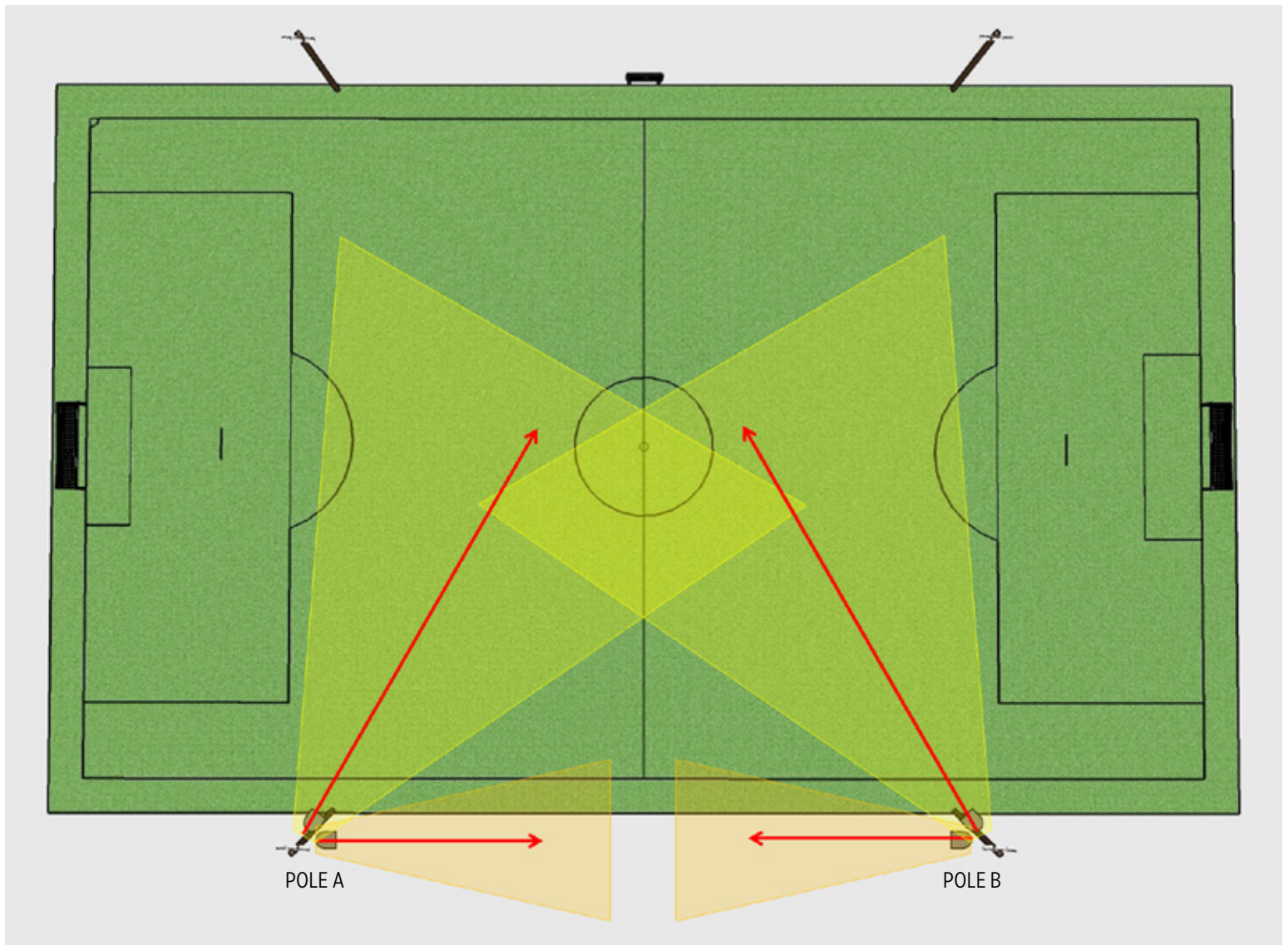
- Four (4) R.35-3896
- Great musicality and excellent voice articulation.
- One (1) ALC-404D*

Option C:

- Four (4) R.5-66Z
- Very good musicality, enhanced low frequency extension and excellent voice articulation.
- One (1) ALC-404D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Soccer Field 'Pole Mount - Sideline and Field'



Installation Description:

- The loudspeakers are pole mounted at least 30 feet above the ground on light poles about 180 feet apart.
- Seating may be on the ground between the poles or on small bleachers.
- Higher mounting points are preferred to minimize the effects of artificial echoes, ensuring good intelligibility.
- Another option is using only one loudspeaker array position to cover the sideline area (as explained on page 9) to consolidate the loudspeakers on one pole.

Option A:

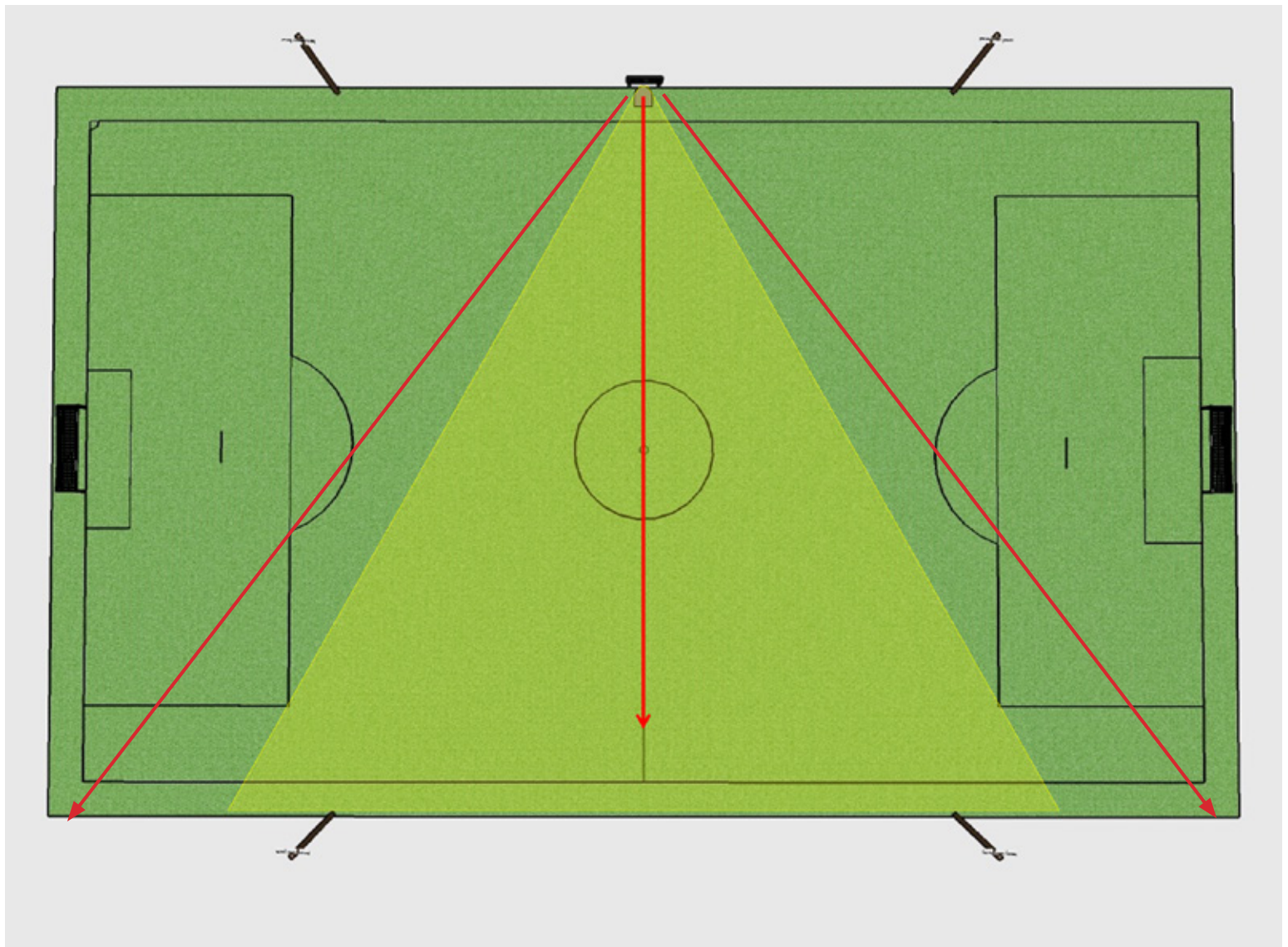
- Two (2) R.35-3896 (sideline coverage)
- Two (2) R.35-3896 (field coverage)
- Great musicality and excellent voice articulation for the seating area and the middle of the field.
- One (1) ALC-404D*

Option B:

- Two (2) R.5-66Z (sideline coverage)
- Two (2) R.5-94Z (field coverage)
- Very good musicality, enhanced low frequency extension and excellent voice articulation for the seating area and the middle of the field.
- One (1) ALC-404D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Soccer Field 'Scoreboard'



Installation Description:

- Single or dual R2-52Z or R2-52MAX loudspeakers are mounted on the scoreboard to cover the middle of the field and the far sideline.

Option A:

- One (1) R2-52Z (single cross-field red arrow; light green color coverage)
- Great coverage for the viewing side and great speech intelligibility. Careful consideration should be given to the amplifier-loudspeaker wire gauge.
- One (1) ALC-404D*

Option B:

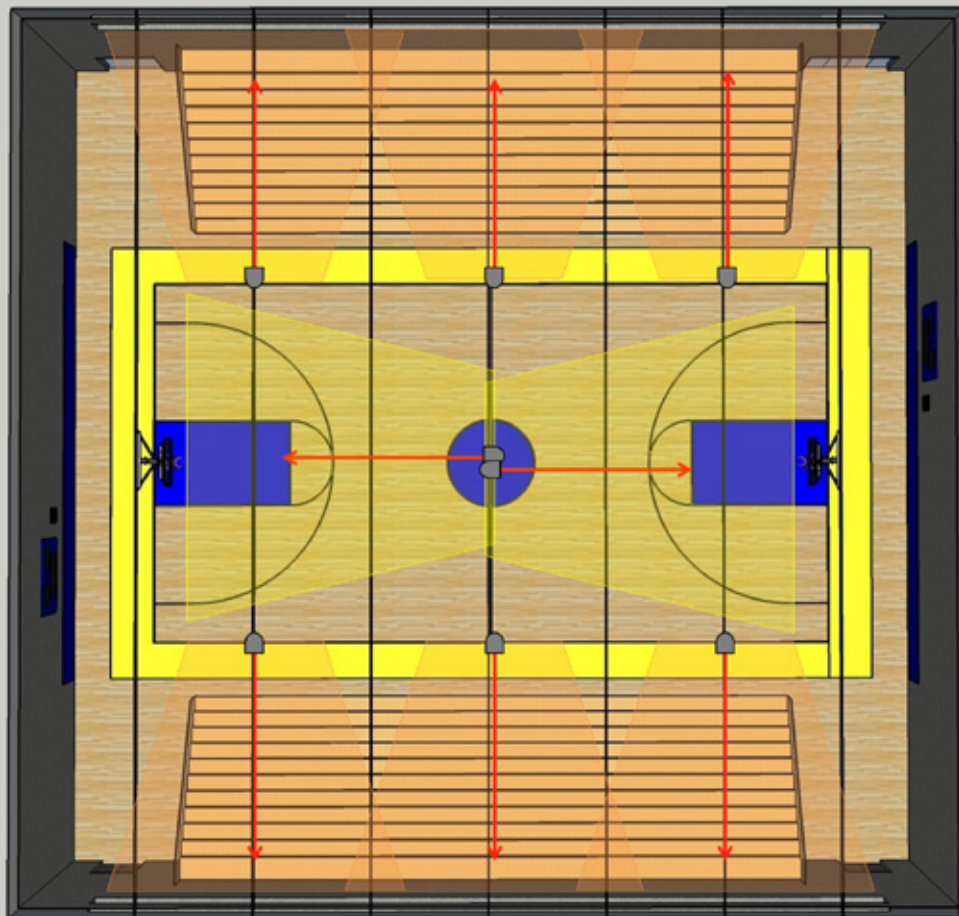
- Two (2) R2-52Z (two yellow arrows from the scoreboard to opposite corners of the field)
- Expanded coverage providing a wider listening area along the entire sideline.
- One (1) ALC-404D*

Upgrade Option:

- One (1) R2-52MAX or
- Two (2) R2-52MAX
- Substitute R2-52MAX models in either Option A or B to enhance musicality and intelligibility.
- One (1) ALC-3202D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Basketball Court 'General Coverage'



Installation Description:

- A typical 120-foot by 100-foot gymnasium with a 28-foot height to the low steel (bottom of trusses).
- The bleachers are up to 14 feet tall.
- The bleacher loudspeakers are mounted about 20 feet in front of the first row.
- Bleachers longer than 70 feet can require four (4) or more loudspeakers per side.
- The court loudspeakers provide general coverage to the court and floor seating for sporting events.

Option A:

- Six (6) R.5-94Z (bleacher coverage)
- Two (2) R.5-99Z (center court)
- Good pattern control (for intelligibility) and moderate SPL in non-acoustically treated spaces.
- One (1) ALC-1604D*

Option B:

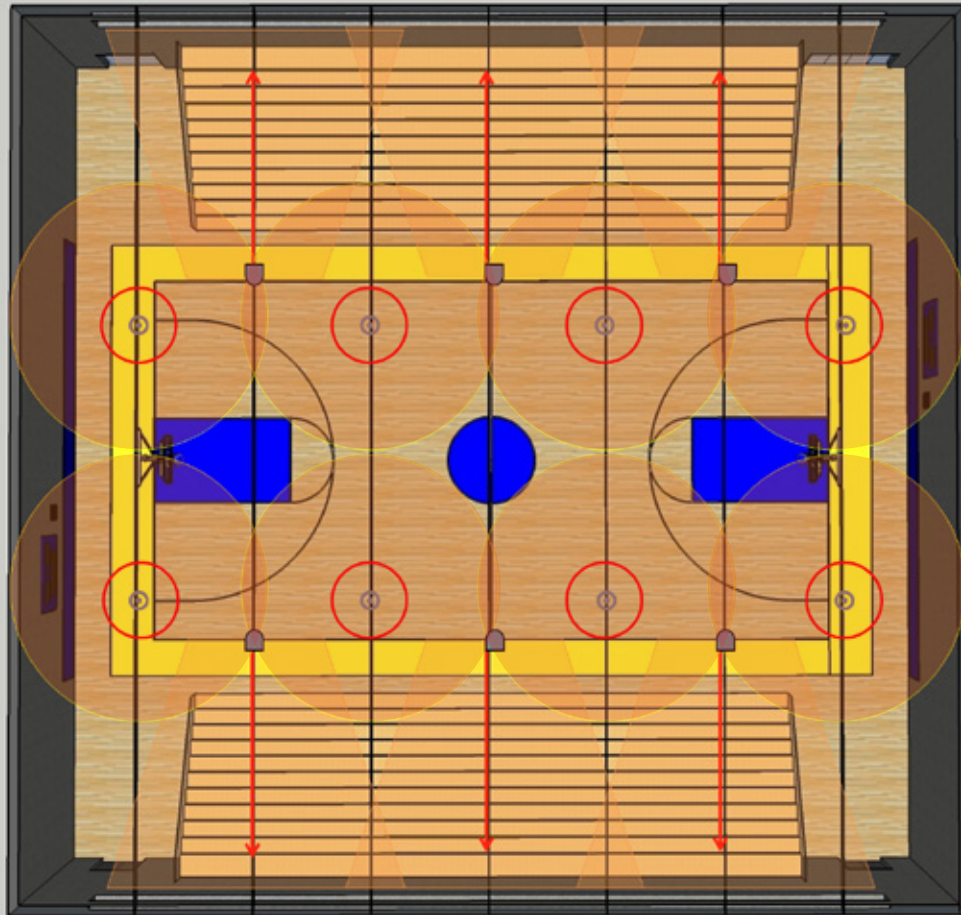
- Six (6) R.35-3896 (bleacher coverage)
- Two (2) R.35-3896 (center court)
- Less low frequency extension, but excellent voice clarity with moderate SPL.
- One (1) ALC-1604D*

Option C:

- Six (6) R.5-96MAX (bleacher coverage)
- Two (2) R.5-99Z (center court)
- Increased musicality, high SPL, and great pattern control. Subwoofers are often added to this system configuration.
- One (1) ALC-1604D*

* Amplified Loudspeaker Controller - minimum recommended for low impedance operation with channels maximized.

Basketball Court 'Enhanced Court Coverage'



Installation Description:

- A typical 120-foot by 100-foot gymnasium with a 28-foot height to the low steel (bottom of trusses).
- The bleachers are up to 14 feet tall.
- The bleacher loudspeakers are mounted about 20 feet in front of the first row.
- Bleachers longer than 70 feet can require four (4) or more loudspeakers per side.
- The court loudspeakers provide enhanced coverage to the court for higher speech intelligibility and allow more zone control to accommodate multi-purpose events.

Option A:

- Six (6) R.5-94Z (bleacher coverage)
- Eight (8) R.25-94Z (court coverage)
- Good pattern control and moderate SPL in non-acoustically treated spaces for the bleachers, court and floor seating.
- Two (2) ALC-404D*

Option B:

- Six (6) R.35-3896 (bleacher coverage)
- Eight (8) R.35COAX (court coverage)
- Less low frequency extension, but excellent voice clarity with moderate SPL for all areas.
- One (1) ALC-1604D* + One (1) ALC-404D*

Option C:

- Six (6) R.5-96MAX (bleacher coverage)
- Eight (8) R.5-99Z (court coverage)
- Increased musicality, high SPL, and great pattern control across all listening areas.
- Two (2) ALC-1604D*

* Amplified Loudspeaker Controllers- minimum recommended for low impedance operation with channels maximized.

Product Specifications

For loudspeakers referenced in this guide

R.25-94Z (R.25-94TZ)		Transducers: LF - 1 x 8"; HF - 1 x 0.75" exit compression driver Operating Range: 100 Hz - 16 kHz Sensitivity (1W/1m): 97 dB (96 dB) Power Handling: 200W continuous @ 8 ohms (Various) Continuous Max Output: 120 dB (126 dB Peak) Nominal Beamwidth (H x V): 90° x 40° Dimensions (H x W x D): 11.3 x 11.3 x 13.3 in. (287 x 287 x 338 mm)
R.35COAX		Transducers: LF - 1 x 10"; coaxial HF - 1 x 1.25" exit compression driver Operating Range: 70 Hz - 16 kHz Sensitivity (1W/1m): 97 dB Power Handling: 200W continuous @ 8 ohms, or 70V/100V Autoformer Continuous Max Output: 122 dB (128 dB Peak) Nominal Beamwidth (H x V): 90° x 90° (conical) Dimensions (H x W x D): 11 x 13 x 13.5 in. (279 x 330 x 343 mm)
R.35-3896		Transducers: LF - 1 x 8"; coaxial MF - 2 x 2.35" and HF - 1 x 1" exit comp. driver Operating Range: 80 Hz - 16 kHz Sensitivity (1W/1m): 100 dB Power Handling: 400W continuous @ 8 ohms, or 70V/100V Autoformer Continuous Max Output: 126 dB (132 dB Peak) Nominal Beamwidth (H x V): 90° x 60° Dimensions (H x W x D): 11 x 13 x 13.5 in. (279 x 330 x 343 mm)
R.5-66Z (R.5-66TZ)		Transducers: LF - 1 x 12"; HF - 1 x 1" exit compression driver Operating Range: 85 Hz - 16 kHz Sensitivity (1W/1m): 102 dB - 103 dB (101 dB - 102 dB) Power Handling: 200W continuous @ 8 ohms (Various) Continuous Max Output: 126 dB (132 dB Peak) Nominal Beamwidth (H x V): -66Z (60° x 60°), -94Z (90° x 40°), -99Z (90° x 90°) Dimensions (H x W x D): 16 x 16 x 16 in. (406 x 406 x 406 mm)
R.5-94Z (R.5-94TZ)		
R.5-99Z (R.5-99TZ)		
R.5-96MAX		Transducers: LF - 1 x 12"; coaxial HF - 1 x 1.4" exit compression driver Operating Range: 70 Hz - 20 kHz Sensitivity (1W/1m): 103 dB Power Handling: 600W continuous @ 8 ohms Continuous Max Output: 130 dB (136 dB Peak) Nominal Beamwidth (H x V): 90° x 60° (Additional horn patterns available) Dimensions (H x W x D): 16.0 x 16.0 x 16.2 in. (406 x 406 x 411 mm)
R2-94Z		Transducers: LF - 2 x 12"; MF - 1 x 2" exit M200 driver; HF - 1 x 1" exit comp. driver Operating Range: 70 Hz - 16 kHz Sensitivity (1W/1m): 105 dB Power Handling: 400W continuous @ 4 ohms Continuous Max Output: 131 dB (137 dB Peak) Nominal Beamwidth (H x V): 90° x 40° (Additional horn patterns available) Dimensions (H x W x D): 24.75 x 24.75 x 29 in. (629 x 629 x 737 mm)
R2-52Z		Transducers: LF - 2 x 12"; MF - 2 x 2" exit M200 driver; HF - 1 x 1" exit comp. driver Operating Range: 70 Hz - 16 kHz Sensitivity (1W/1m): 107 dB Power Handling: 400W continuous @ 4 ohms Continuous Max Output: 133 dB (139 dB Peak) Nominal Beamwidth (H x V): 50° x 20° Dimensions (H x W x D): 24.75 x 24.75 x 29 in. (629 x 629 x 737 mm)
R2-52MAX		Transducers: LF - 2 x 12"; MF - 2 x 2" exit M200HP driver; HF - 1 x 1" exit comp. driver Operating Range: 71 Hz - 19.5 kHz Sensitivity (1W/1m): LF: 102 dB, HF/MF: 110 dB Power Handling: LF: 1200W cont. @ 8 ohms, HF/MF: 350W cont. @ 8 ohms Continuous Max Output: 135 dB (141 dB Peak) Nominal Beamwidth (H x V): 50° x 20° Dimensions (H x W x D): 24.75 x 24.75 x 29 in. (629 x 629 x 737 mm)

Full specifications for these, and other models, are available at www.biamp.com/community.

Loudspeaker data files are available for EASE and EASE Focus acoustic modeling software to facilitate optimum system design. (EASE and EASE Focus are products of AFMG Technologies GmbH.)

Technical Considerations

'Amplified Loudspeaker Controllers'

Biamp recommends our series of **Community Amplified Loudspeaker Controllers (ALC)** for all Community loudspeaker applications, like those shown in this application guide. ALCs provide all of the signal routing, zone switching, DSP processing, protective limiting, remote monitoring, and amplification functions needed between a mixer and the loudspeakers in virtually any Community loudspeaker application. Standard Ethernet communication protocols allow for fast system design, system control, and remote system monitoring. Analog and Dante® inputs are included in each model, for quick and easy integration into any new or existing system. Biamp-authored loudspeaker presets include equalization, high pass filters, and multi-stage limiters tailored to each model, ensuring consistent sound quality and full loudspeaker protection in every application.

ALC Application Note

- Total available power can be safely distributed asymmetrically across the outputs in any combination of low impedance and 70V/100V loads. Power delivered from each output is individually managed; total shared power per ALC is monitored and limited independently by the power supply.

ALC-404D

- 4 inputs (Analog and/or Dante®)
- 4 channels of amplification and DSP processing
- Each channel provides up to 400W of power into low impedance or 70V/100V loads, stable to 2Ω
- In bridged mode, each pair of channels provides up to 800W into 8Ω, 4Ω, or 70V/100V loads
- Total shared power not to exceed 1200W
- Perfect for Small R SERIES, V SERIES, Compact I SERIES, W SERIES, ENT200 models, and zoned C SERIES & D SERIES applications

ALC-1604D

- 4 inputs (Analog and/or Dante®)
- 4 channels of amplification and DSP processing
- Each channel provides up to 1600W of power into low impedance or 70V/100V loads, stable to 2Ω
- In bridged mode, each pair of channels provides up to 3200W into 4Ω, or 70V/100V loads
- Total shared power not to exceed 4800W
- Perfect match for Larger R SERIES, I SERIES, IV6 and ENT-FR

ALC-3202D

- 2 inputs (Analog and/or Dante®)
- 2 channels of amplification and DSP processing
- Each channel provides up to 3200W of power into low impedance or 70V/100V loads
- In bridged mode, each pair of channels provides up to 6400W into 4Ω, or 70V/100V loads
- Total shared power not to exceed 6400W
- Perfect for R6-MAX, I SERIES subwoofers and larger IV6 Arrays

Model	Power @ 2Ω	Power @ 4Ω	Power @ 8Ω	Bridged @ 4Ω	Bridged @ 8Ω	70V	100V	Max Output Voltage @ Lo-Z
ALC-404D	4 x 400W	4 x 400W	4 x 400W	2 x 800W	2 x 800W	4 x 400W	4 x 400W	80 Vpk
ALC-1604D	4 x 1600W	4 x 1400W	4 x 1250W	2 x 3200W	2 x 2800W	4 x 1600W	4 x 1600W	142 Vpk
ALC-3202D	2 x 3200W	2 x 2400W	2 x 1250W	1 x 6400W	1 x 4800W	2 x 3200W	2 x 3200W	142 Vpk



Dante® is a registered trademark of Audinate Pty Ltd.

'TesiraFORTÉ DAN AI'

To eliminate press box control challenges, Biamp recommends **TesiraFORTÉ DAN AI** for all source limiting and system routing. While accommodating level control via built-in GPI, TesiraFORTÉ DAN AI eliminates the need for additional widgets for handling input and level control. Inputs and controls can be easily expanded to a total of 12 within Tesira itself and more with expansion module options.

With the Dante output option on this Tesira model, the only thing needed to connect to a Community Amplified Loudspeaker Controller (ALC) is a non-managed gigabit switch, which makes routing very easy, especially if remote amplifier locations are available. For simpler systems, TesiraFORTÉ AI (analog only) can also be used. This model is a great value for what we can accomplish compared to traditional mixers.

Between the loudspeaker protection we offer in our ALC models and the available limiting and control available in Tesira, we can say with complete confidence that a properly commissioned system using these components would be nearly impossible to damage via operator error, ensuring a long life for the system and great value for our customers.





biamp.

9300 SW Gemini Drive
Beaverton, OR 97008 USA
Phone: +1 503 641 7287

www.biamp.com

© 2020 Biamp Systems