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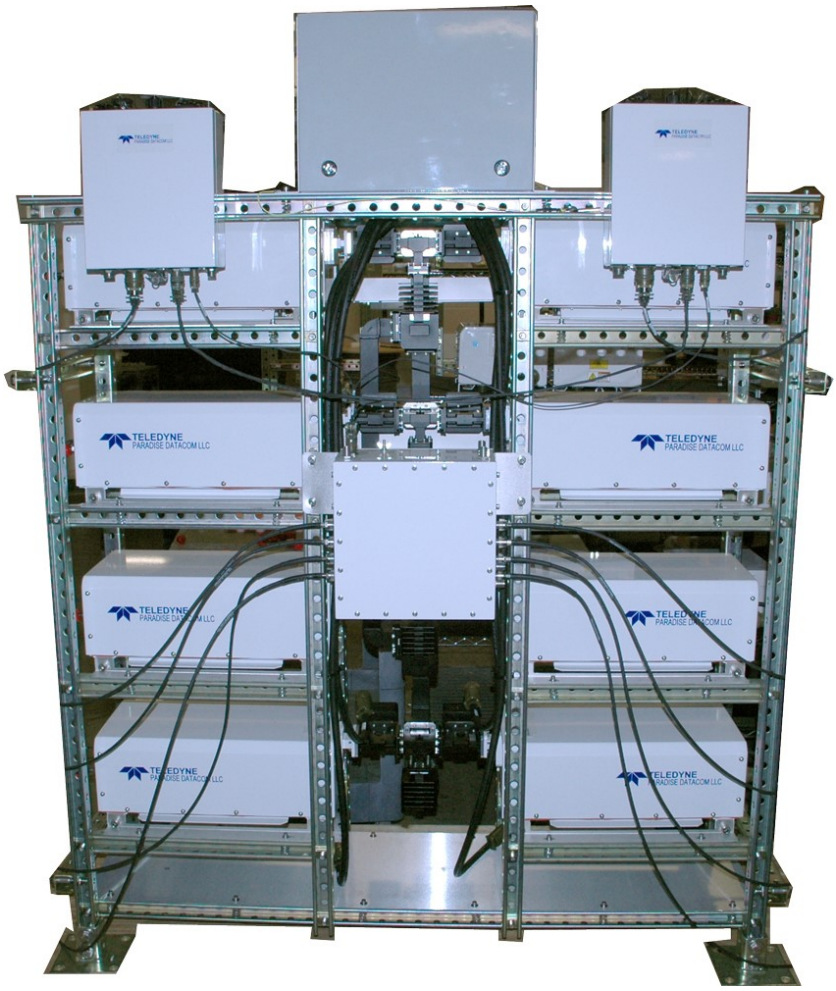
PARADISE DATACOM
A Teledyne Technologies Company

Outdoor PowerMAX Systems
Compact Outdoor SSPA Modules
C-Band System Installation Manual



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1.0 Scope

This manual contains the installation instructions for a C-Band Compact Outdoor PowerMAX System, in configurations of 4-module, 8-module and 16 module arrays.

1.1 Inspection and Unpacking

When the system is received, an initial inspection should be completed. First, ensure that the shipping containers are not damaged. If any damage is discovered, have a representative of the shipping company present when the container is opened.

Perform a visual inspection of the equipment to make sure that all items on the packing list are enclosed. If any damage has occurred or if items are missing, contact:

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Save all shipping containers and packing materials for future use.

1.2 Installation Conventions

The Compact Outdoor PowerMAX system was shipped from the factory as intact as possible. The following conventions should be observed when preparing to install your system.

1.2.1 Uni-Strut Frames

The uni-strut frame assembly is typically broken down to an 8-module configuration; thus, a 4-module or 8-module system uni-strut frame will ship intact, while a 16-module system will ship as two 8-module uni-strut frames. Uni-strut segments used to tie together multiple 8-module uni-strut frames may be secured to one of the 8-module frames.

Before beginning installation, the user should inspect the uni-strut frame and ensure that all hardware used to connect uni-strut to uni-strut is fastened securely.

1.2.2 Solid State Power Amplifier Modules

SSPA modules are typically packaged individually in boxes, which are subsequently packaged in wooden shipping crates. An identification label is affixed to each SSPA module. When it comes time to install the SSPA modules, match this label with the label on the uni-strut frame, and install the module into that position in the frame.

1.2.3 RF Distribution Boxes and Outdoor System Controllers

An identification label is affixed to the RF Distribution Boxes and Outdoor System Controllers. In 16-module systems, make sure to use the items labeled “System 1” with SSPA modules S1.X.X, and the items labeled “System 2” with SSPA modules S2.X.X.

1.2.4 Optional AC Distribution Boxes

An identification label is affixed to the AC Distribution Boxes. In 16-module systems, make sure to use the AC Distribution Box labeled “System 1” with SSPA modules S1.X.X, and the AC Distribution Box labeled “System 2” with SSPA modules S2.X.X.

1.2.5 Waveguide Combiner Arrays

The waveguide combiner arrays for each 4-module or 8-module system were shipped installed in the uni-strut framework and supported by shipping struts. The shipping struts will need to be removed before installing the amplifiers.

All open waveguide flanges are covered for shipment, either with plastic covers, or with Kapton tape. Keep these covers in place to help prevent debris from falling into an open waveguide. Remove the cover before connecting waveguide flanges together.

A set of half gaskets and full gaskets were shipped with the system. Make sure to install these gaskets between waveguide flanges as prompted in the instructions.

1.2.6 Control and Communication Cable Assemblies

The control and communication cable assemblies are shipped in place on the uni-strut frame, and are typically zip-tied to the frame. Yellow zip-ties are used to temporarily tie down cables during shipment, and these yellow zip-ties may be cut as needed during installation. Zip-ties that are trimmed should not be cut, unless the cable being tied down needs to be removed from the system.

1.2.7 Semi-Rigid Coaxial Cables

All semi-rigid coaxial cables are pre-formed at the factory for best fit into the system. Do not bend or otherwise alter the form of these cables. Each coaxial cable is identified with a label, and should be installed as prompted in the instructions.

1.2.8 Installation Hardware

Where possible, the hardware used to install the various system components was shipped in place on the uni-strut frame. The hardware will need to be removed, saved and re-used when installing the component. Refer to **Appendix A** for torque values.

2.0 Introduction

This section describes the unpacking, inspection and installation procedures the user should follow to set up a 4-way or 8-way C-Band Compact Outdoor PowerMAX System.

2.1 Installation

The system was shipped from the factory as intact as possible, but some assembly is required to complete the installation. The system includes the following components:

- (1) Uni-Strut Frame;
- (1) Waveguide/Combiner Assembly (shipped inside Uni-Strut Frame);
- (4) or (8) Compact Outdoor SSPA Modules;
- (1) or (2) Outdoor SSPA Controller Assemblies;
- (1) RF Distribution Box Assembly;
- (1) Optional AC Distribution Box Assembly;
- (1) Optional Maintenance Switch Controller;
- (1) Optional Maintenance Switch and Termination
- (1) Optional Outdoor Ethernet Switch;
- Coaxial cables and COMS cables.

See **Figure 2-1** on the following page.

When securing all hardware during installation, refer to **Appendix A** for hardware torque values.

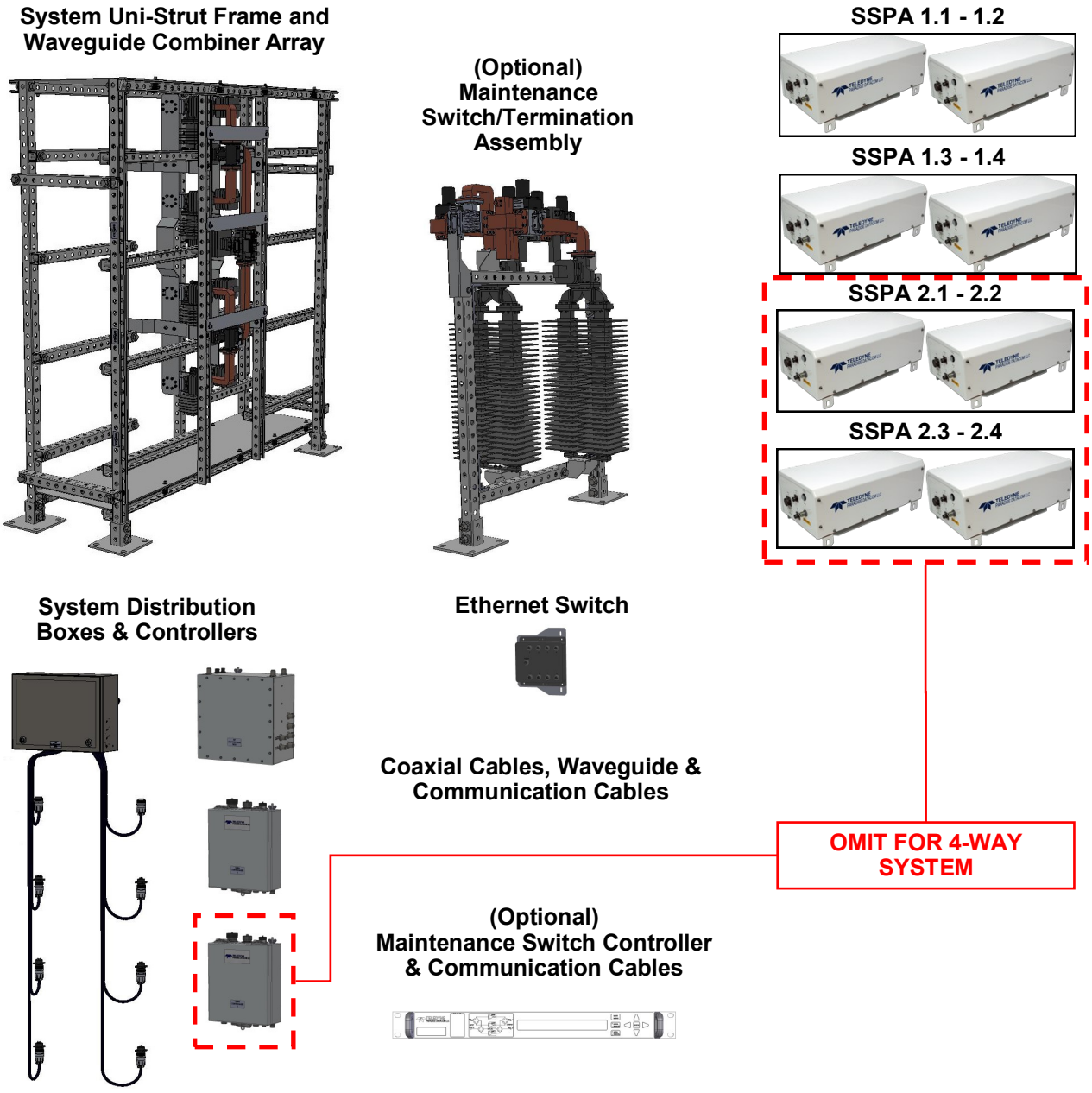


Figure 2-1: System Components, 8-Way System with Optional Maintenance Switch

2.1.1 Prepare Location Decking

The Outdoor PowerMAX System is designed to be installed on a flat, level, solid surface with the capability of anchoring the uni-strut frame assemblies to the decking.

Figure 2-2 shows the typical dimensions of the base mounting installation and anchor points for the system and an optional Maintenance Switch/Termination Assembly. An outline drawing specific to your system will be included with your system.

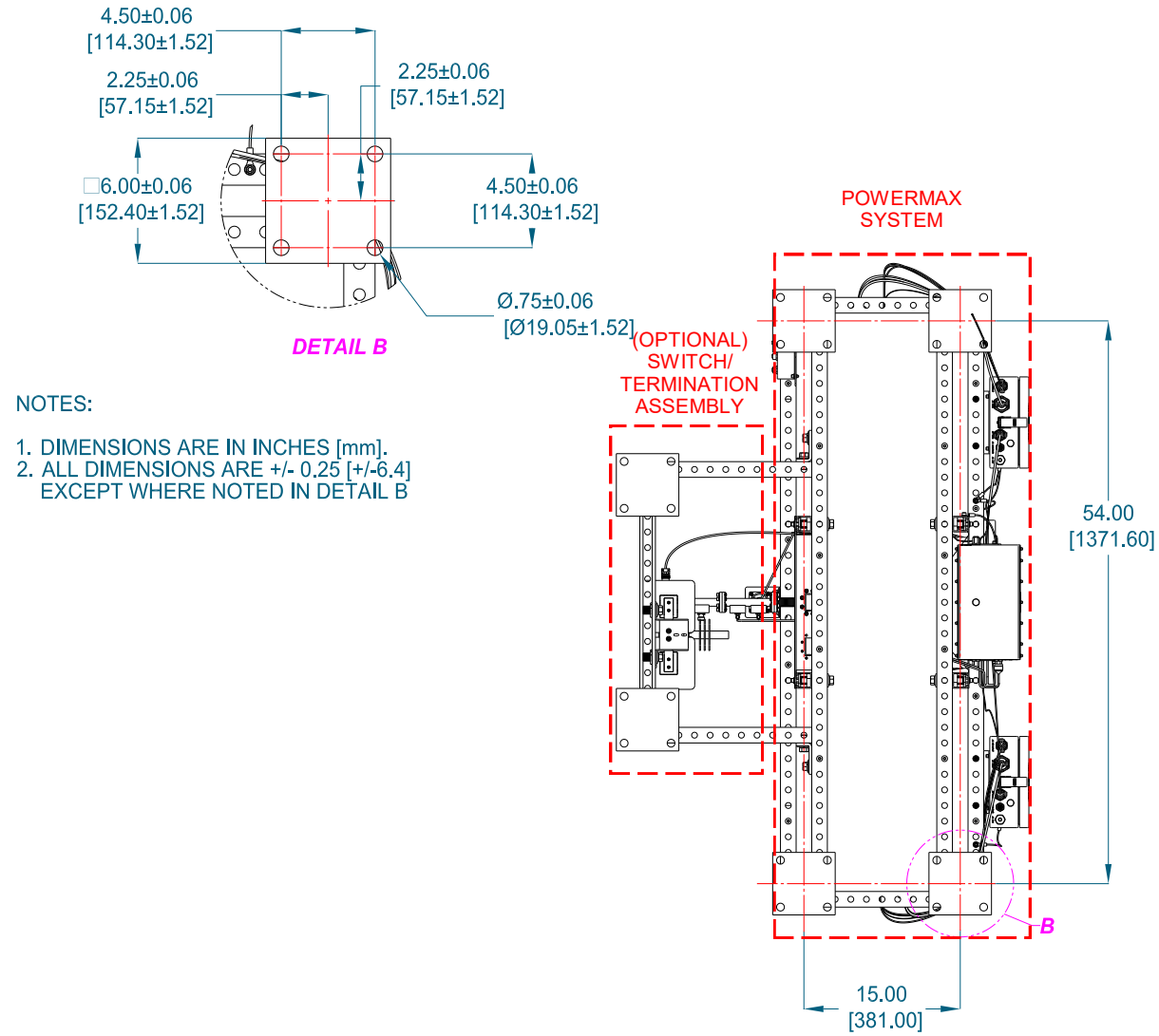


Figure 2-2: Installation, Base Mounting and Anchor Points

The RF Distribution Box will be mounted on the uni-strut frame opposite the RF Output, as described in **Section 2.1.8**. The Outdoor SSPA Controllers will be mounted to the top rail opposite the RF Ouput, as described in **Section 2.1.9**. The optional AC Distribution Box will be mounted at the top of the uni-strut frame, as described in **Section 2.1.7**.

The indoor controller for the optional Maintenance Switch requires installation in a climate controlled environment.

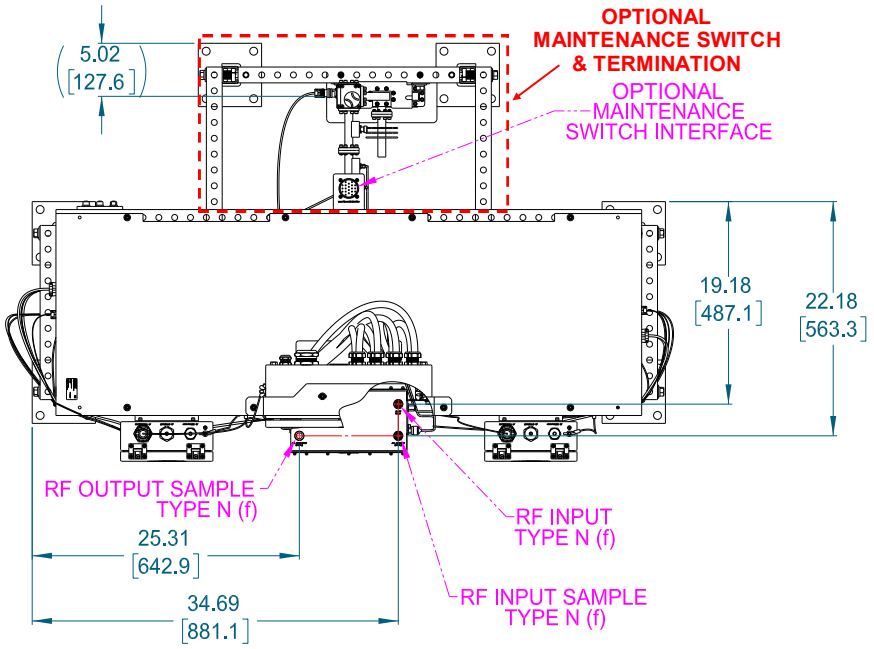


Figure 2-3: System Outline, Top View (C-Band Shown)

Figure 2-3 shows the top view of the system, after installation is completed.

Figure 2-4 shows the system end views of the fully-installed system.

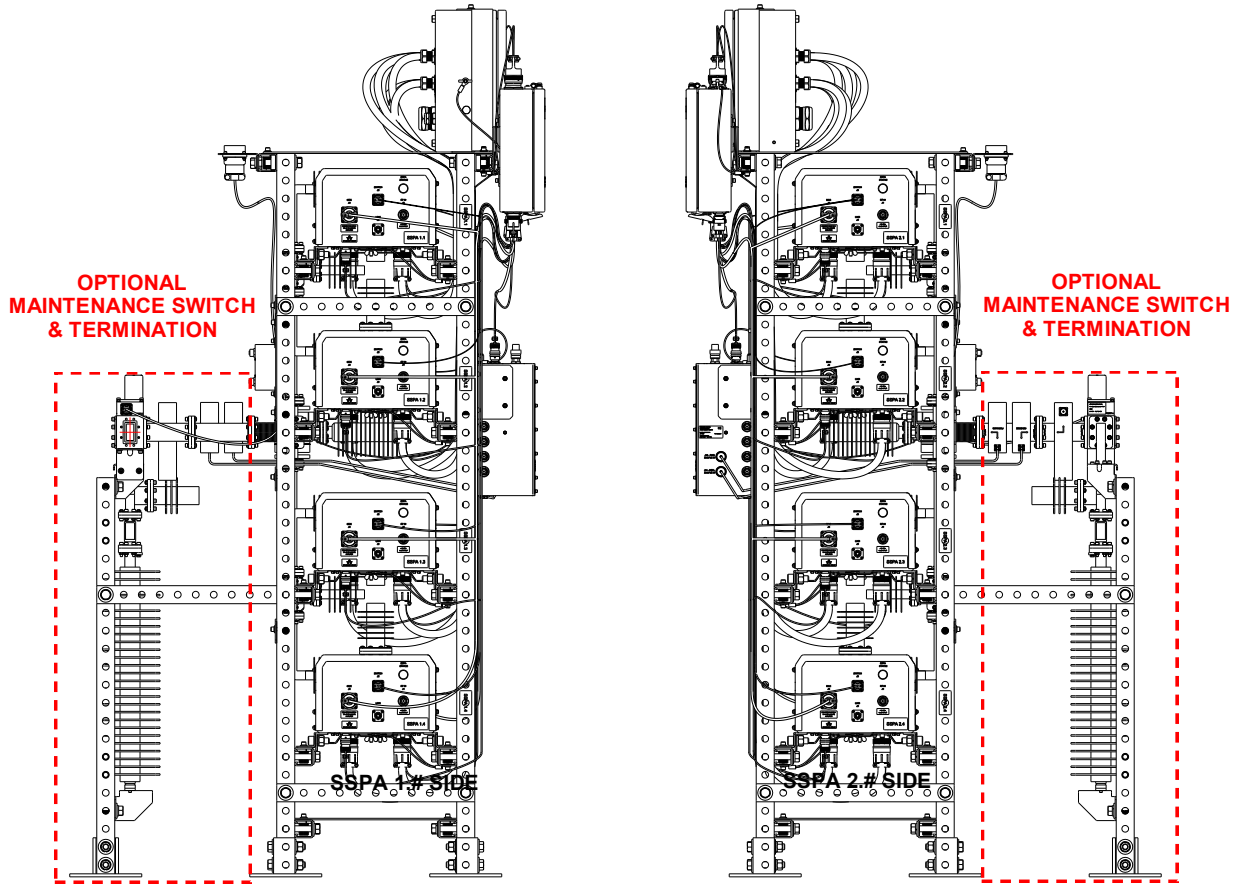


Figure 2-4: System Outline, End Views (C-Band 8-Way System Shown)

2.1.2 Install System Framework

Begin the system installation by bolting the system's uni-strut frames to the system deck. The frames should be squared, leveled and plumbed. Ensure the hardware securing the uni-strut pieces together is tightly fastened.

> **Warning! The uni-strut frame requires at least two persons to place into position. Take care not to tip the assembly over.**

The system was shipped with cables zip-tied to the uni-strut frame. Some of the zip ties were used to secure the cables for shipment purposes.

> **Note**: All trimmed zip ties should remain in place. Any untrimmed zip ties may be cut when it comes time to connect the cables.

2.1.2.1 Remove Shipping Supports

Before installing the SSPA modules into the uni-strut frame, remove the supports that stabilized the waveguide assembly during shipment. See **Figure 2-5**.

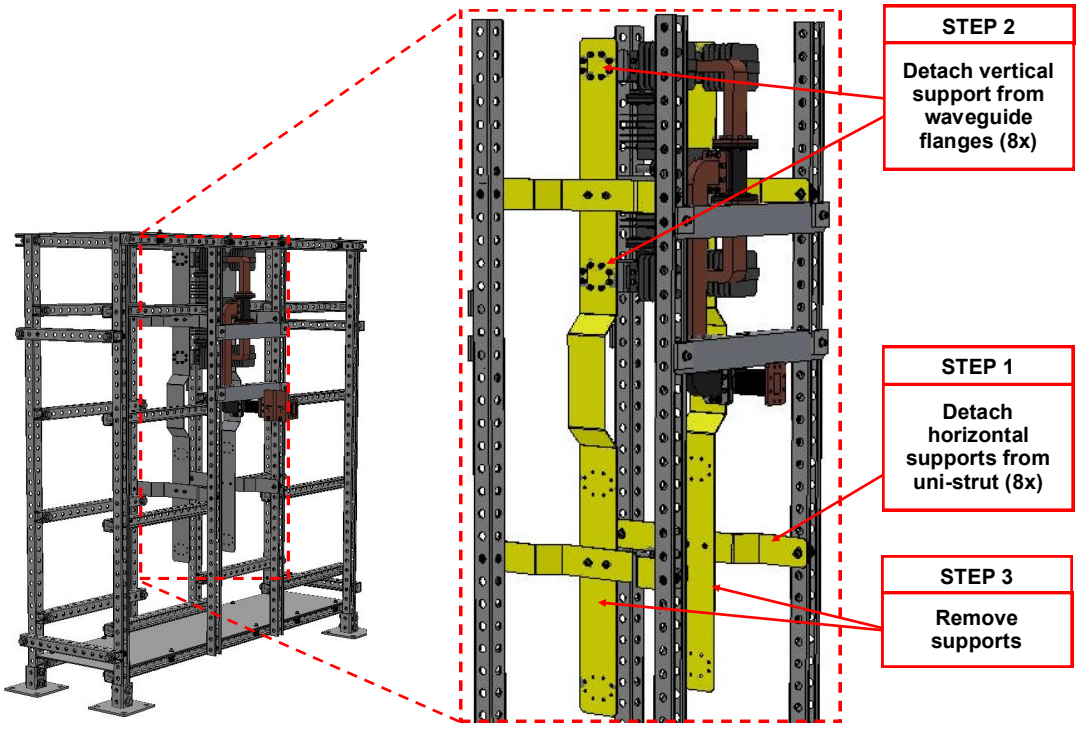


Figure 2-5: Remove Waveguide Assembly Shipping Supports (C-Band Shown)

The vertical shipping supports are secured to the waveguide flanges (four per side) by 10-32 hardware. Remove and save all hardware.

Each horizontal support is secured to the frame by two (2) 1/4-20 x 5/8 socket head cap screws, flat and lock washers, and 1/4-20 self holding nuts. Remove hardware.

Carefully remove the shipping supports, taking care not to damage any threaded posts in the waveguide flanges.

2.1.3 Install Compact Outdoor SSPA Modules

Each of the uni-strut frame assemblies has SSPA unit identification stickers affixed to the space where the matching SSPA module should be installed. All SSPA modules are labeled. When installing the SSPAs, make sure to match SSPAs from the same system together, and insert the corresponding SSPA Module to its position in the uni-strut frame. This will reduce the need to optimize the system output at initial startup.

Aluminum supports are attached to the mounting brackets of the Compact Outdoor SSPA modules. These supports allow the SSPA module to be inserted into the frame, and slide along the top of the uni-strut. See **Figure 2-6**.

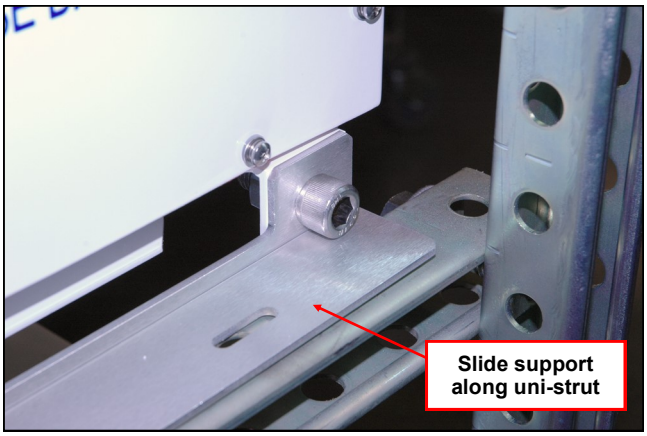


Figure 2-6: Compact Outdoor SSPA Module Support

Insert an appropriately sized half gasket (provided) between the Compact Outdoor SSPA module RF output and the waveguide assembly.

Ensure the Compact Outdoor SSPA module is level, and properly aligned with the waveguide assembly. Make any necessary adjustment at the SSPA module support.
If the through holes in the RF Output flange of the SSPA module do not align with the threaded posts (as shown in **Figure 2-7**, **left**), adjust the height at each of the four (4) connections between the Compact Outdoor enclosure and the Module Support (see **Figure 2-7**, **right**). Make sure the module is level before tightening the hardware.

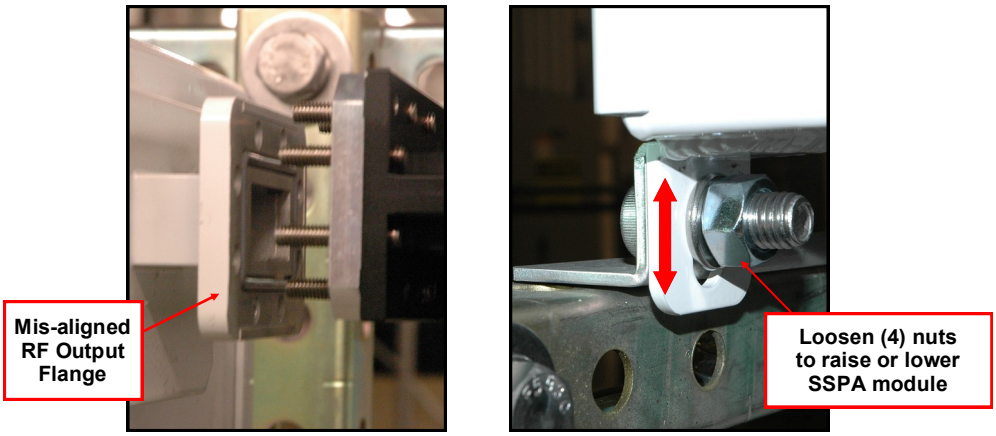


Figure 2-7: Mis-Aligned RF Output Flange (left) and Support Adjustment (right)

Secure the RF Output flange of the Compact Outdoor SSPA module to the waveguide assembly using the hardware that was used to secure the shipping supports to the waveguide flange. See **Figure 2-8**. Tighten hardware securely.

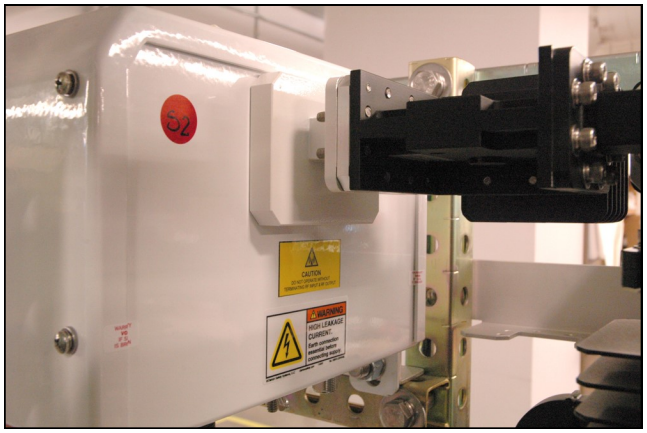


Figure 2-8: Secure RF Output Flange to Waveguide Assembly

Bolt the SSPA module supports to the uni-strut frame using the provided hardware (quantity 4 each SSPA: 1/4-20 x 0.75 socket head cap screw, flat washer, lock washer, and 1/4-20 self holding nut). See **Figure 2-9**. Use the hardware nearest the SSPA Module's ground stud to connect a green/yellow striped ground wire between the stud and the frame. Tighten hardware securely.

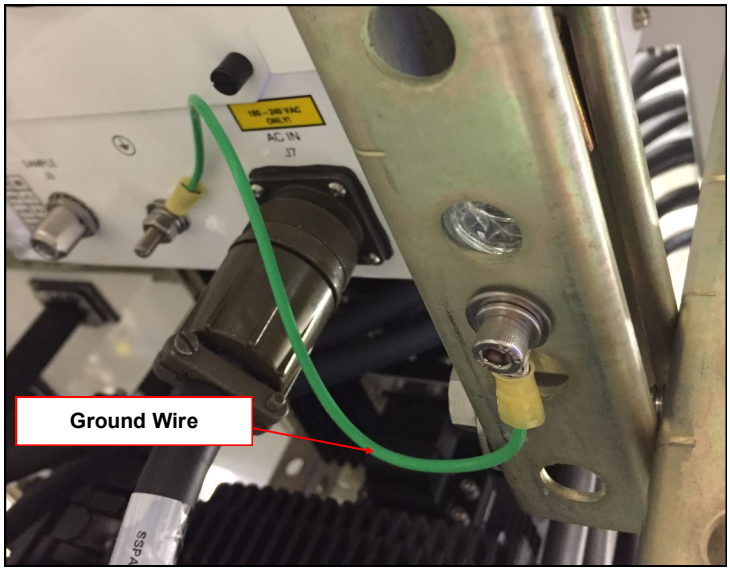


Figure 2-9: Connect Ground Wire to SSPA Ground Terminal

Repeat for each of the Compact Outdoor SSPA modules in the system.

2.1.4 Install Optional AC Distribution Box

Place the AC Distribution Box on the top of the frame, centered on the side opposite the system RF Output. Refer to **Figure 2-10** for a 4-Way system, and **Figure 2-11** for an 8-Way system.

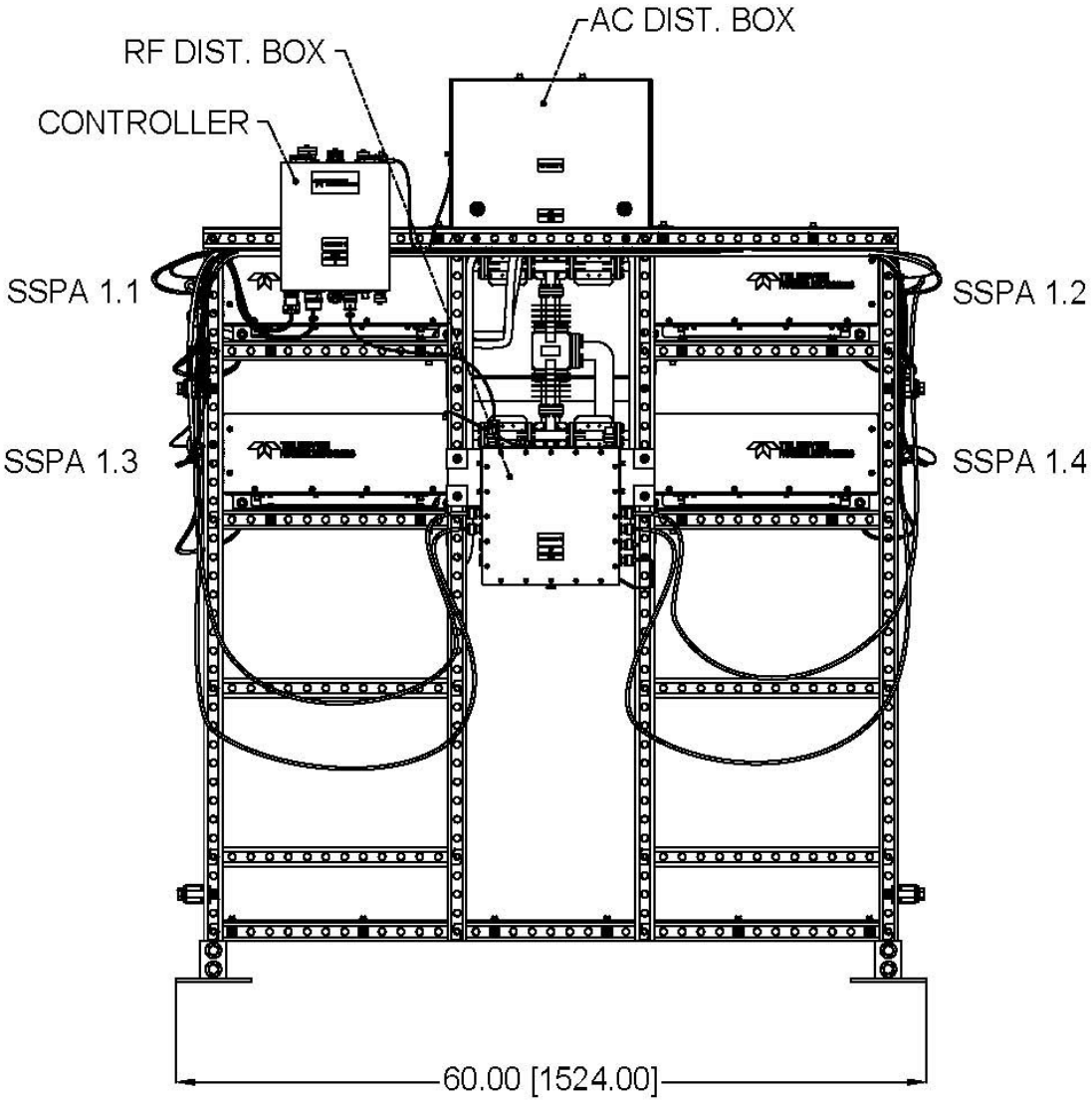


Figure 2-10: 4-Way System, Mounting, Distribution Boxes and Controller

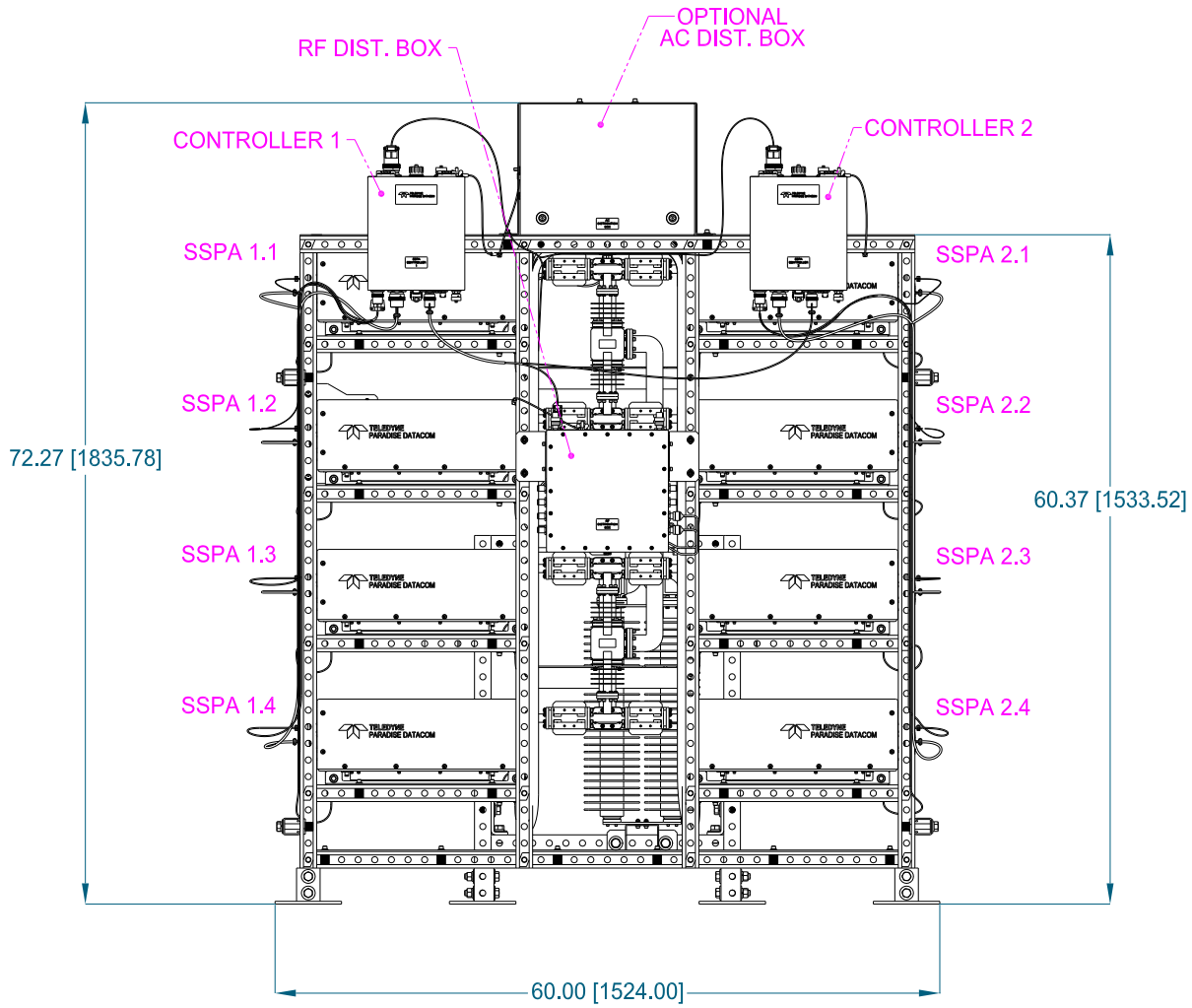


Figure 2-11: 8-Way System, Mounting, Distribution Boxes and Controllers

Insert the power cables through the slot in the top cover, as shown in **Figure 2-12**.

Figure 2-12: Insert Power Cables Through Top Cover Slot

Secure the mounting bracket to the uni-strut frame using the provided 1/4-20 x 0.75 socket head cap screws, flat washers, lock washers and 1/4-20 self-holding nuts. Secure a ground wire to the stud on the AC Distribution Box. See **Figure 2-13**.

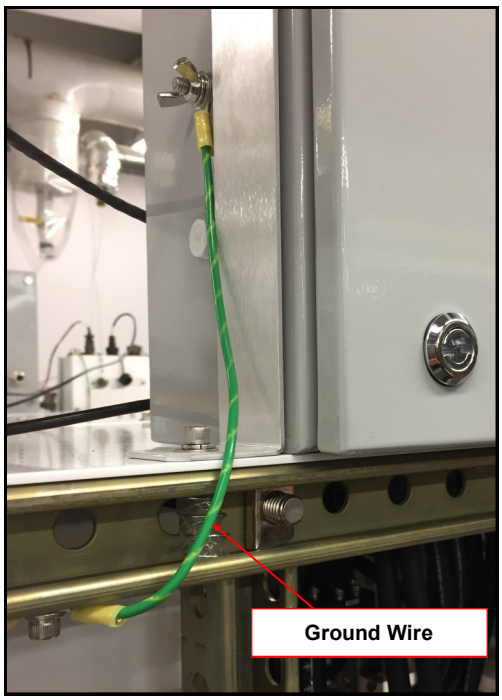


Figure 2-13: Secure Bracket to Frame

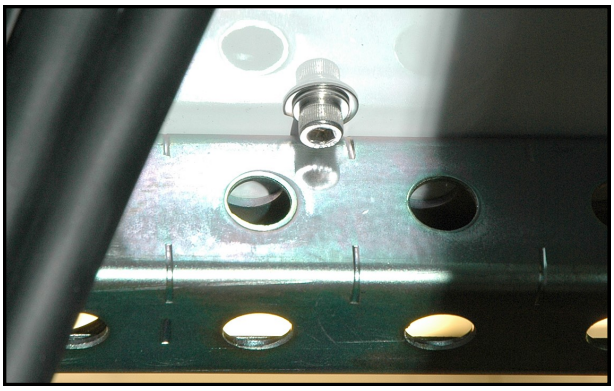


Figure 2-14: Bolt Down AC Box

Insert two (2) 1/4-20 x 1/2 socket head cap screws, flat washers and lock washers through the underside of the system's top cover (just behind the uni-strut) and into the AC Distribution Box. See **Figure 2-14**.

Connect the power cables to each of the SSPA Modules in the system. Each power cable is labeled near the connector end to identify to which SSPA Module it should connect. See **Figure 2-15**.

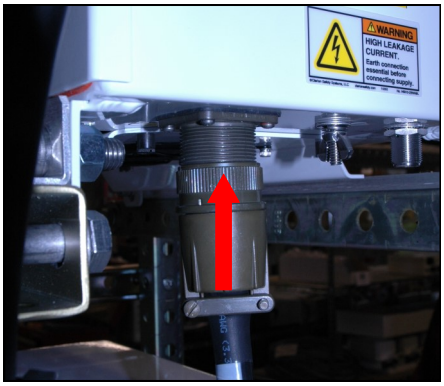


Figure 2-15: Connect Power Cables to SSPA Module

2.1.5 Install RF Distribution Box

For placement of the RF Distribution Box, refer to **Figure 2-10** for 4-Way systems, and **Figure 2-11** for 8-Way systems.

In the center two uni-strut segments, insert self-holding nuts 18.5 inches from the top cover. Insert a second pair of self-holding nuts 3 inches lower.

Secure the mounting brackets to the uni-strut frame using four (4) sets of 1/4-20 x 0.5 socket head cap screws, flat washers, lock washers and the self-holding nuts installed above. Tighten hardware securely. See **Figure 2-16**.

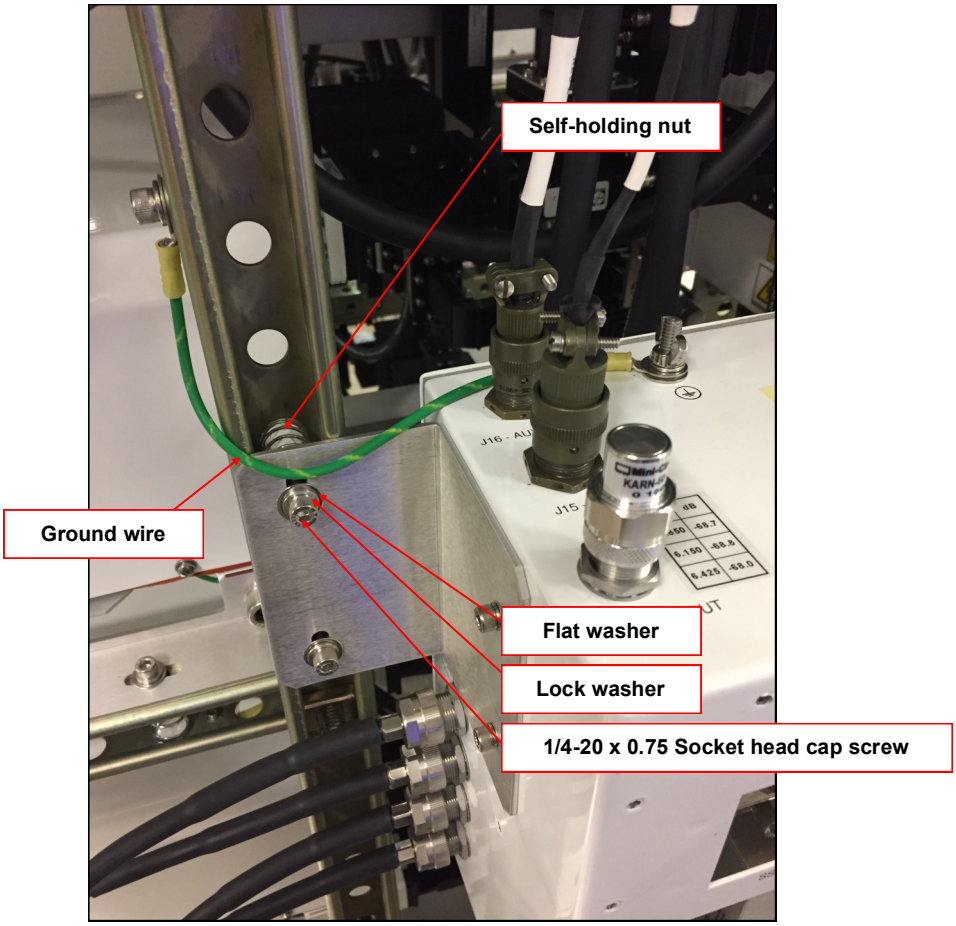


Figure 2-16: Secure RF Distribution Box to Uni-strut Frame

Connect the green/yellow striped ground wire to the earth ground stud on the RF Distribution Box.

2.1.6 Install Outdoor SSPA Controllers

Remove the mounting brackets from back of each of the system's Outdoor SSPA Controllers. Save the hardware.

For 4-Way systems, position the mounting bracket on the uni-strut frame to the left of the AC Distribution Box, as shown in **Figure 2-10**. For 8-Way systems, position the mounting brackets on uni-strut frame, one to the left of the AC Distribution Box and one to the right of the AC Distribution Box, as shown in **Figure 2-11**.

Secure with two (2) sets of 1/4-20 x 3/4 socket head cap screws, flat washers, lock washers and self-holding nuts. See **Figure 2-17**.

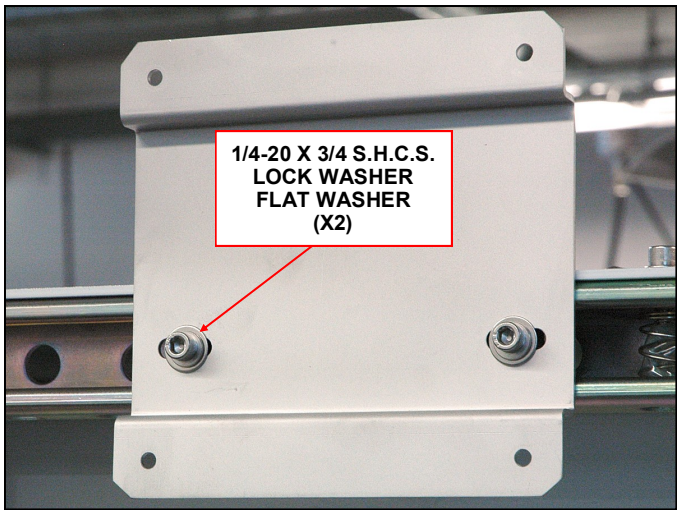


Figure 2-17: Attach Controller Mounting Bracket to Frame

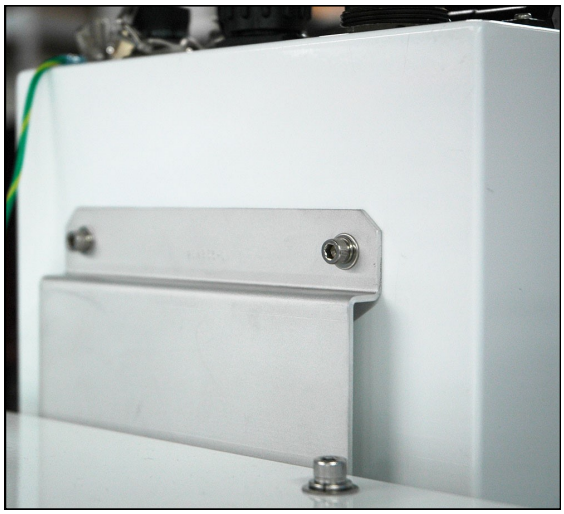


Figure 2-18: Attach Controller to Mounting Bracket

Attach the controllers to the mounting brackets using four (4) each 10-32 x 0.375 socket head cap screws, lock washers and flat washers. See **Figure 2-18**.

Make sure Controller 1 is located to the left of the AC Distribution Box, and Controller 2 is located to the right. Connect the green/yellow striped ground wire to the ground terminal on the controllers. See **Figure 2-19**. The ground wire for Controller 1 is connected to the same hardware as the ground wire for the AC Distribution box.

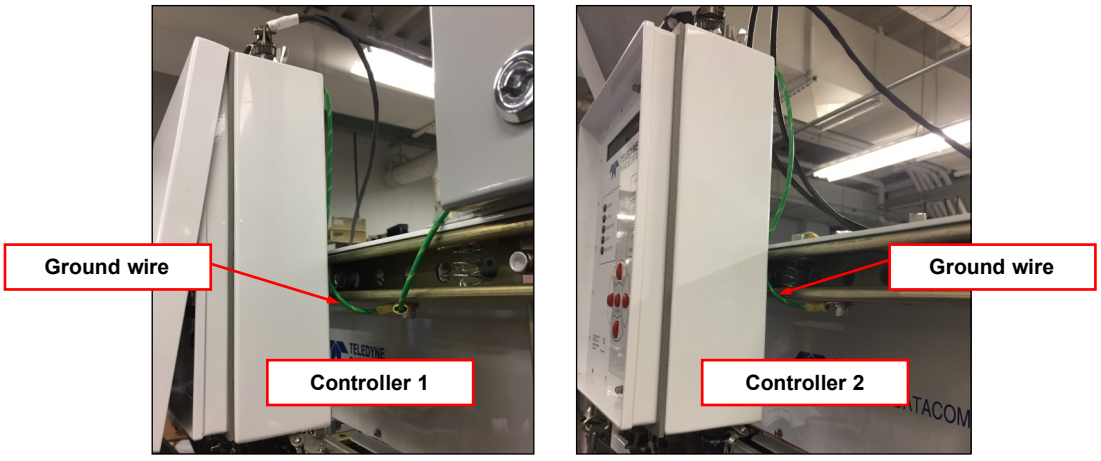


Figure 2-19: Connect Controllers to Ground

2.1.7 Install System Maintenance Switch (Optional)

The Outdoor PowerMAX system may include an optional Maintenance Switch for the purpose of directing the system's RF Output signal to a dummy load during maintenance.

The system termination is mounted to a uni-strut frame, which is attached to the system uni-strut frame. See **Figure 2-20**. Connect the horizontal sections of uni-strut to the HPA system framework using a two-hole L-bracket, two (2) self-holding nuts, two (2) 1/2-13X1.25" hex bolts, lock washers and flat washers. Secure all hardware.

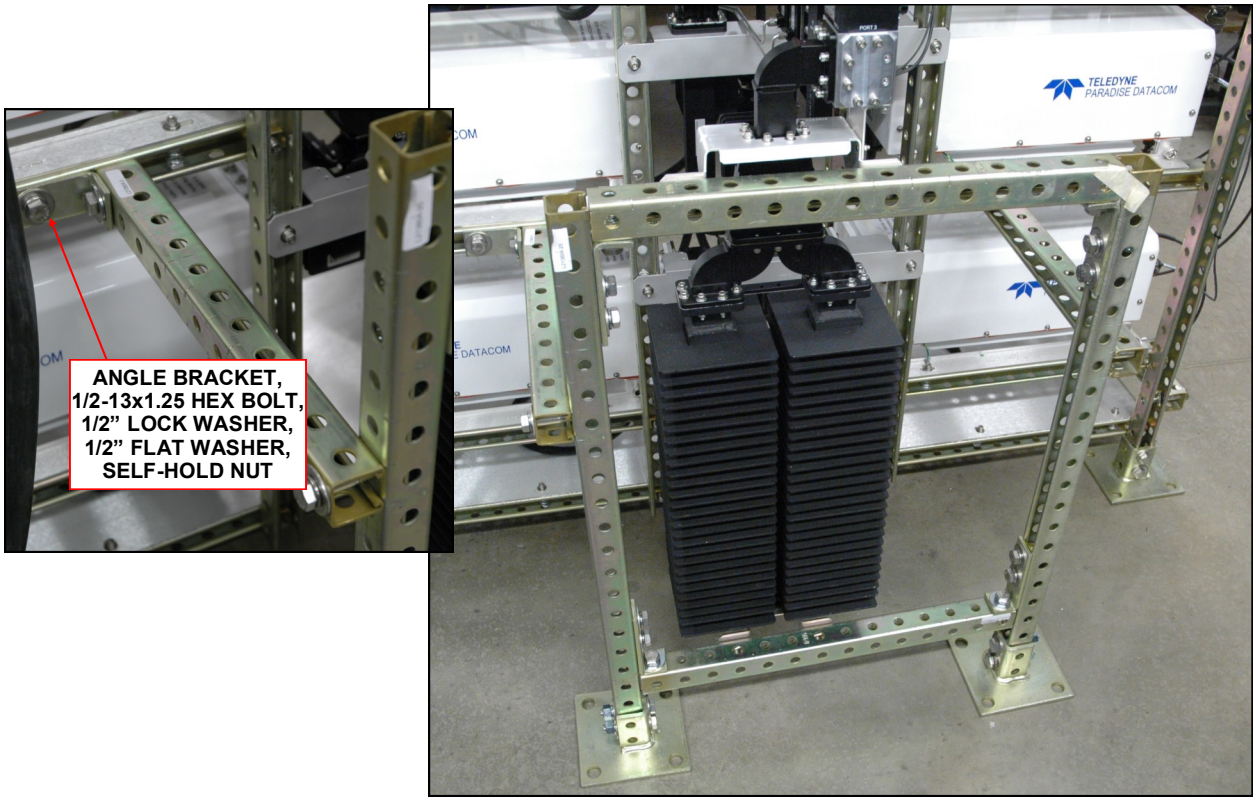


Figure 2-20: Install System Maintenance Switch Assembly

Make sure to connect the system RF output waveguide to the antenna or other load before providing power to the system.

Never look into an open RF waveguide! RF transmission at high power levels may cause eyesight damage and skin burns.

2.1.7.1 Install E-Bend/Crossguide Coupler at System RF Output

For shipping purposes, the flexible waveguide E-bend and crossguide coupler were removed from the system outputs, and need to be re-attached.

Insert a half gasket between the Magic Tee and the flex waveguide E-Bend. Secure the waveguide flange at the E-bend to the system's Magic Tee using 10-32 x 3/4 socket head cap screws, flat washers, lock washers and nut plates. Tighten hardware securely. See **Figure 2-21**.

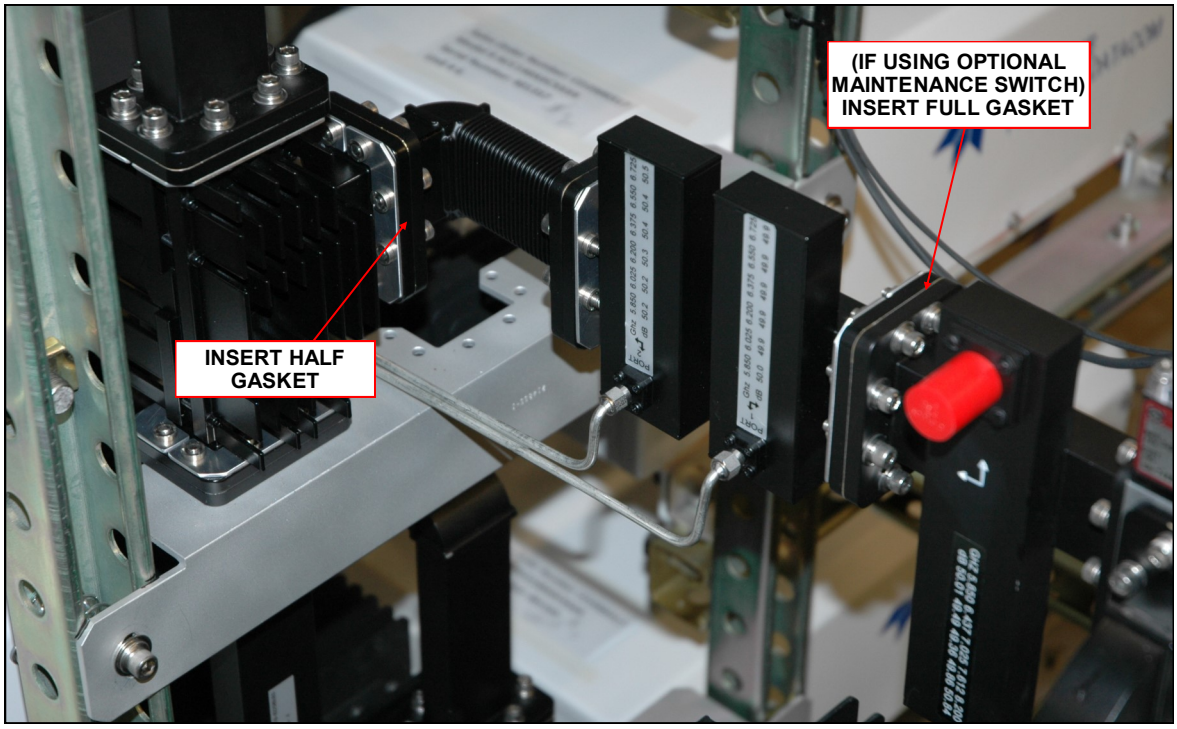


Figure 2-21: Connect E-Bend/Crossguide Coupler and Optional Maintenance Switch

For systems using the optional maintenance switch, insert a full gasket at the output of the dual crossguide coupler. Attach the switch using 10-32 x 1/2 hardware, as shown in **Figure 2-21**.

The flexible waveguide allows for some slight adjustment in position without the need to adjust the entire SSPA assembly.

2.1.8 Install Optional Ethernet Switch

The Ethernet Switch should be installed on the uni-strut frame, on the same side as the RF output.

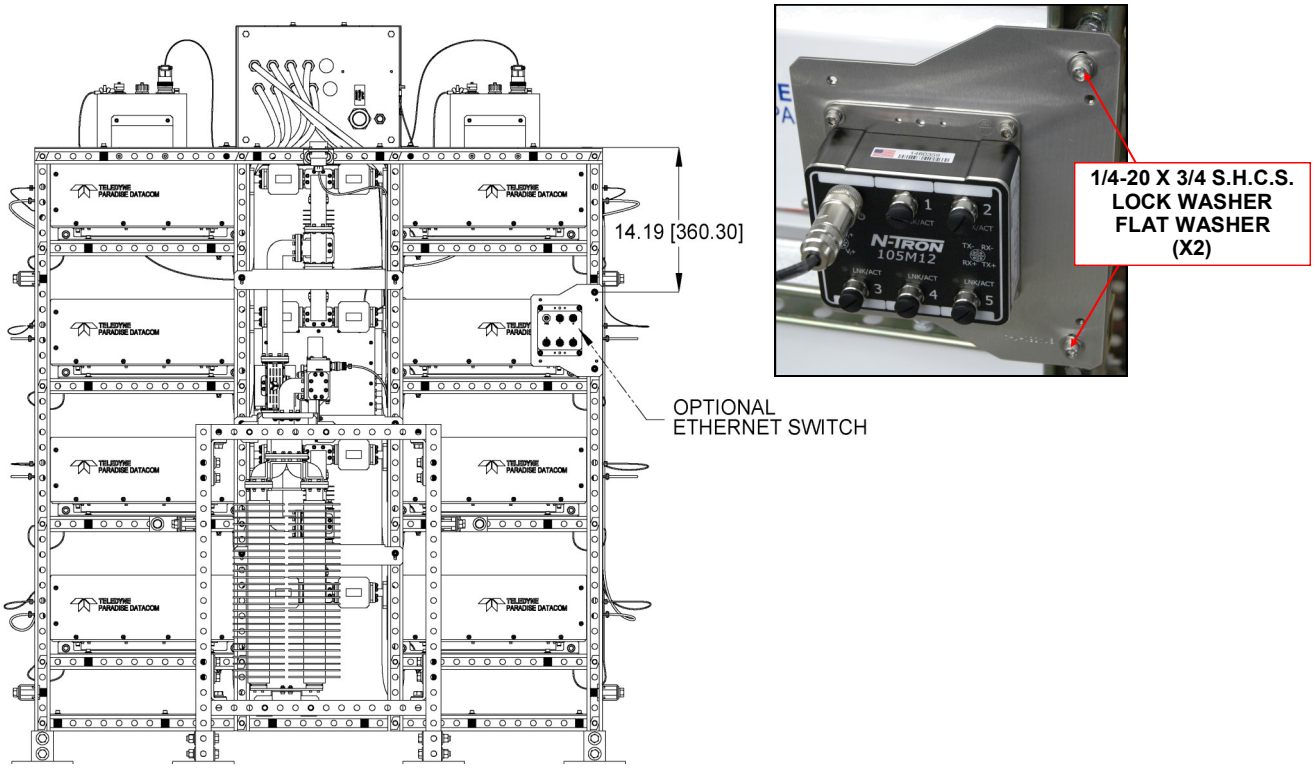


Figure 2-22: Mount Optional Ethernet Switch

> **Note**: The system RF Distribution Boxes provide power to the Ethernet Switch over the Auxiliary Power Cable. See **Section 2.1.10.4**.

The M12 D-coded, 4-pin (F) connectors and were shipped with IP67 caps installed to protect from dust and moisture ingress. The caps will need to be removed before connecting cables to the COMs port. All unused M12 connectors should remain capped.

2.1.9 Install Indoor Switch Controller (Optional)

The optional indoor Switch Controller should be installed into a standard 19” equipment rack in a sheltered environment.

Access to the rear panels should be kept available.

Plug the provided IEC line cords into the power supplies at the rear panel of each controller. Plug in the opposite ends to a power source.

2.1.10 Connect Cables

Install the following sets of cables as described. All semi-rigid coaxial cable is pre-formed and should not be re-shaped or otherwise altered.

After installation is completed, all cable connectors should be weatherized with self-amalgamating tape or putty to prevent water intrusion.

Prior to weatherizing a connector, remove all traces of oil or grease from the connect-or. Ensure that the connector is clean and dry.

Apply the weatherizing material from the plug/socket connector (MS-type) to as close as possible to the cable sheath. Cover all connector junctions (N-type; SMA) so that no water can creep into the thread between the plug and socket.

2.1.10.1 Forward Sample In

This cable is a semi-rigid coaxial cable labeled W10 that connects between the SMA connector of the forward sample off the crossguide coupler at the system output and Port J13 of the System 1 RF Distribution Box.

Do not bend or otherwise alter the shape of this cable during installation.

2.1.10.2 Reflected Sample In

This cable is a semi-rigid coaxial cable labeled W9 that connects between the SMA connector of the reflected sample off the crossguide coupler at the system output and Port J14 of the System 1 RF Distribution Box.

Do not bend or otherwise alter the shape of this cable during installation.

2.1.10.3 RF Distribution Cables

The RF Distribution Cables are flexible coaxial cables used to distribute the RF signal from the RF Distribution Box to each of the SSPA Modules in the system.

Each of the cables are labeled, and should be plugged in to the appropriate connector. See **Table 2-1**.

Table 2-1: RF Distribution Cable Connections

Label	SSPA Module	Label	SSPA Module
W1	SSPA 1.1	W5 (8-way only)	SSPA 2.1
W2	SSPA 1.2	W6 (8-way only)	SSPA 2.2
W3	SSPA 1.3	W7 (8-way only)	SSPA 2.3
W4	SSPA 1.4	W8 (8-way only)	SSPA 2.4

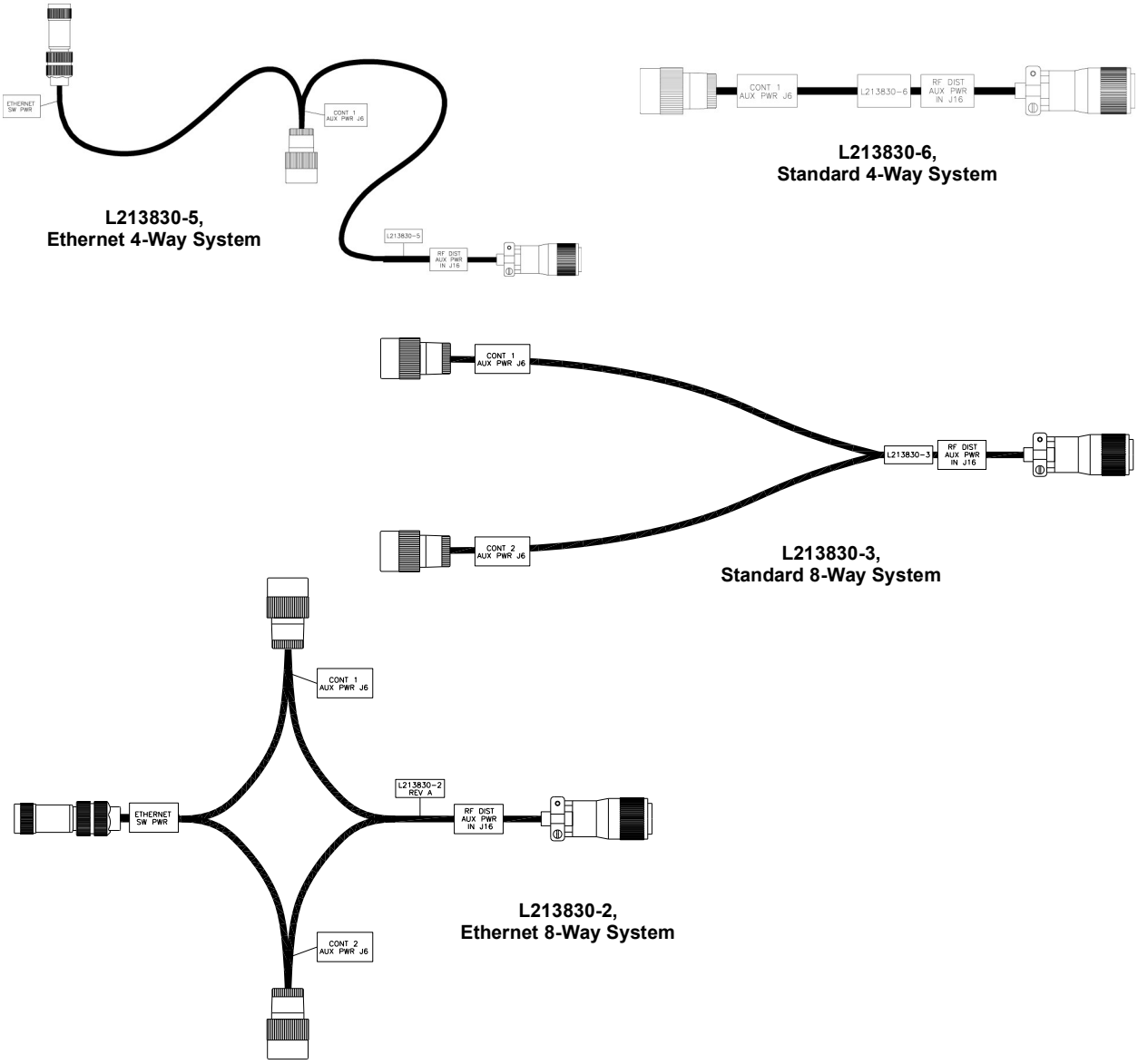


Figure 2-23: System Auxiliary Power Cables, L213830-X

2.1.10.4 Auxiliary Power Cable

The power detector module in the system's RF Distribution Box is powered from the Outdoor SSPA Controllers via the System Auxiliary Power Cable.

For 8-way Outdoor PowerMAX systems not using the optional Ethernet switch, the part number is L213830-3. Systems with the optional Ethernet switch use cable L213830-2.

For 4-way Outdoor PowerMAX systems not using the optional Ethernet switch, the part number is L213830-6. Systems with the optional Ethernet switch use cable L213830-5.

Refer to **Figure 2-23**. Each cable end is labeled near the connector. Plug the connectors into the appropriate port in the Outdoor SSPA Controllers (Port J6 AUX PWR), the RF Distribution Box (Port J16 AUX PWR IN), and the optional Ethernet Switch (SW PWR).

2.1.10.5 SSPA Module M&C Cable

Communication for monitor and control purposes between the SSPA Controllers and each of the connected amplifiers is established through the Monitor & Control Cables. These cables connect to Port J4 of the SSPA Controller, and to Port J4 of each SSPA in the controller's array of amplifiers. A label is affixed near each connector that describes the port to which it should be attached.

The cables used in 8-Way Systems are: part number L213827-3 for the SSPA modules connected to Controller 1, and part number L213827-4 for the SSPA modules connected to Controller 2. See **Figure 2-24**.

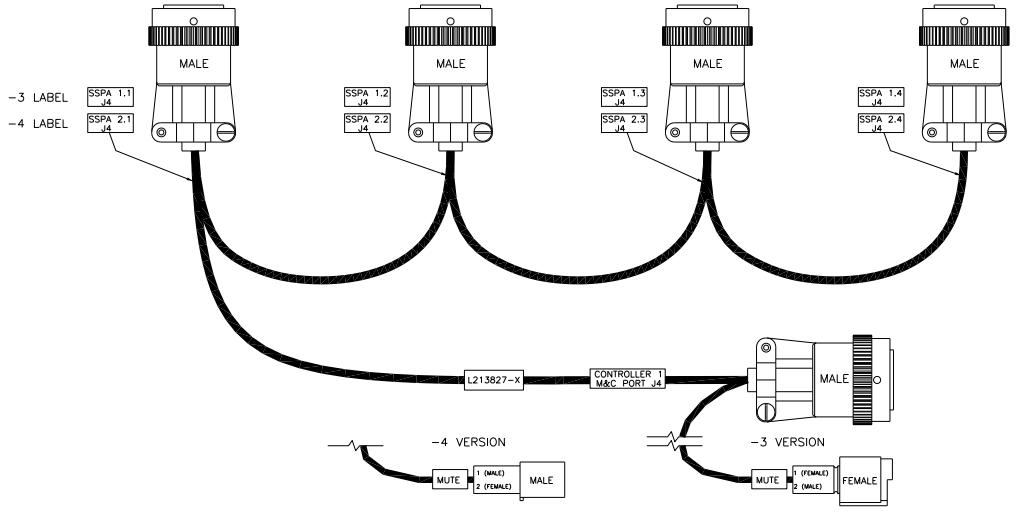


Figure 2-24: SSPA Module M&C Cables, L213827-3/-4 (8-Way Systems)

Connect the female sure seal connector (Mute line) of L213827-3 to the male sure seal connector (Mute line) of L213827-4.

The cable used in 4-Way Systems is: part number L213827-5 for all four (4) SSPA modules connected to Controller 1. See **Figure 2-25**.

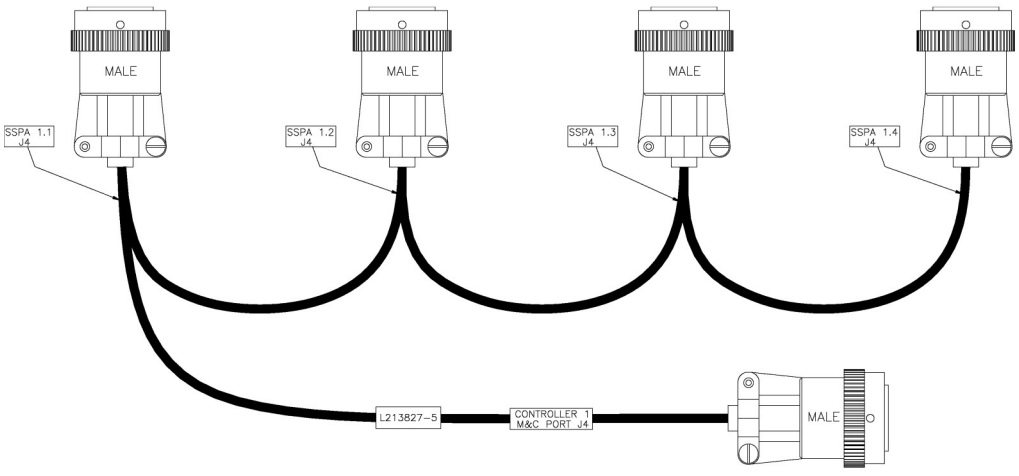


Figure 2-25: SSPA Module M&C Cable, L213827-5 (4-Way Systems)

2.1.10.6 Outdoor SSPA Controller DC Input Cables

Power to the SSPA Controllers is provided from each of the amplifiers in the array that the controller monitors and controls. The Controller Power Cables connect between Port J5 of the controller and Ports J6 and J8 of each amplifier in its array. A label is affixed near each connector that describes the port to which it should be attached.

In 4-Way systems, the cable used with Controller 1 is part number L213826-5.

In 8-Way systems, the cable used with Controller 1 is part number L213826-3 and the cable used with Controller 2 is part number L213826-4. See **Figure 2-26**.

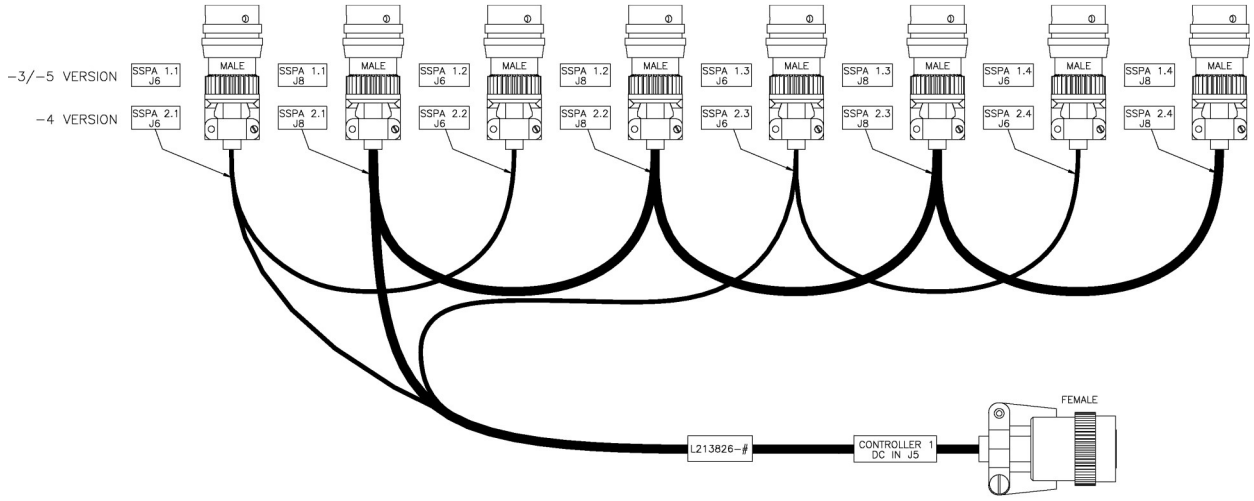


Figure 2-26: Outdoor SSPA Controller DC Input Cable, L213826-3/-4/-5

2.1.10.7 System Link Cable

The System Link Cable, part number L213828-3 for 4-Way systems or L213828-2 for 8-Way systems, connect the system's SSPA Controllers and the RF Detector module housed within the RF Distribution Box. This cable is used to pass online/standby status information between the amplifiers.

A label is affixed near each connector that describes the port to which it should be attached. Plug the connectors into the appropriate ports (Port J8 of each Controller and Port J15 of the RF Distribution Box). See **Figure 2-27**.

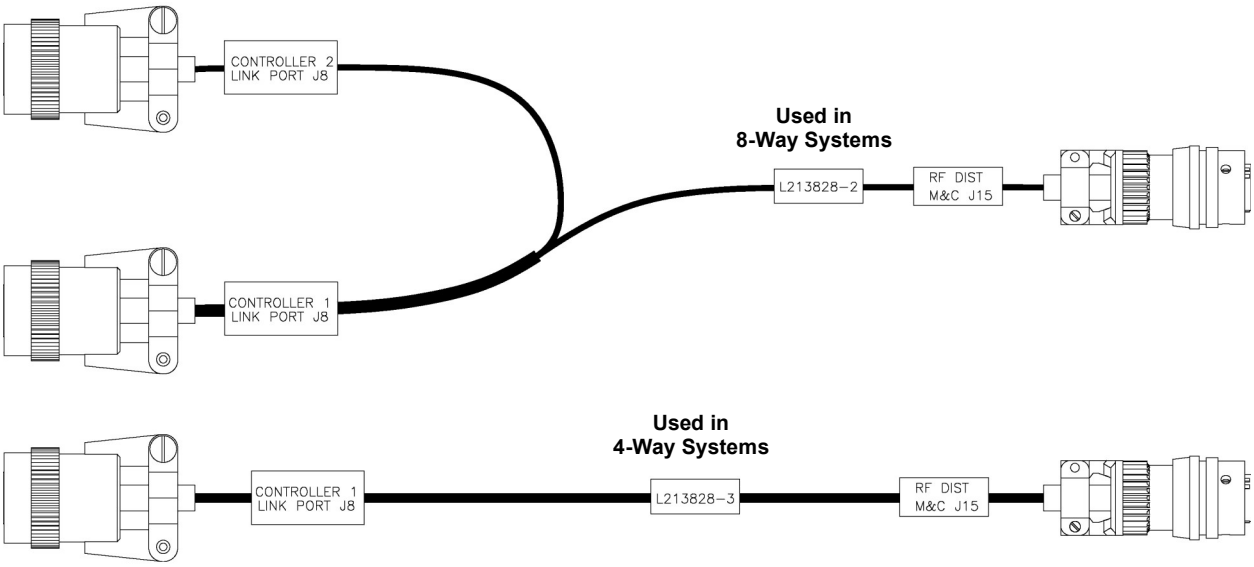
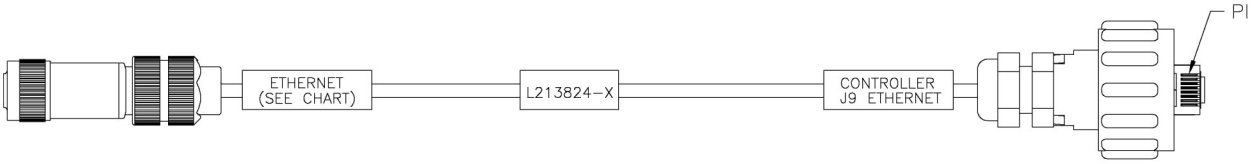


Figure 2-27: System Link Cable, L213828-2 (top, for 8-Way) and L213828-3 (bottom, 4-Way)

2.1.10.8 Optional Ethernet Cables

Connect each Outdoor SSPA Controllers to the Optional Ethernet Switch using the provided Ethernet cables, part numbers L213824-6 and L213824-7 (8-Way systems only). Use the table in **Figure 2-28** to identify which cable to use for each controller, and the corresponding port on the Ethernet Switch to which it should connect.



LABEL CHART	
REVISION	LABEL TEXT
-6	CONT1-PORT 4
-7	CONT2-PORT 5 (8-WAY ONLY)

Figure 2-28: Optional Ethernet Cables, L213824-6/-7

2.1.10.9 Switch Mute Cable (Optional)

This cable connects between the optional maintenance switch, and the Outdoor SSPA Controllers, and to the aluminum bracket labeled “MAINTENANCE SWITCH” located at the top of the uni-strut frame, above the system RF output.

The Switch Mute Cable must be connected between the indoor controllers in order to pass along the Mute on Switch command whenever the position of one of the system’s transfer switches changes position.

This cable has labels affixed near the connectors to identify to which port that connector should be plugged. See **Figure 2-29**. Connect between port J7 of the two (2) Outdoor SSPA Controllers (Controller 1 and Controller 2 for 8-Way systems; just Controller 1 for 4-Way systems) and the circular MIL connector of the optional switch.

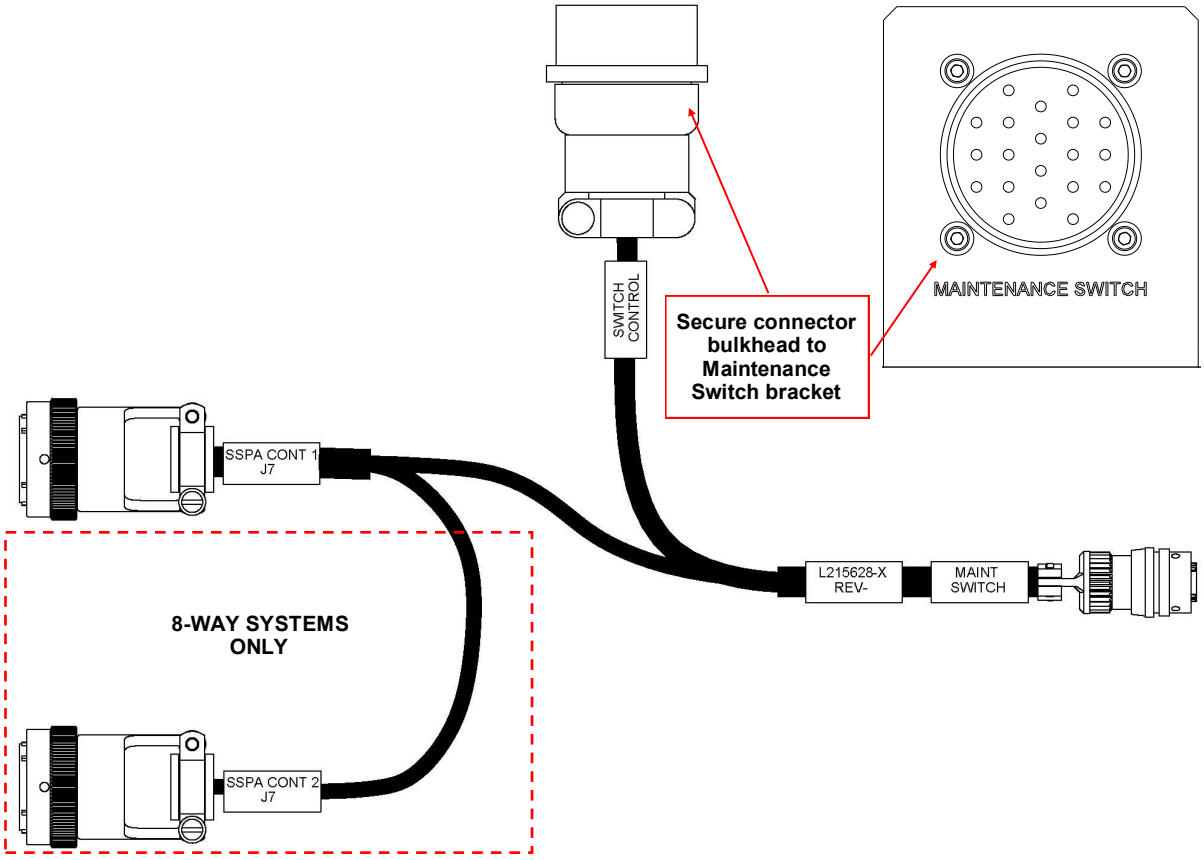


Figure 2-29: Optional Switch Mute Cable

2.1.6.10 Maintenance Switch Controller Cable (Optional)

This cable is part number L201061-1, and has labels affixed near the connectors to identify to which port that connector should be plugged. See **Figure 2-30**. Plug the connectors into the appropriate ports of the Maintenance Switch Controller (Port J3 Plate Assy) and the Switch Mute Cable affixed to the bracket (see **Section 2.1.6.9**).

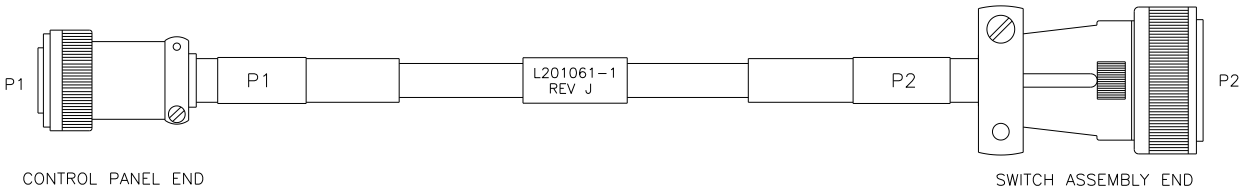


Figure 2-30: Maintenance Switch Controller Cable

2.2 Weatherize Cable Connections

After installation is completed, all cable connectors that will be subject to outdoor environmental conditions should be weatherized with self-amalgamating tape or putty to prevent water intrusion.

Prior to weatherizing a connector, remove all traces of oil or grease from the connector. Ensure that the connector is clean and dry.

Apply the weatherizing material from the plug/socket connector (MS-type) to as close as possible to the cable sheath. Cover all connector junctions (N-type; SMA) so that no water can creep into the thread between the plug and socket.

A.1 Hardware Torque Specifications

All hardware should be fastened to the torque specifications listed in **Table A-1**.

Table A-1: Recommended Hardware Torque Specifications

Hardware Size	Torque	Units
10-32	32	in./lbs.
1/4-20	6.3	ft./lbs.
1/2-13	50	ft./lbs.

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