

Directional Speaker Arrays (DSA)

Electronic Siren



Description, Specifications, and Installation Manual

Limited Warranty

This product is subject to and covered by a limited warranty, a copy of which can be found at www.fedsig.com/SSG-Warranty. A copy of this limited warranty can also be obtained by written request to Federal Signal Corporation, 2645 Federal Signal Drive, University Park, IL 60484, email to info@fedsig.com or call +1 708-534-3400.

This limited warranty is in lieu of all other warranties, express or implied, contractual or statutory, including, but not limited to the warranty of merchantability, warranty of fitness for a particular purpose and any warranty against failure of its essential purpose.



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Contents

Safety Messages.....	5
General Description	7
Introduction	7
Features	8
Specifications	8
Wiring Options.....	10
Installation Instructions	11
Determine a Suitable Location	11
Installing the Sirens	12
Installation Bracket Options	12
Pole Installation.....	14
Wood Utility Pole Installation.....	15
Concrete or Metal Pole Installation	16
Wall Mount Applications	20
Obtaining Service.....	21
Appendix A DSA Drawings	22

Tables

Table 1 DSA Specifications.....	8
Table 2 Mounting Configurations and Horizontal Coverage	8
Table 3 General Specifications.....	9
Table 4 Wind Loading.....	9
Table 5 Mounting Kits	9
Table 6 Bracket Options.....	13

Figures

Figure 1 Two DSAs with a DSAMK4 bracket.....	7
Figure 2 Various DSA Configurations	10
Figure 3 Top of pole mount using DSAMK4.....	13
Figure 4 Typical Pole Installation.....	14
Figure 5 DSAMK1 Bracket Drawing.....	16
Figure 6 DSAMK1 Bracket Picture.....	16
Figure 7 DSAMKSPB45 Bracket Drawing.....	17
Figure 8 DSAMKSPB45 Bracket Picture.....	17
Figure 9 DSAMKSPB23 Bracket Drawing.....	18
Figure 10 Top view of DSAMK4 bolt hole pattern.....	18
Figure 11 Wall Mount Configuration	19
Figure 12 DSAMKSP Mounting Kit.....	20
Figure 13 DSA Assembly Drawing	21
Figure 14 Wiring Options.....	22
Figure 15 Wiring Options Continued.....	23

Safety Messages

⚠ WARNING

It is important to follow all instructions shipped with this product. This device is to be installed by trained personnel who are thoroughly familiar with the country electric codes and will follow these guidelines as well as local codes.

Listed below are important safety instructions and precautions you should follow:

Important Notice

Federal Signal reserves the right to make changes to devices and specifications detailed in the manual at any time in order to improve reliability, function or design. The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for any inaccuracies.

Publications

Federal Signal recommends the following publications from the Federal Emergency Management Agency for assistance with planning an outdoor warning system:

- The “Outdoor Warning Guide” (CPG 1-17)
- “Civil Preparedness, Principles of Warning” (CPG 1-14)
- FEMA-REP-1, Appendix 3 (Nuclear Plant Guideline)
- FEMA-REP-10 (Nuclear Plant Guideline).

Planning

- If suitable warning equipment is not selected, the installation site for the siren is not selected properly or the siren is not installed properly, it may not produce the intended optimum audible warning. Follow Federal Emergency Management Agency (FEMA) recommendations.
- If sirens are not activated in a timely manner when an emergency condition exists, they cannot provide the intended audible warning. It is imperative that knowledgeable people, who are provided with the necessary information, are available at all times to authorize the activation of the sirens.
- When sirens are used out of doors, people indoors may not be able to hear the warning signals. Separate warning devices or procedures may be needed to effectively warn people indoors.
- The sound output of sirens is capable of causing permanent hearing damage. To prevent excessive exposure, carefully plan siren placement, post warnings, and restrict access to areas near sirens.
- Activating the sirens may not result in people taking the desired actions if those to be warned are not properly trained about the meaning of siren sounds. Siren users should follow FEMA recommendations and instruct those to be warned of correct actions to be taken.

- After installation, service, or maintenance, test the siren system to confirm that it is operating properly. Test the system regularly to confirm that it will be operational in an emergency.
- If future service and operating personnel do not have these instructions to refer to, the siren system may not provide the intended audible warning and service personnel may be exposed to death, permanent hearing loss, or other bodily injury. File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to new recruits and trainees. Also give a copy to anyone who is going to service or repair the siren.

Installation and Service

- Electrocution or severe personal injury can occur when performing various installation and service functions such as making electrical connections, drilling holes, or lifting equipment. Therefore only experienced electricians should install this product in accordance with national, state and any other electrical codes having jurisdiction. Perform all work under the direction of the installation or service crew safety foreman.
- The sound output of sirens is capable of causing permanent hearing damage. To prevent excessive exposure, carefully plan siren placement, post warnings and restrict access to areas near the sirens. Sirens may be operated from remote control points. Whenever possible, disconnect all siren power including batteries before working near the siren.
- After installation or service, test the siren system to confirm that it is operating properly. Test the system regularly to confirm that it will be operational in an emergency.
- If future service personnel do not have these warnings and all other instructions shipped with the equipment to refer to, the siren system may not provide the intended audible warning and service personnel may be exposed to death, permanent hearing loss, or other bodily injury. File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to new recruits and trainees. Also, give a copy to anyone who is going to service or repair the sirens.

Operation

Failure to understand the capabilities and limitations of your siren system could result in permanent hearing loss, other serious injuries or death to persons too close to the sirens when you activate them or to those you need to warn. Carefully read and thoroughly understand all safety notices in this manual and all operations-related-items in all instruction manuals shipped with equipment. Thoroughly discuss all contingency plans with those responsible for warning people in your community, company, or jurisdiction.

Read and understand the information contained in this manual before attempting to install or service the siren.

Pay careful attention to the notice located on the equipment.

General Description

Introduction

This manual describes the features, specifications, and installation of the Directional Speaker Arrays (DSA). Refer to the UltraVoice Electronic Siren Controller Manual for operating instructions.

The DSA is a flexible and adaptable high-powered speaker array. It can be configured in many ways to customize to your site's needs. Let Federal Signal design your DSA configuration. Contact Federal Signal through pre-sales or contact your local sales representative.

The DSA is a flexible family of high-powered speakers that are capable of providing audible signals (tone or voice) over a large area with the potential for satisfying varying signaling needs in multiple directions. A typical installation consists of between one and four arrays, which are designed to be powered by a Federal Signal UltraVoice Controller. A highly efficient design enables the speakers to produce a high sound level, while making moderate demands on the power source. Each array can contain between two and six individual speakers. (Figure 1 shows two DSA4s with a DSAMK4.)

Figure 1 Two DSAs with a DSAMK4 bracket



DSA sirens are comprised of fiberglass projectors and aluminum housings and stainless steel mounting brackets. Each individual speaker provides 100 watts of signaling power.

Each DSA speaker array includes one DSAMK1, which is a wall mounting kit for one vertical stack that includes stainless steel brackets and mounting hardware.

Specifications

Each array set covers one 90° quadrant. The dB(C) ratings at 100 feet on axis are shown below:

DSA2 111 dB(C)

DSA4 117 dB(C)

DSA6 121 dB(C)

The DSA provides excellent voice reproduction and with the aid of the UltraVoice Controller produces the following pre-programmed warning signals: Wail, Pulsed Steady, Pulsed Wail, Alternating Alert, Alternating Wail, and Westminster Chimes. The UltraVoice Controller can be networked and provide voice messages for clear instructions during emergency notification.

Features

The DSA has the following features:

- Maintenance Free
- Multiple mounting options available—wall, pole (wood or steel)
- Able to mount up to four speaker arrays per pole
- Each speaker contains a 100 watt driver
- Provides excellent voice reproduction when used with the UltraVoice Controller
- Available in 3 models for a wide range of sound coverage

Specifications

Table 1 DSA Specifications

Color	Black projectors and off-white housing
Paint type	TGIC polyester powder coat
Projector Type	Re-entrant
Frequency Response	200 to 2000 Hz

Table 2 Mounting Configurations and Horizontal Coverage

Single Unit	70°
Two Units:	
Side by Side at 90°	180°
Opposite Sides of pole at 180°	140° Collectively
Three adjacent sides at 90° to one another	210°
Four sides at 90° to one another	360°

Table 3 General Specifications

Specifications	DSA2	DSA2-1	DSA4	DSA4-1	DSA6	DSA6-1
Number of Speakers	2		4		6	
Watts	200		400		600	
Sound output per individual stack, dB(C) at 100 feet	111		117		121	
Effective Range at 70 dB(C)	1700 ft		2600 ft		3400 ft	
Height in inches	24.25		48.75		73.25	
Net Weight (lbs)	43		95		125	
Cable Length	50 ft	100 ft	50 ft	100 ft	50 ft	100 ft
Power Requirements	One UV400 Amplifier Can support two DSA2s		One UV400 Amplifier		Two UV400 Amplifiers Three UV400s can support two DSA6s	

Table 4 Wind Loading

	DSA2	DSA4	DSA6
EPA at 40 feet	3.66 ft ²	7.32 ft ²	10.98 ft ²
Wind Load (110 mph, 40 feet above ground)	189 lbf	404 lbf	626 lbf

NOTE: When calculating total power requirements, determine the total number of speakers that is needed in your installation and divide the total by four. The resultant number will be the quantity of amplifiers required. If the resultant is not a whole number, then round the number up to the next whole number. This number will be the number of amplifiers required for your installation.

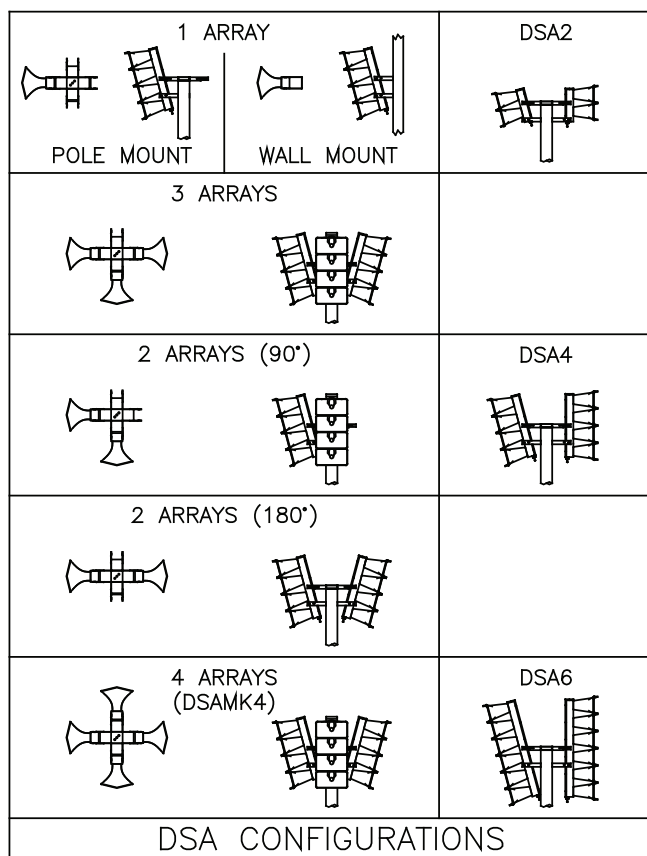
For example, if your site needs 1200 watts then this is 12 speakers, because each individual speaker provides 100 watts of signaling power. Consider the following example: (12 speakers)/4 = 3 amplifiers

The above example shows that the power requirements are three 400 watt amplifiers.

Table 5 Mounting Kits

DSAMK1	Each DSA is shipped with one DSAMK1 bracket for wall mount applications. Order an additional DSAK1 per DSA. See Figure 3.
DSAMK4	Mounting kit for one to four vertical stack(s) 90° apart. See Figure 3.
DSAMKSP	Mounting kit for the top of steel poles that includes a 4.5" pole and brackets for one DSA.
DSAMKSPB45	Mounting kit for 4.5" steel pole that includes two brackets, two u-bolts, and mounting hardware for one DSA speaker.
DSAMKSPB23	Mounting kit for 2.375" steel pole that includes two brackets, two u-bolts, and mounting hardware for one DSA speaker.

Figure 2 Various DSA Configurations



Wiring Options

You can configure DSA speakers to address many different applications when used with UV Controllers. Typical installations involve one to four DSA speakers operated from a UV Controller. Equip the UV Controller with up to eight UV400 amplifiers. Each UV400 amplifier provides 400 watts. Also, each DSA is equipped with a 4-conductor cable 50 feet or 100 feet in length. When installing DSA speakers with less than 6 speakers, tie off the unused connectors. Do not trim connectors. Use extra connectors, later, to add accessories or other speakers.

DSA2 Wiring Options

A DSA2 speaker requires 200 W of power which uses 50% of a single UV400 amplifier. Use a single UV400 amplifier to power two DSA2s that are wired in parallel for a total power of 400 W. A UV Controller equipped with eight UV400 amplifiers can power up to sixteen DSA2s. See Figure 14.

DSA4 Wiring Options

A DSA4 speaker requires 400 W of power or a single UV400 amplifier. A UV Controller equipped with eight UV400 amplifiers can power up to eight DSA4s. See Figure 14.

DSA6 Wiring Options

A DSA6 speaker requires 600 W of power or two UV400 amplifiers with one at 100% and the other at 50%. Equip a UV Controller with six UV400 amplifiers to

power four DSA6s. Use the remaining two UV400 amplifiers for two DSA4s or other combinations up to 800 W. See Figure 15.

Mixing DSA Speakers Wiring Options

DSA4 speakers always use a single UV400 amplifier. You can mix DSA2 and DSA6 to efficiently use the UV400 amplifiers. When wiring different DSA speakers together, be careful to follow the wiring diagrams to ensure drivers are always in series or series/parallel arrangement. See Figures 14 and 15 for wiring examples.

Installation Instructions

Determine a Suitable Location

The information in this section provides guidelines to aid you in the selection of installation sites that make the best possible use of the speaker array siren.

⚠ WARNING

The sound output level of some DSA sirens is capable of causing permanent hearing damage. To prevent excessive exposure, carefully plan placement of sirens and post warnings.

Do not expose personnel to sound levels above 123 dBC.

When the sirens are used out of doors, people indoors may not be able to hear the warning signals. You may need separate warning devices or procedures to effectively warn people indoors.

Careful consideration of the factors affecting the propagation of sound from the siren and the response of the human ear to the sound will optimize the ability of the siren to effectively warn the community.

The reduction of signal intensity as distance from the siren increases and the minimum desired signal level at the fringe of the area to be covered are important considerations when choosing a siren installation site. As the distance from the siren increases, sound level losses accumulate. These losses are a result of weather conditions, the terrain, obstructions in the sound path, and the pitch of the sound and the height of the siren.

Optimum sound propagation conditions occur when no obstructions exist in the sound path, the terrain is hard and flat, and the air is blowing away from the source. Under these conditions, you can expect a 6 dB loss per distance doubled. A loss per distance doubled of 10 dB is typically experienced because atmosphere is rarely calm, terrain may not be flat, and buildings or other obstructions are frequently present in the sound path.

Using a 10 dB per distance doubled loss factor, the following sound levels are predicted for the DSA6:

- 100 feet (30.5 m) the sound level is 121 dB
- 200 feet (61 m) the sound level is 111 dB
- 400 feet (122 m) the sound level is 101 dB

- 800 feet (244 m) the sound level is 91 dB

FEMA studies indicate typical ambient sound levels vary by location as follows:

- Industrial Areas: 70+ dBC
- Urban Areas: 60 dBC
- Rural Areas: 50 dBC

Optimum warning is obtained when the warning signal is at least 10 dB above ambient. Do not expose personnel to sound levels above 123 dBC.

Wind speed and direction often affects the propagation of sound from the siren. Consequently, the direction of the prevailing wind may be a significant factor to consider when selecting the installation site(s) of a small, one or two site siren system. For example, if the prevailing wind is from the west, it may be desirable to install the siren toward the western edge of the area to be covered.

Other factors to consider when selecting the installation site(s) include the availability of suitable electrical power, the access to and ease of installation and maintenance, the height of surrounding obstructions, and security against vandalism.

Installing the Sirens

DANGER

SHOCK HAZARD: Electrocution or severe personal injury can occur when making electrical connections, drilling holes, or lifting equipment. Therefore, installation should be performed by experienced electricians in accordance with national and local codes.

WARNING

SOUND HAZARD: The sound output level of some DSA sirens is capable of causing permanent hearing damage. To prevent excessive exposure, carefully plan placement of sirens and post warnings.

Most DSA siren installations are on poles. The arrays may also be installed on elevated vertical surfaces, such as walls, or on flat horizontal surfaces, such as roofs.

A siren is typically installed 40 to 50 feet above the ground. If a DSA siren is installed at less than 40 feet above the ground, the sound intensity at close range may increase, but at the same time the effective range of the siren may be reduced. Conversely, if the siren is located more than 50 feet above ground, the effective range of the siren may increase, but the sound may skip over areas closer to the siren. These variables make it desirable to test the sound coverage of the siren at various heights and locations whenever possible.

Installation Bracket Options

Each DSA speaker array includes a DSAMK1, which is a wall mounting kit for one vertical stack that includes stainless steel brackets and mounting hardware. This bracket will become the lower bracket in your installation. (See Figure 3.) You can use all

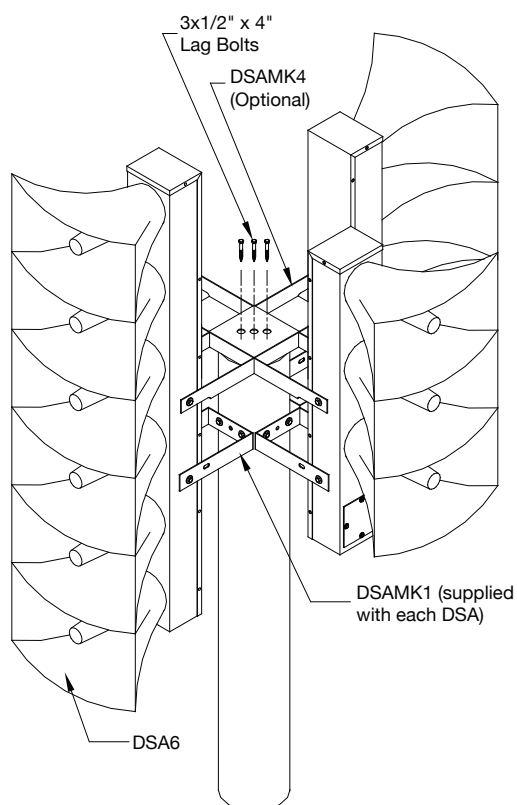
brackets on wood, concrete, or metal utility poles. Also use brackets on interior and exterior wall structures.

Use the following table for bracket options.

Table 6 Bracket Options

Number of DSAs	Mounting Bracket for Installation
Single DSA mounted on either a pole or a vertical surface	Use a second DSAMK1 bracket. (See Figure 11.)
Two DSAs installed on a wood pole	Use any of the following optional upper brackets (See Figure 3.): - Two DSAMK1s for any two array installation. - One DSAMK4 for installations where the arrays will be at 90° or 180° to one another.
Three or four DSAs installed on a wood pole	Use DSAMK4 for the upper bracket in the installation. DSAMK4 is designed to be mounted on top of pole. (See Figure 3.)
Top of pole mount for 1 to 4 DSA speakers	- Use DSAMKSP—includes complete mounting assembly for top of pole and 4.5" pole with brackets for one DSA speaker. - Use additional DSAMKSPB45 for each additional DSA. (See Figure 12.)
4.5" steel pole mount	Use DSAMKSPB45 for mounting a DSA to a 4.5" steel pole.
2 3/8" steel pole mount	Use DSAMKSPB23 for mounting a DSA to a 2 3/8" steel pole.

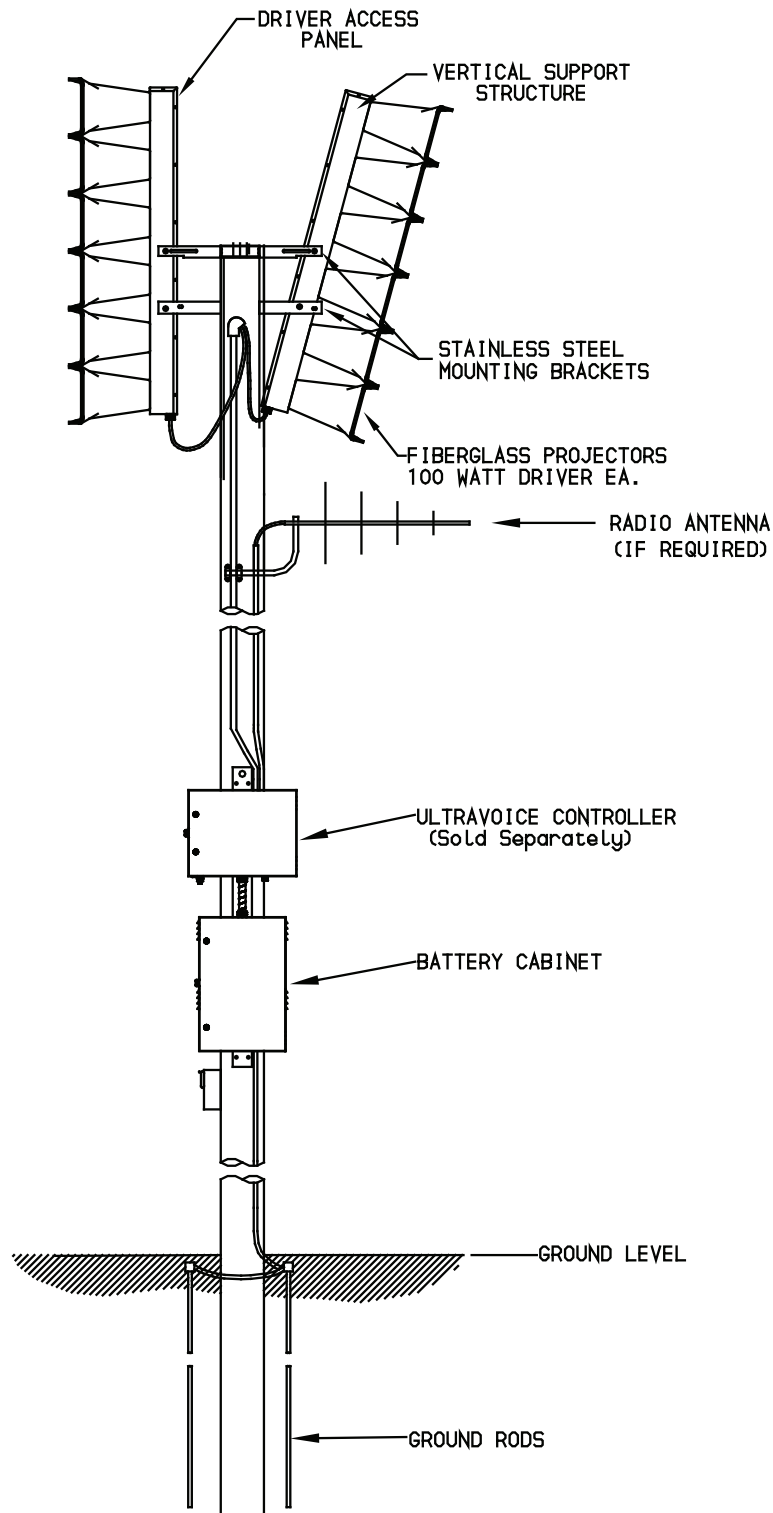
Figure 3 Top of pole mount using DSAMK4



Pole Installation

Install a utility pole in accordance with national and local acceptable practices. Determine the number of arrays to be mounted and the direction in which the array(s) is/are to be orientated.

Figure 4 Typical Pole Installation



Wood Utility Pole Installation

To install a wood utility pole, do the following:

1. Mount the upper DSA bracket, obtained as an option, at the top of the pole with the proper orientation. Secure the DSA bracket to the utility pole with three ½ x 4 inch long galvanized lag bolts and three ½ inch flat washers. (Bolts and washers are supplied by the installer.) See Figure 3.
2. Measure 12 inches down the pole from the center of the upper bracket to the point that will be at the center of the DSAMK1 bracket.
3. Align the lower bracket, DSAMK1, so it is in vertical alignment with the upper bracket.
4. Mount the lower DSAMK1 bracket using three ½ x 4 inch long galvanized lag bolts and three ½ inch flat washers.
5. Remove and save the mounting bolts from the DSA.
6. Lift the array into position, with the cable coming out the bottom, and loosely secure it to the previously installed upper DSA bracket at the outer most bracket holes using the hardware previously removed.
7. Depending on how the array is mounted, do the following:
 - If the array is to be mounted facing in a horizontal plane, attach it to the DSAMK1 lower bracket in the outer most bracket holes using the hardware previously removed.
 - If the array is to be mounted so that it is pitched downward at a 15° angle, attach it to the lower bracket at the inner most bracket holes using the hardware previously removed.
8. Tighten all array mounting bolts.

Repeat steps 1-8 for each array in the installation.

Concrete or Metal Pole Installation

If the metal pole has a top of pole plate, use the DSAMKSP to mount to the top of the pole. The DSAMKSP has all hardware to mount to the top of the pole and to mount one DSA. If additional DSA speakers are to be mounted use the DSAMKSPB45 kit.

When using a concrete or metal pole, you will provide adapter plates to mate to the DSA mounting brackets. Pay careful attention to the orientation of these attachments to the poles. Once in place, the speakers will project the loudest sounds in the directions that the brackets face.

When the installation requires the use of DSAMK4 mounting bracket, you must make a circular plate and rigidly attached to the top of the pole. Figure 10 shows the required bolt hole pattern for those brackets.

NOTE: The pole top mounting holes are at a 45° angle to the horizontal center line of the speakers.

The balance of the installation is similar to that for a wooden utility pole installation except that the installer will provide grade 5 machine screws, washers, and nuts for attachment of the siren brackets to the pole brackets.

A drawing of the DSAMK1 is provided in Figure 5 to show the bolt hole pattern that the new bracket must be attached to.

Figure 5 DSAMK1 Bracket Drawing

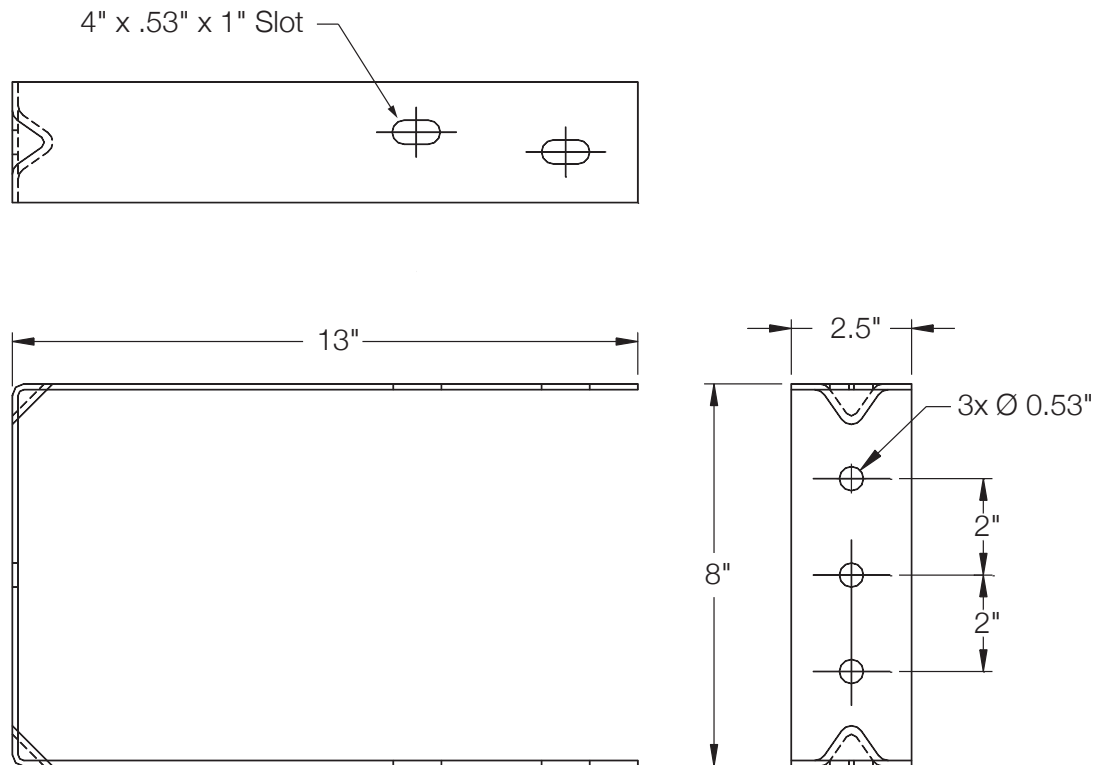


Figure 6 DSAMK1 Bracket Picture



Figure 7 DSAMKSPB45 Bracket Drawing

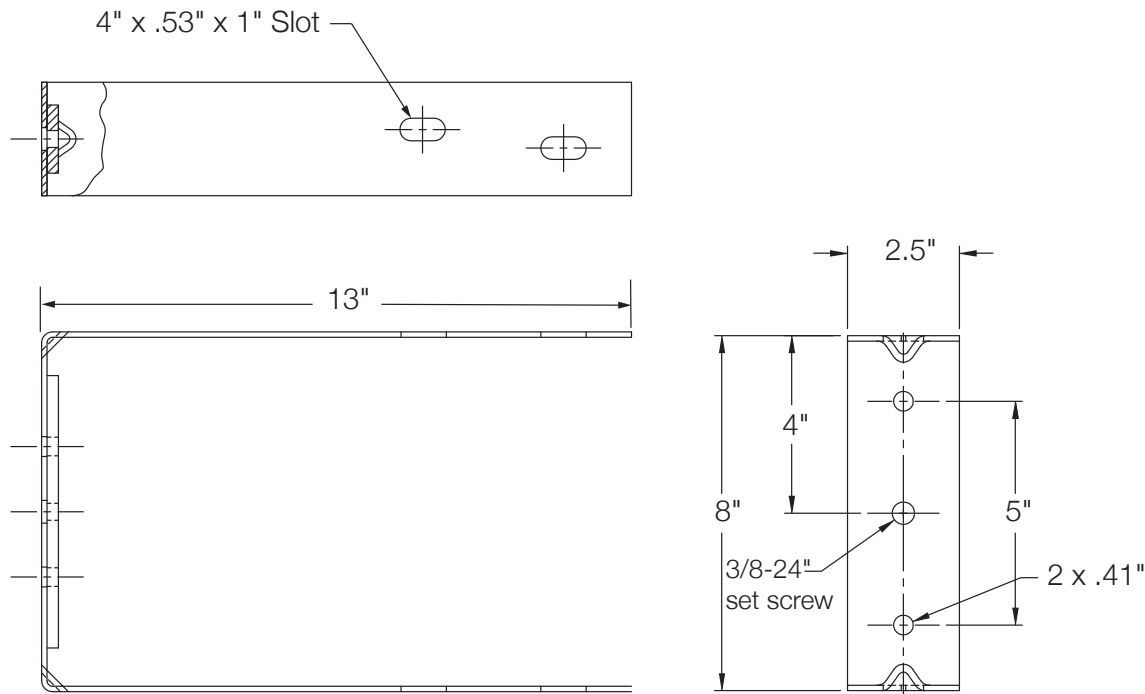


Figure 8 DSAMKSPB45 Bracket Picture



Figure 9 DSAMKSPB23 Bracket Drawing

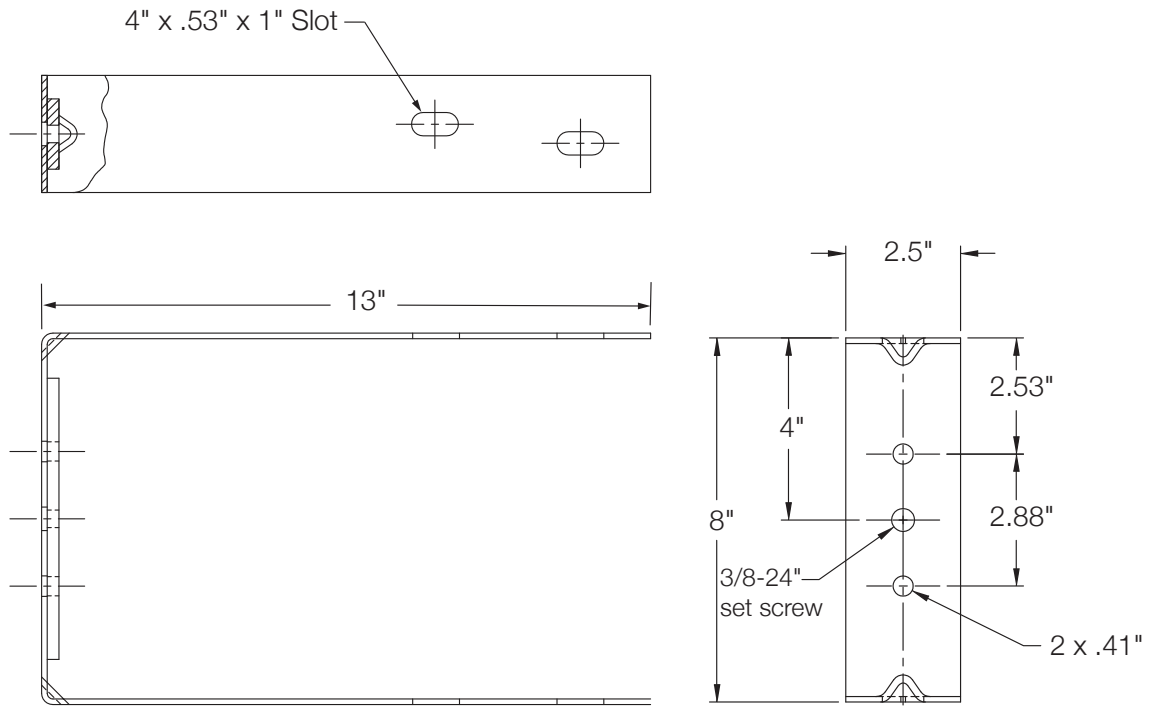
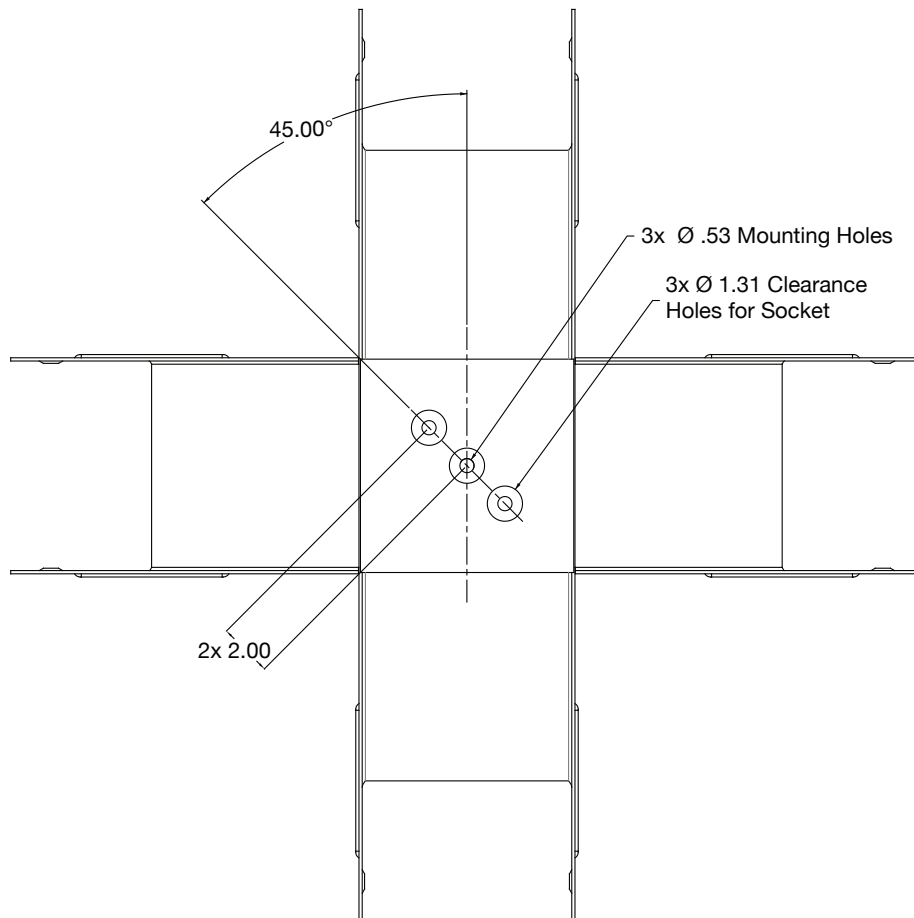


Figure 10 Top view of DSAMK4 bolt hole pattern



Wall Mount Applications

For wall mount installation, materials, and securing methods may vary depending on local and national electrical codes.

A structural engineer may be needed to determine the required mounting method.

You can wall mount the DSA speaker array either outdoors or indoors.

Figure 11 Wall Mount Configuration

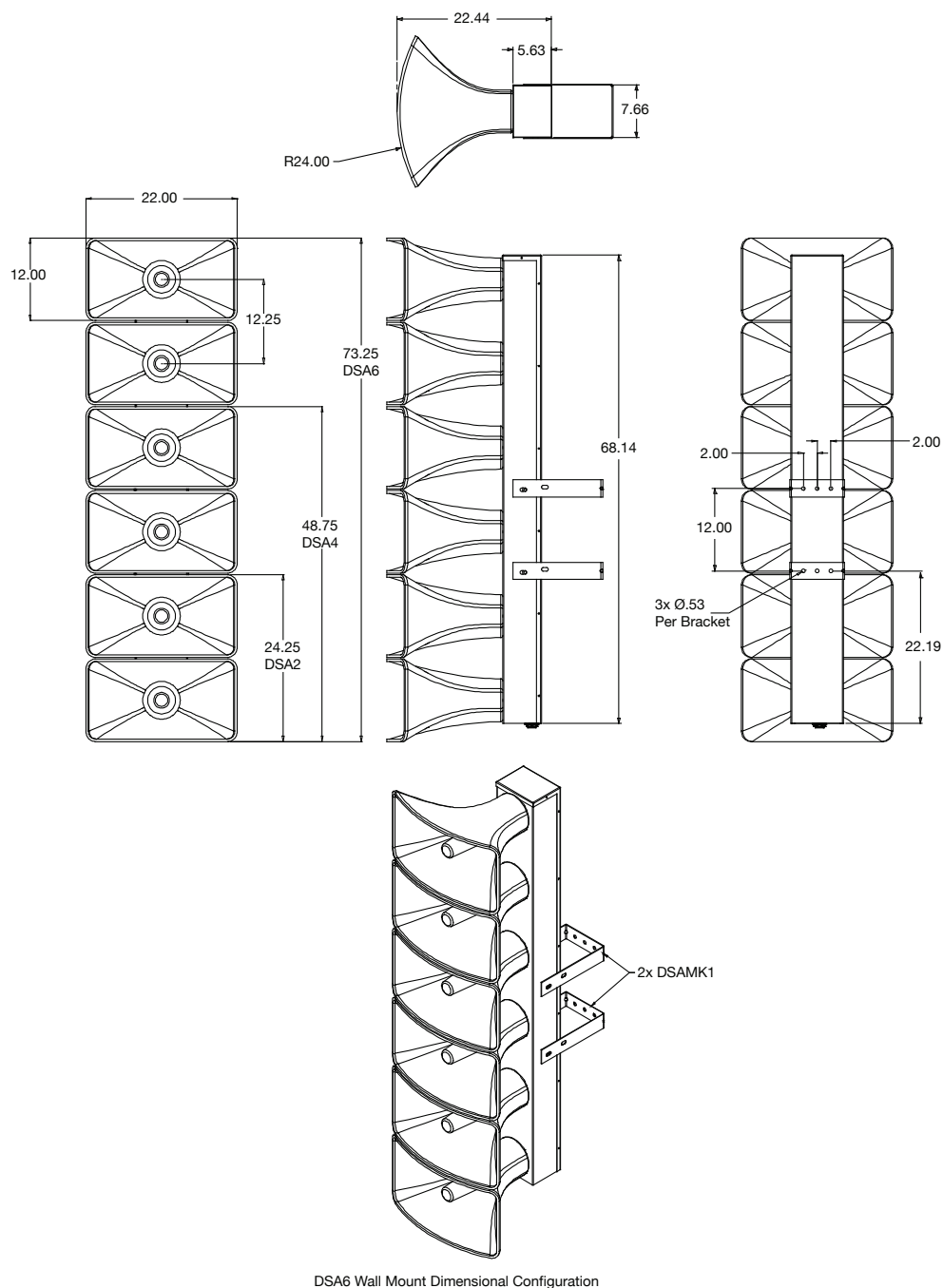
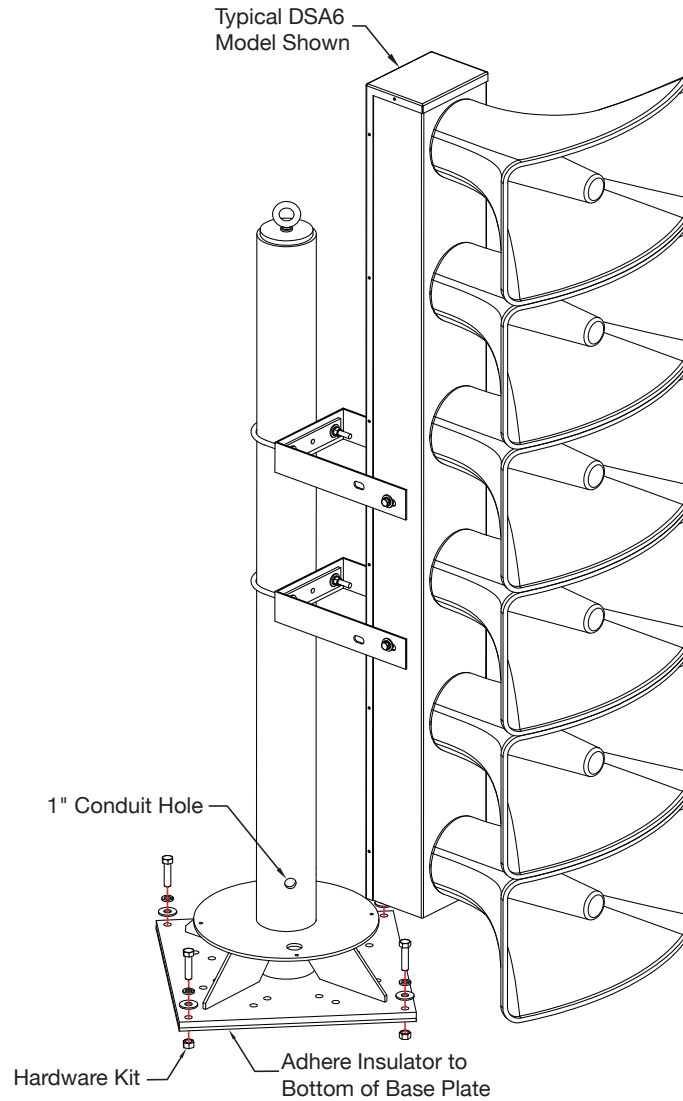


Figure 12 DSAMKSP Mounting Kit



Obtaining Service

If you are experiencing any difficulties, contact Federal Signal Customer Care at: 800-548-7229 or 708-534-3400 extension 7511 or Technical Support at: 800-524-3021 or 708-534-3400 extension 7329 or through e-mail at: techsupport@fedsig.com. For instruction manuals and information on related products, visit: <http://www.fedsig.com/>

Appendix A DSA Drawings

Figure 13 DSA Assembly Drawing

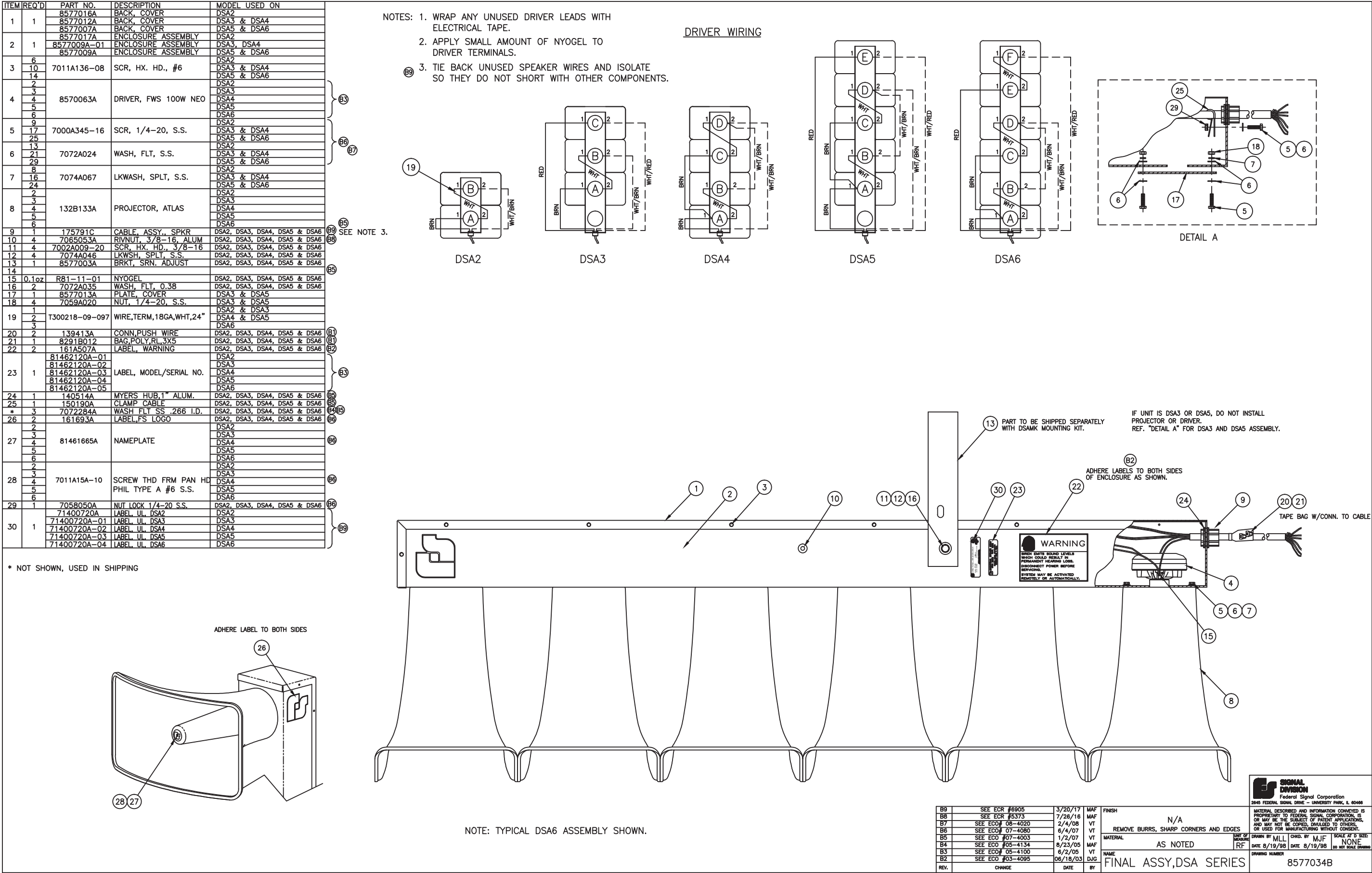
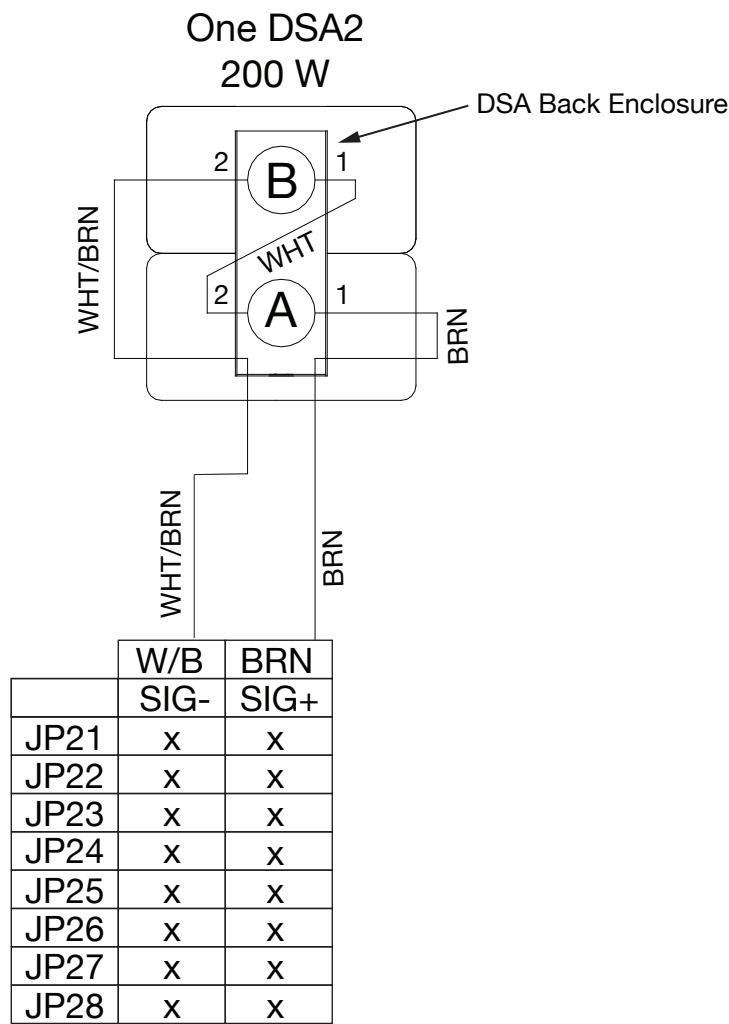
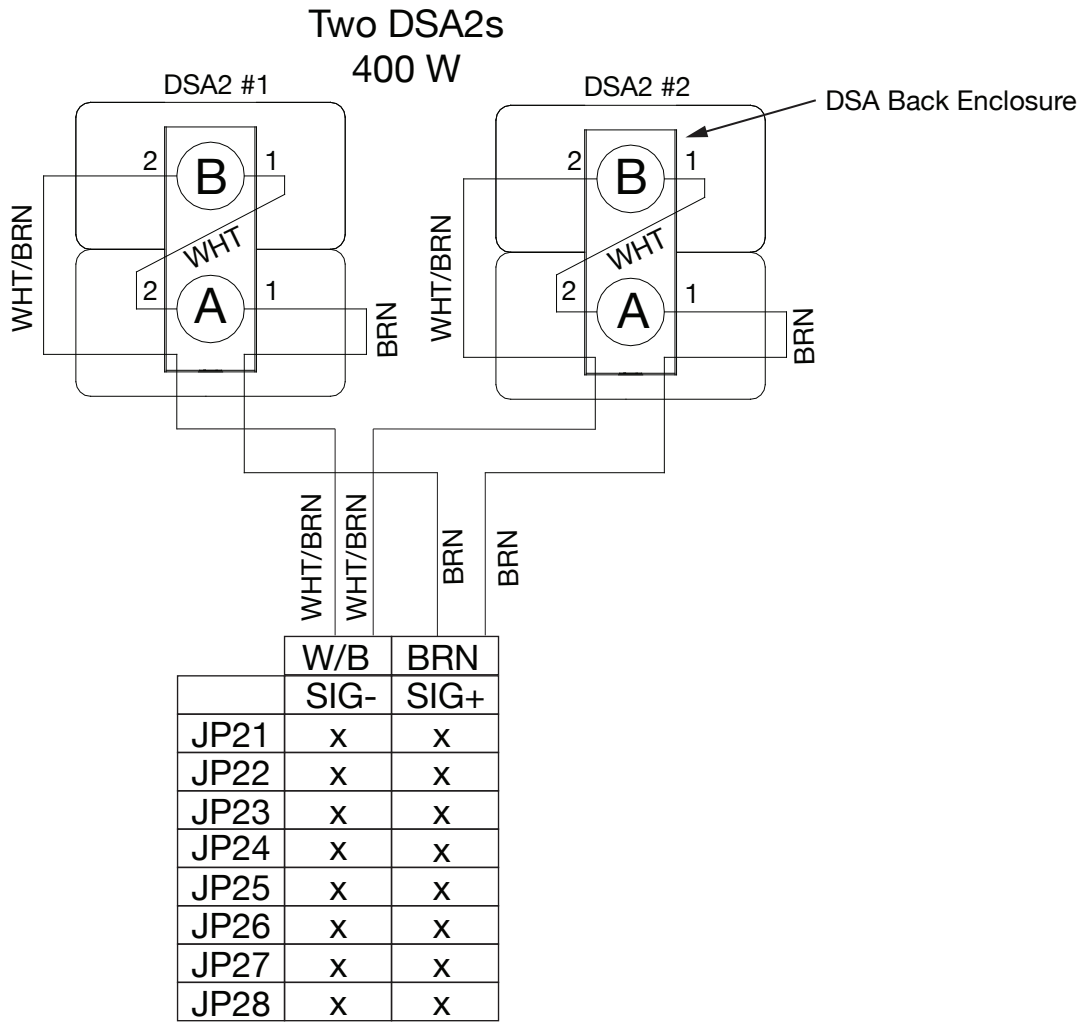


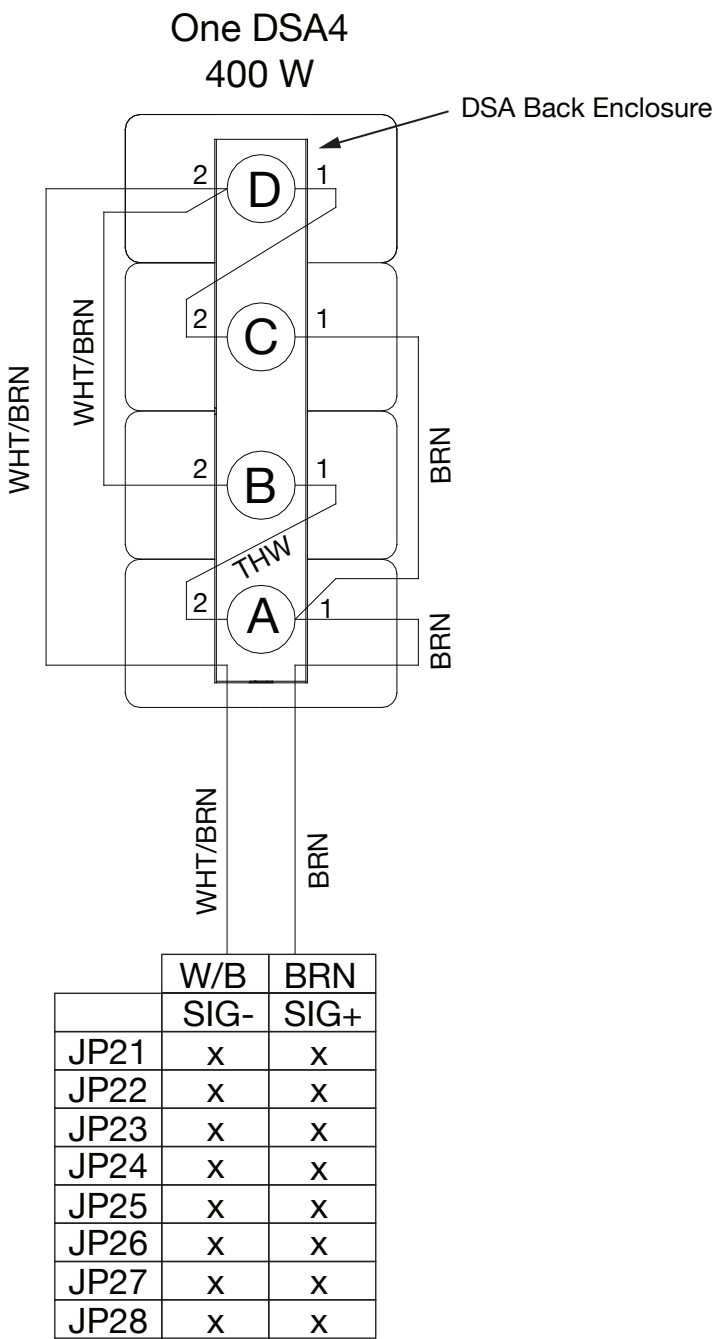
Figure 14 Wiring Options



x = Possible connection



x = Possible connection



x = Possible connection

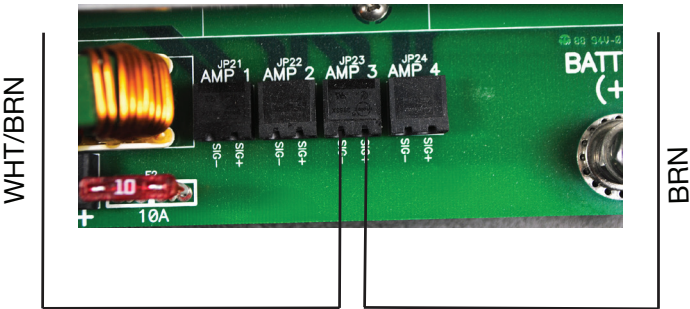
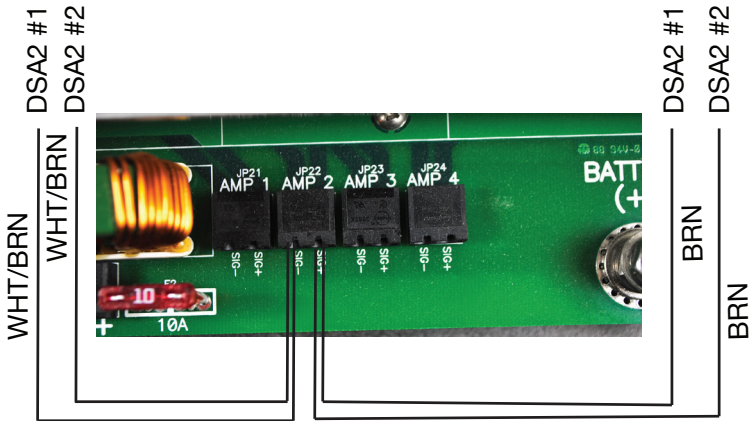
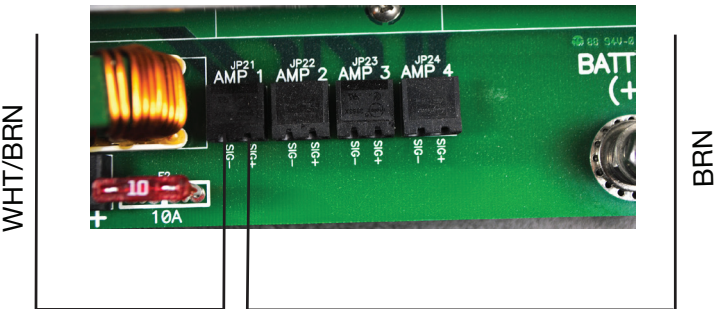


Figure 15 Wiring Options Continued

