



Altai AX500 Outdoor 2x2 802.11ac Wave 2 Access Point

Installation Manual

Version 1.0 (Draft)

Federal Communication Commission Interference Statement (FCC) – USA

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Please install a lightning arrestor to protect the base station from lightning dissipation during rainstorms. Lightning arrestors are mounted outside the structure and must be grounded using a ground wire to the nearest ground rod or item that is grounded.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 36cm between the radiator & your body.

European Conformity (CE) – EU

This is a Class B product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.



Warning

AX500-S/AX500-T/AX500-X may require professional installation depending on the deployment scenario.

Only use the power adaptor supplied with AX500-S/AX500-T/AX500-X. Using a different power adaptor might damage the device.

Disclaimer

All specifications are subject to change without prior notice. Altai Technologies assumes no responsibilities for any inaccuracies in this document or for any obligation to update information in this document. This document is provided for information purposes only. Altai Technologies reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

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1. Introduction

Thank you for purchasing Altai AX500 Series products. This manual is intended for field support engineers and installers who are responsible for installing the products on site. Users who perform the tasks should read through this document and also be familiar with the hardware and software capabilities of the products.

This document applies to the following models and associated hardware versions.

Product Name	Model Name	H/W Versions
AX500 Outdoor 2x2 802.11a Wave 2 Access Point	AX500-S	1.0 or above
	AX500-T	1.0 or above
	AX500-X	1.0 or above

There are 3 AP models for AX500 Series.

- (1) **AX500-S**: Integrated-antenna AP model designed to provide long range and wide beam (120 degree) of sector coverage.
- (2) **AX500-T**: Integrated-antenna AP model designed to provide 360 degree coverage.
- (3) **AX500-X**: External-antenna AP model which is designed to provide more flexibility for deployment to meet various purposes and requirement. You can choose omni antennae or sector antennae for access coverage; or choose panel antennae or parabolic antennae for bridge link setup.

It is assumed that site survey has already been performed. Appropriate antenna pole or AP locations have been selected. It is highly recommended that cable lengths of various cables are confirmed. Good site installation plan should consist of site maps or drawings illustrating AP and poles locations, antenna orientation including bearing/down-tilt, antenna height, and network topology.

User may also refer the following documents during AX500 installation and configuration if necessary.

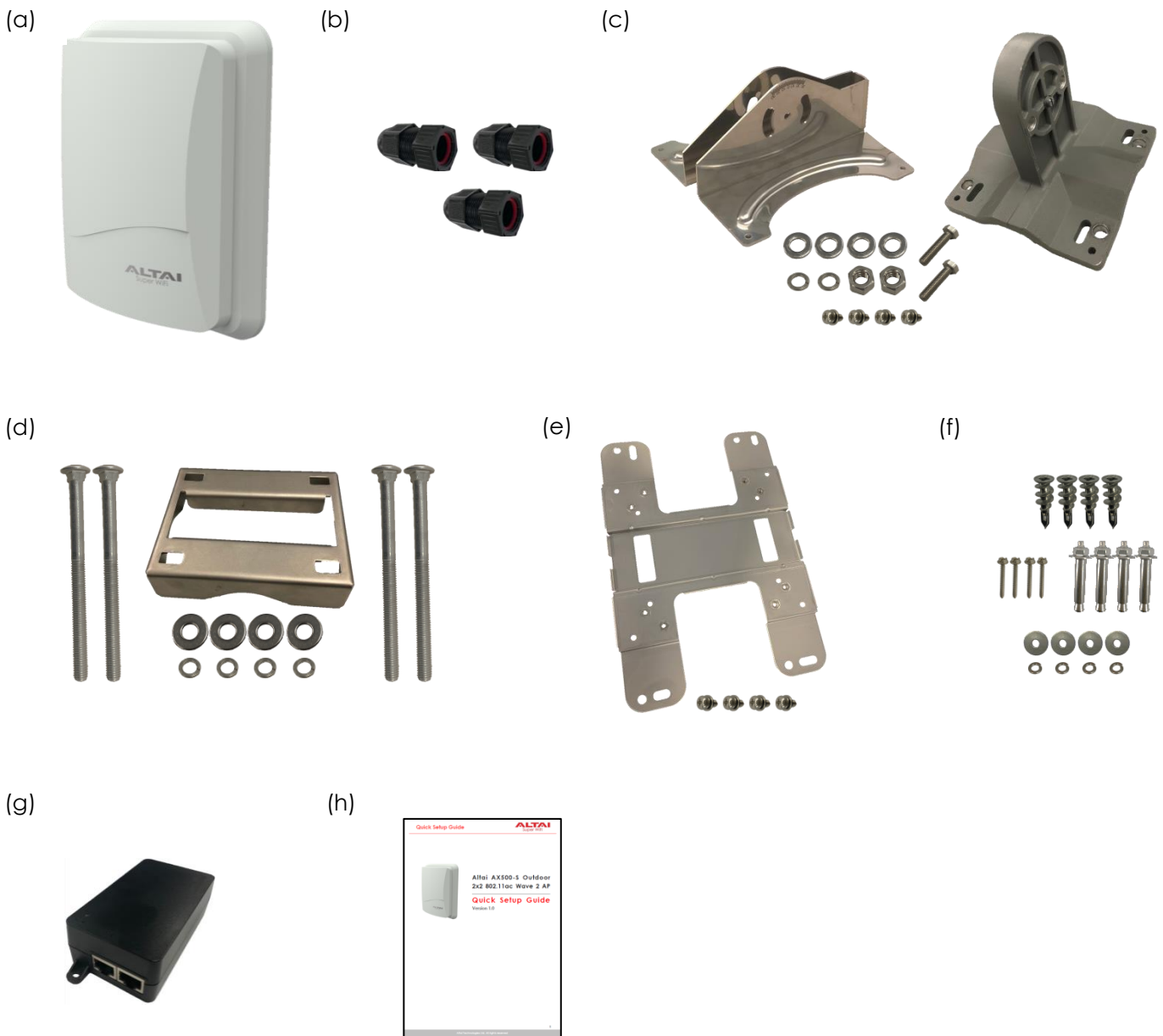
- (1) Altai AP Web UI Configuration Manual
- (2) AX500 Outdoor 2x2 802.11a Wave 2 Access Point Data Sheet

2. Package Contents

Below are the standard package lists of Altai AX500-S, AX500-T and AX500-X models respectively. Check the package that you purchased against the corresponding list to ensure the equipment and all its accessories are included. Please contact our sales representatives if there is any discrepancy.

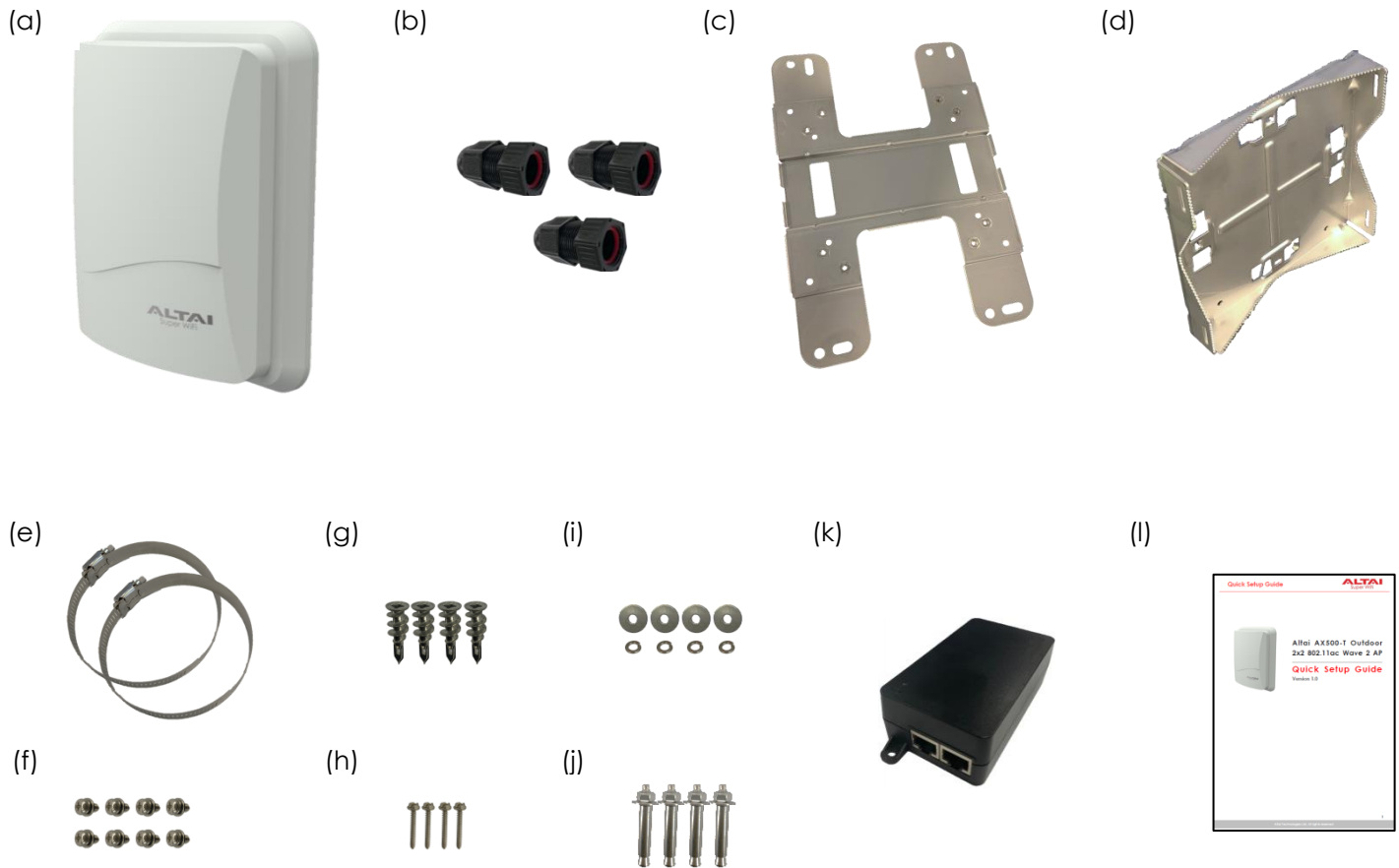
Moreover, verify if the equipment does not have any physical defect. If there is any defect, please contact our sales representatives for repair or replacement.

2.1 AX500-S Model Package List



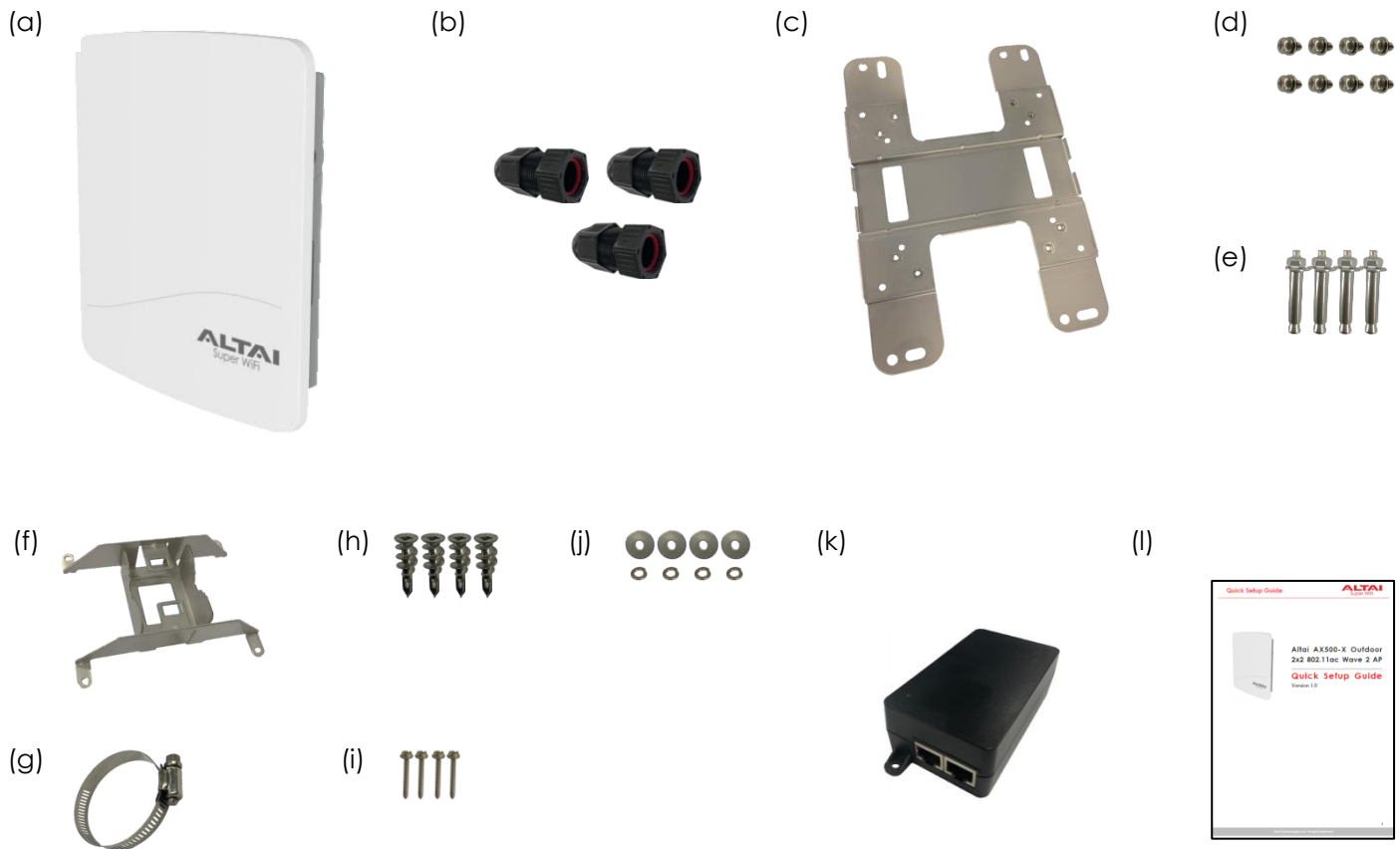
	Description	Quantity	Remark
(a)	AX500-S Main Unit	x 1 pcs	
(b)	Cable Gland	x 3 pcs	
Pole Mounting Kit			
(c)	- Downtilt Bracket Set	x 1 pcs	
	- M8 Screw	x 2 pcs	
	- M8 Lock Nut	x 2 pcs	
	- M8 Flat Washer	x 4 pcs	
	- M8 Spring Washer	x 2 pcs	
	- M4 x 10 Screw with Washers (Shared with Wall Mounting Kit)	x 4 pcs	
(d)	- Mounting Back Plate	x 1 pcs	
	- M8 x 110 Mounting Screw	x 4 pcs	
	- Flat Washer and Spring Washer	x 4 pcs	
	-		
Wall Mounting Kit			
(e)	- Mounting Bracket	x 1 pcs	
	- M4 x 10 Screw with Washers (Shared with Pole Mounting Kit)	x 4 pcs	
(f)	- Drywall Mounting Screw	x 4 pcs	
	- Hex Head Screw	x 4 pcs	
	- Anchor with Flat Washer and Nut	x 4 pcs	
	- Flat Washer and Spring Washer	x 4 pcs	
	-		
(g)	- PoE Injector (Optional)	x 1 pcs	Purchased separately if required
(h)	- Quick Setup Guide	x 1 pcs	

2.2 AX500-T Model Package List



	Description	Quantity	Remark
(a)	AX500-T Main Unit	x 1 pcs	
(b)	Cable Gland	x 3 pcs	
Pole/Wall Mounting Kit			
(c)	Back Mounting Plate	x 1 pcs	
(d)	Pole Mount Bracket	x 1 pcs	
(e)	Hose Clamp	x 2 pcs	
(f)	M4*8 Round Head Screw with Flat and Spring Washers	x 8 pcs	
(g)	Mounting Screw	x 4 pcs	
(h)	P3.5*32 Screw	x 4 pcs	
(i)	Flat and Spring Washers	x 4 pcs	
(j)	Anchor with Flat Washer and Nut	x 4 pcs	
(k)	PoE Injector (Optional)	x 1 pcs	Purchased separately if required
(l)	Quick Setup Guide	x 1 pcs	

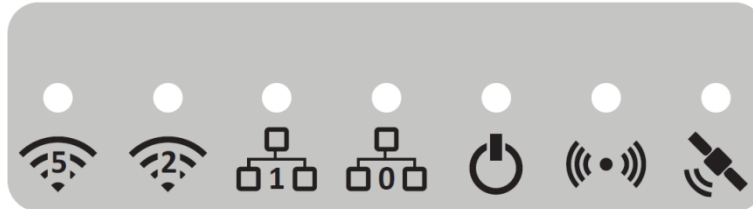
2.3 AX500-X Model Package List







	Description	Quantity	Remark
(a)	AX500-X Main Unit	x 1 pcs	
(b)	Cable Gland	x 3 pcs	
Pole/Wall Mounting Kit			
(c)	Back Mounting Plate	x 1 pcs	
(d)	M4*8 Round Head Screw with Flat and Spring Washers	x 8 pcs	
(e)	Anchor with Flat Washer and Nut	x 4 pcs	
(f)	Pole Mount Bracket	x 1 pcs	
(g)	Hose Clamp	x 1 pcs	
(h)	Mounting Screw	x 4 pcs	
(i)	P3.5*32 Screw	x 4 pcs	
(j)	Flat and Spring Washers	x 4 pcs	
(k)	PoE Injector (Optional)	x 1 pcs	Purchased separately if required
(l)	Quick Setup Guide	x 1 pcs	

3. Hardware Overview

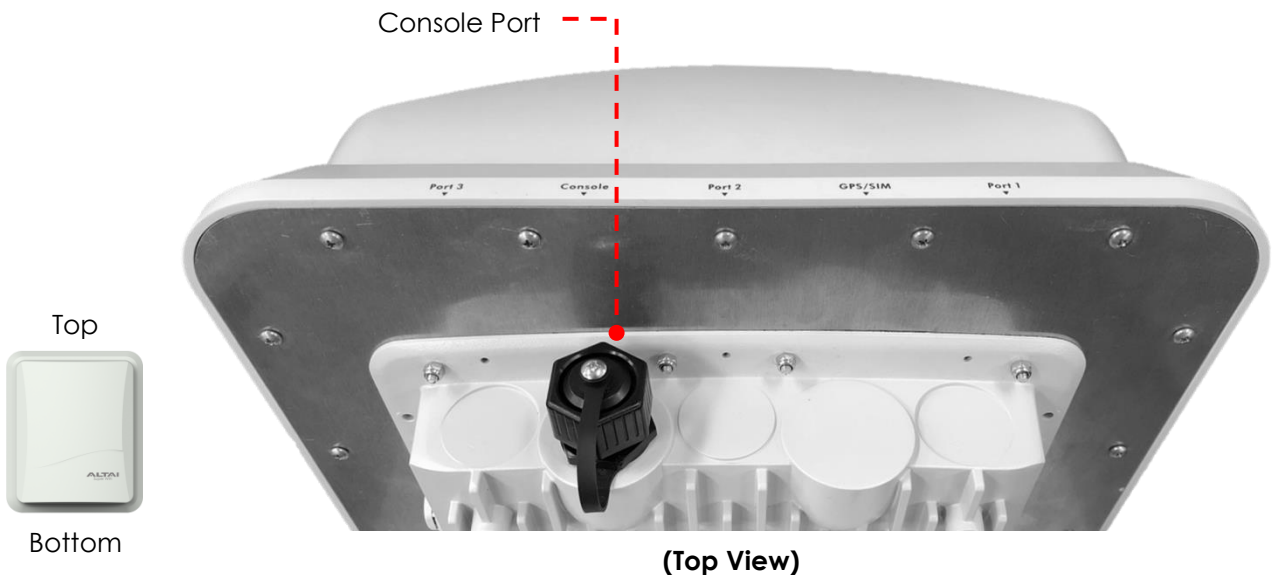
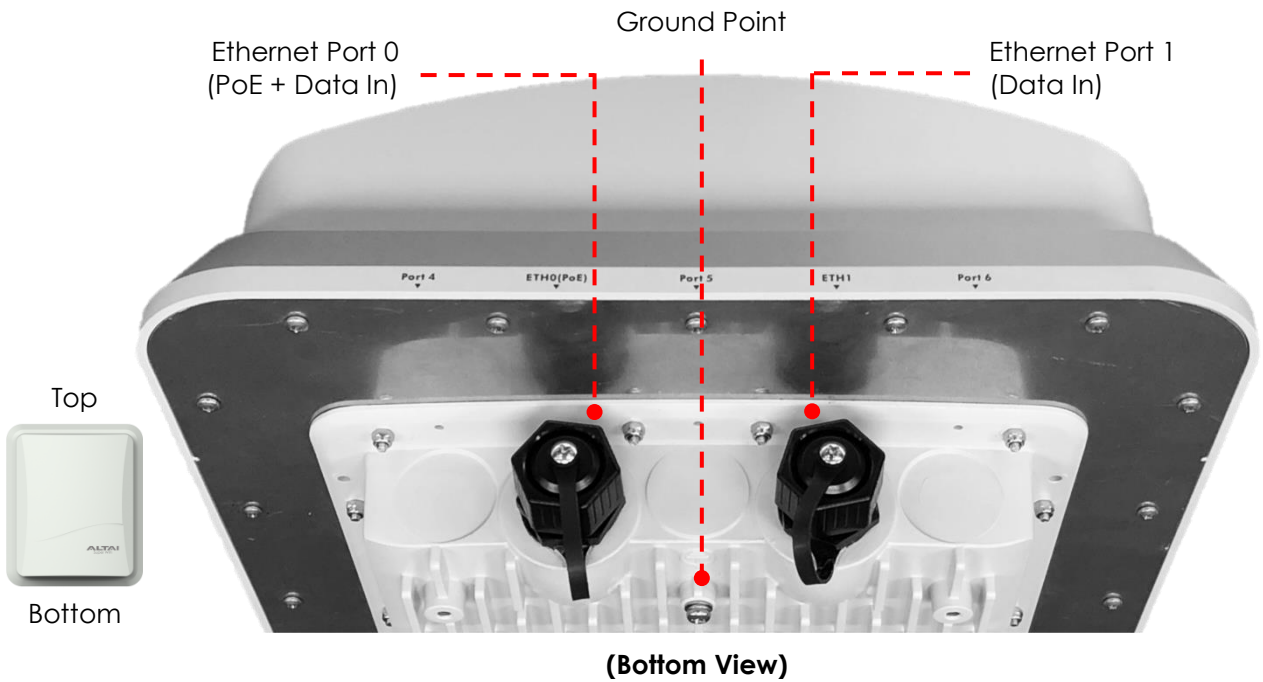
3.1 LED Panel



	<p>2.4G/5G WiFi Radios (AP/Repeater/Bridge Modes)</p> <ul style="list-style-type: none"> ● Solid Green <ol style="list-style-type: none"> 1. AP Mode on but with no Clients Associated 2. Repeater Mode on but not connected to Remote AP 3. Bridge Mode on but not connected to Remote Peer ☀ Flashing Green: Data Transmitting/Receiving ○ Off: Radio Disabled
	<p>LAN (Ethernet 0/1)</p> <ul style="list-style-type: none"> ● Solid Blue/Green: LAN Connected with 1Gbps/100Mbps of Ethernet Speed ☀ Flashing Blue/Green: Data Transmitting/Receiving ○ Off: LAN Disconnected
	<p>Power</p> <ul style="list-style-type: none"> ○ Off: No Power ☀ (1) Flashing Yellow: AP Booting Up (2) Flashing Green: AP Discovering/Connecting to AltaiCare/AltaiGate/Access Controller ● (1) Solid Yellow: AP Boot Up Finished and Running in Standalone Mode (2) Solid Green: AP Boot Up Finished and Running in Thin AP Mode
	<p>Not Applicable to this AP Model</p>

3.2 Physical Port and Ground Point Connections

AX500-S /AX500-T Model



ETH0 (PoE):

It is used to connect to power source (see Section 9 for the power options) and provides 10/100/1000 Mbps network interface for LAN connection.

ETH1:


It provides 10/100/1000 Mbps network interface for LAN connection with peripherals.

Console:

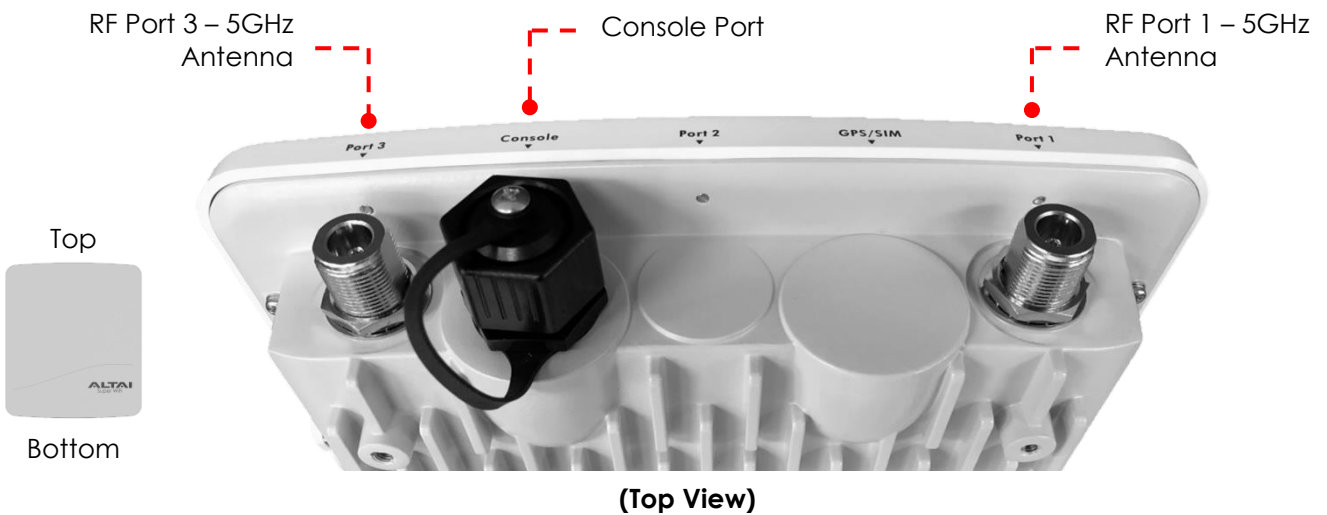
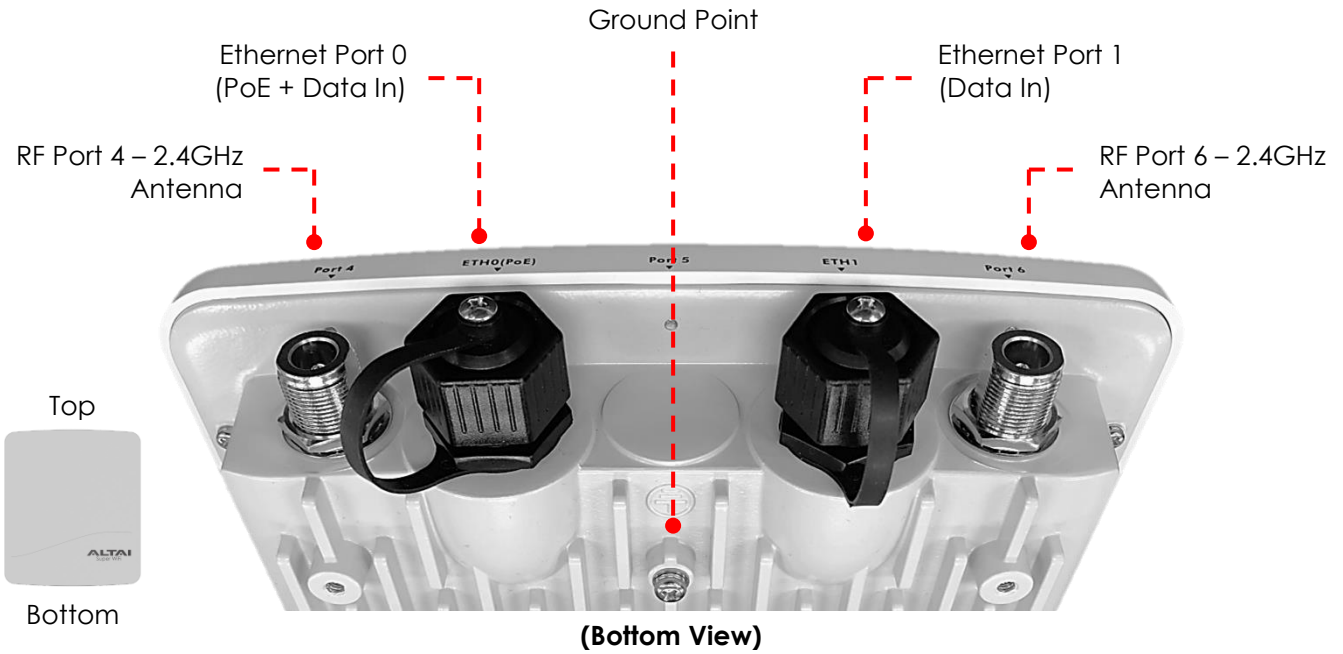
It is used to connect to the computer for local Command Line Interface (CLI) access using a standard DB9 to RJ45 console cable. For details, refer to Section 14.

Ground Point:

It is for AP chassis grounding. For details, refer to Section 11.

 **Caution:** The chassis is designed to provide enhanced protection for the electronics inside. Don't try to open up the chassis. Warranty will be voided if the equipment is found tampered or warranty labels are found broken.

AX500-X Model



ETH0 (PoE):

It is used to connect to power source (see Section 9 for the power options) and provides 10/100/1000 Mbps network interface for LAN connection.

ETH1:

It provides 10/100/1000 Mbps network interface for LAN connection with peripherals.

Console:

It is used to connect to the computer for local Command Line Interface (CLI) access using a standard DB9 to RJ45 console cable. For details, refer to Section 14.

Port 1 and Port 3:

It is used to attach 5G antennae (purchased separately) for 2x2 MIMO WiFi access coverage or bridge connection. For details, refer to Section 7.

Port 4 and Port 6:

It is used to attach 2.4G antennae (purchased separately) for 2x2 MIMO WiFi access coverage. For details, refer to Section 7.

Ground Point:

It is for AP chassis grounding. For details, refer to Section 11.



Caution: The chassis is designed to provide enhanced protection for the electronics inside. Don't try to open up the chassis. Warranty will be voided if the equipment is found tampered or warranty labels are found broken.

4. Preparation of AX500 Installation

Throughout the installation guide, we use the following tools and accessories for AX500 installation. Please make sure to get them ready prior to site installation.

Tools:

- Drill with drill bits (for concrete wall mount installation)
- Hammer (for concrete wall mount installation)
- Screwdriver (Slot type and Phillips type)
- Adjustable wrench
- Scissors and blade cutter
- Wire stripping tool and crimping tool
- Waterproof rubber mastic tape and electrical tape

Accessories:

- 10 AWG Ground Wire x 1 pcs
- Ethernet Cable x 2 pcs

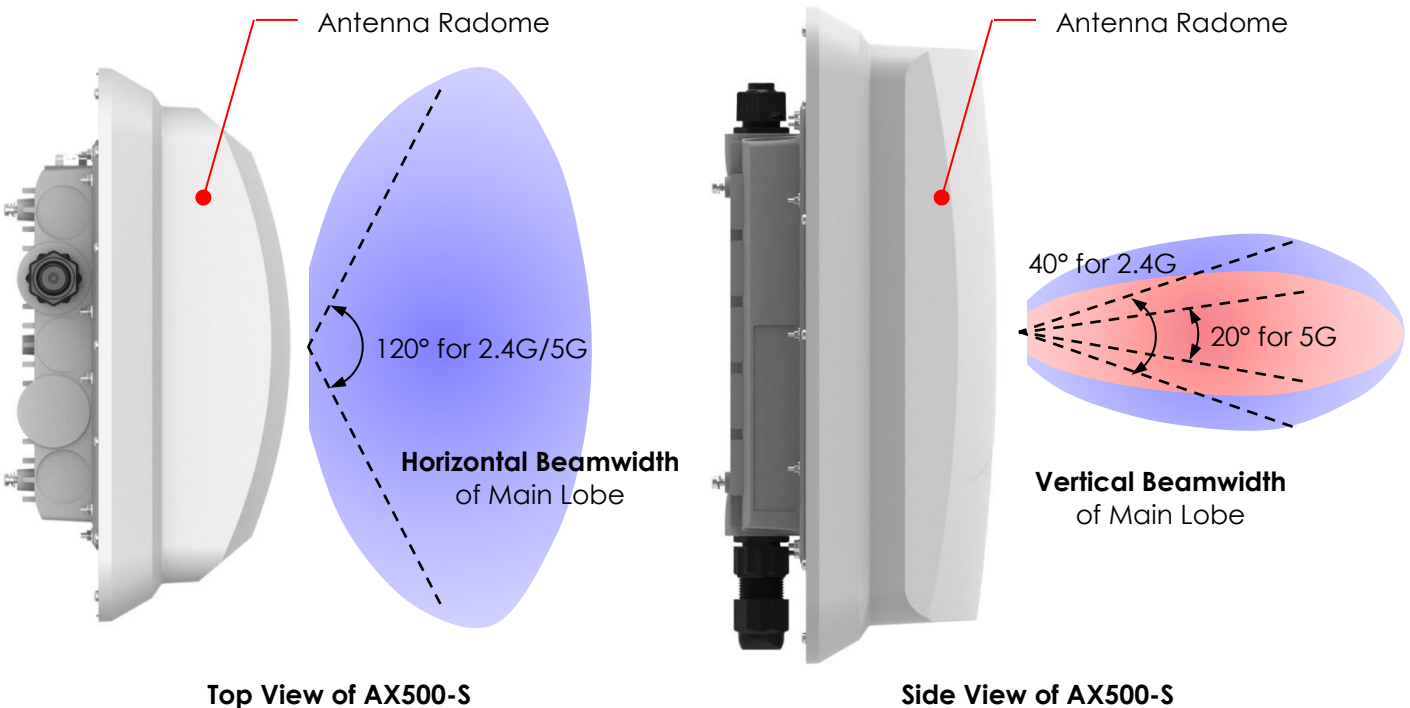
For the best practice, we **STRONGLY** recommend you get the AX500 configuration done in the office first and leave the fine-tuning work on site to save effort and time. You can also perform some basic tests to make sure the desired features function properly before taking it out to the site.

5. AX500-S Installation Options

5.1 Antenna Beamwidth and Orientation

AX500-S is an integrated-antenna AP model which is designed to provide sector coverage. The antenna beamwidth of both 2.4G and 5G radios is shown in the table below. When mounting AP on site, make sure the front antenna radome is pointed at the target coverage area by antenna panning and tilting.

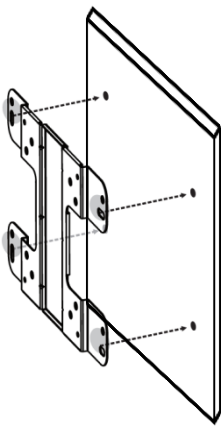
	2.4GHz	5GHz
Horizontal Beamwidth	120° (-3 dB)	120° (-3 dB)
Vertical Beamwidth	40° (-3 dB)	20° (-3 dB)



5.2 Wall Mount Installation

In this section, we will walk you through how to assemble the mounting accessories and mount the AP on two types of wall: (i) concrete wall; or (ii) drywall.

1

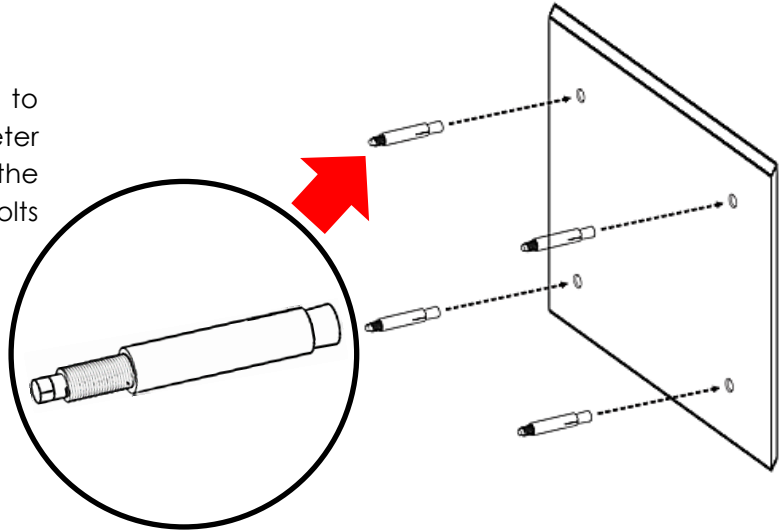


Determine where the AP is to be placed and mark location on the wall surface for the four mounting holes.

2

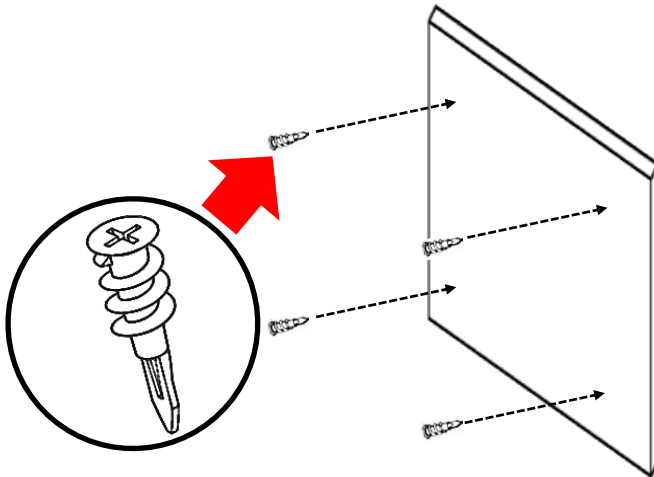
Concrete Wall Mount:

Use the appropriate drill bit to drill four holes of 8mm diameter and 37mm depth on the markings and hammer the bolts into the openings.



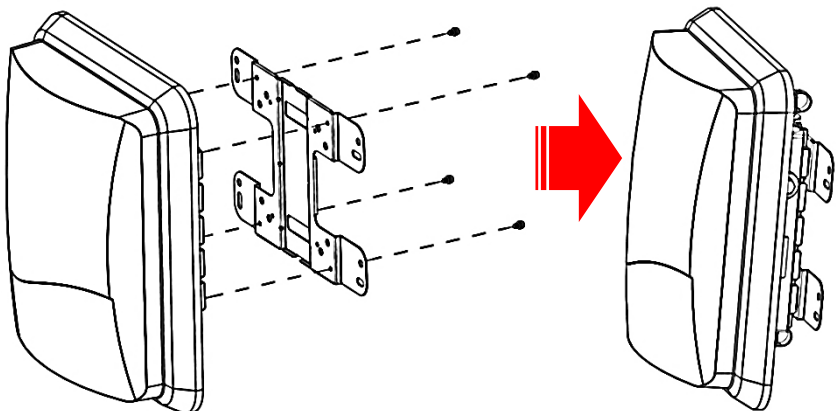
Drywall Mount:

Drive the mounting screws into the wall on the markings.

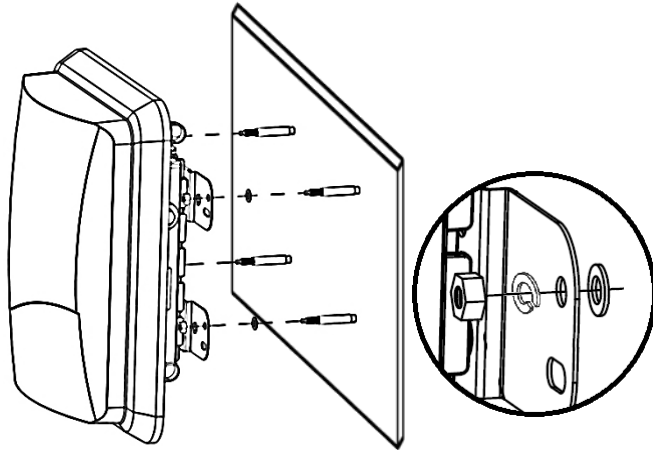


3

Place the spring and flat washers on the M4 round head screws and drive the screws to attach the mounting plate to the back of the Access Point.



4

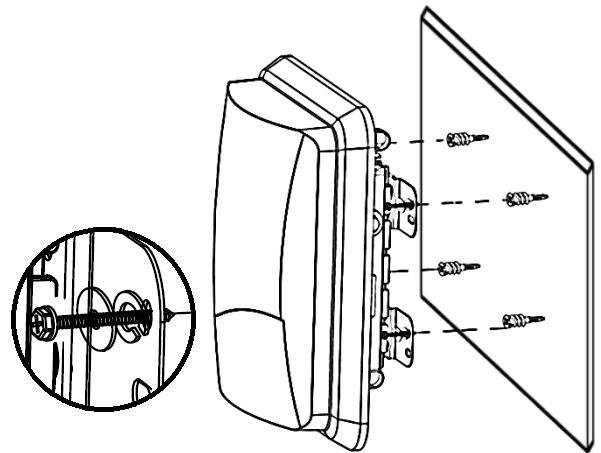


Concrete Wall Mount:

Attach the device onto the wall by tightening the bolt's nuts with flat and spring washers to secure the mounting plate to the mounting surface.

Drywall Mount:

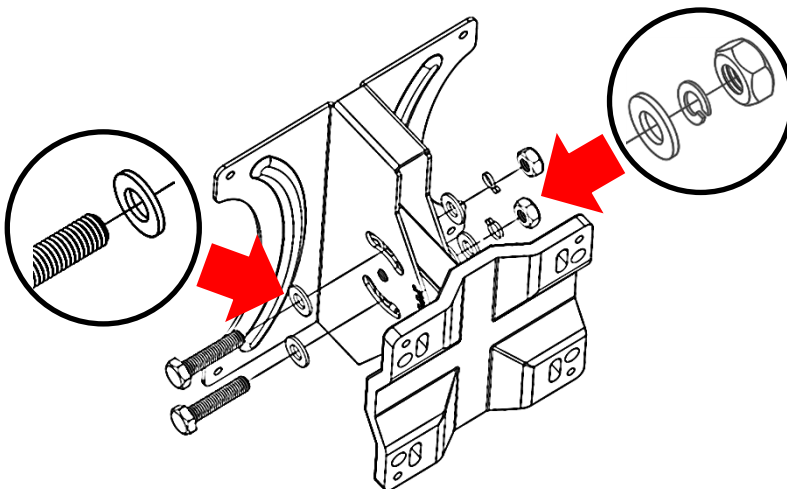
Insert the screws through the flat and spring washers. Then attach the device onto the wall by tightening the screws to secure the mounting plate to the mounting surface.



5.3 Pole Mount Installation

In this section, we will walk you through how to assemble the mounting accessories and mount the AP on a pole. The pole size should be 1 – 3 inches of diameter.

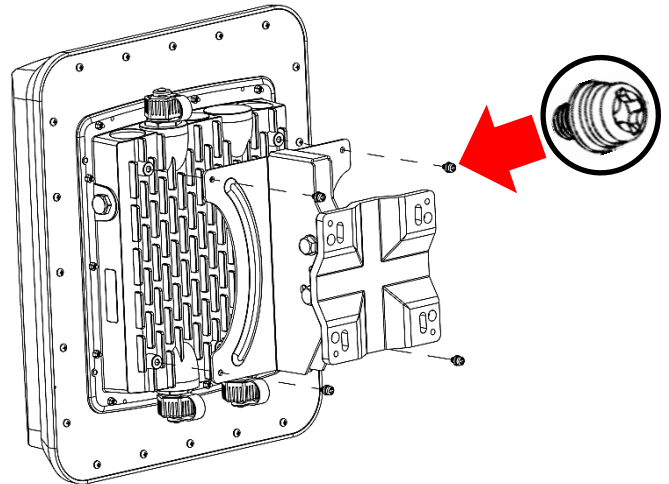
1



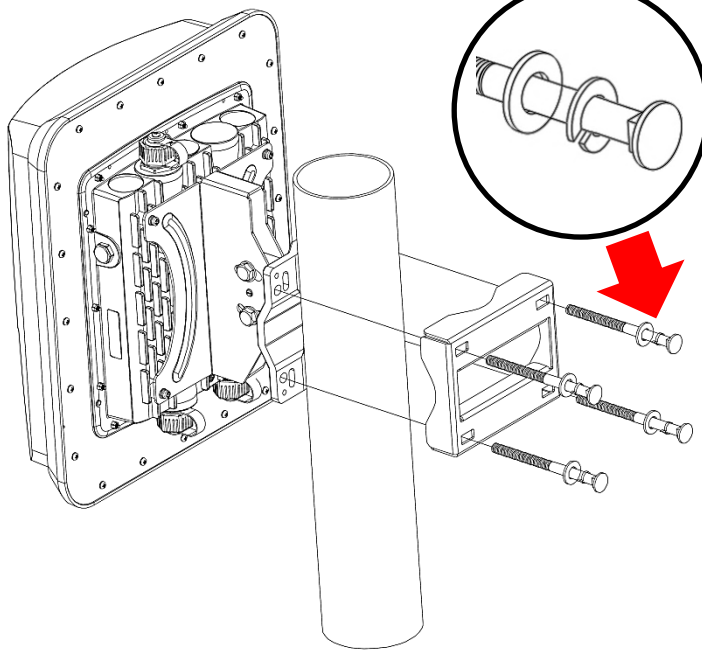
Assemble the downtilt bracket components with M8 screws, flat washers, spring washers and lock nuts as shown in the drawing.

2

Place the spring and flat washers on the M4 round head screws and drive the screws to attach the downtilt bracket to the back of the Access Point.



3



Align the mounting back plate and the Access Point on the pole. Insert the long screws through the mounting Back Plate and the downtilt bracket and tighten it with the screw hex heads and washers.

5.4 Installation Scenarios

Wall Mount

- The AX500-S wall mount kit should be installed on street level, i.e. not more than 10 meters above the target coverage area.
- Suitable for open ground coverage, i.e. warehouses, container ports, ...
- Example: Warehouse

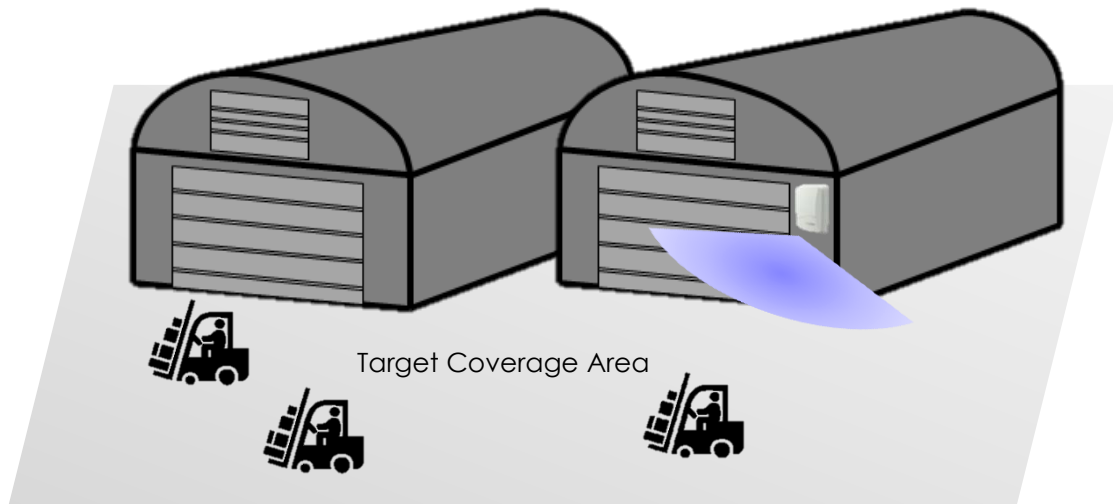


Figure 5-1 AX500-S Installation Scenario - Warehouse

Pole Mount

- The AX500-S pole mount kit is suitable for installation at high places, i.e. building rooftop and tower. Recommend the building height should not be more than 50 meters. The higher the building, the more downtilt angle you should need so that the front antenna radome is pointed at the target coverage area. You can simply determine the downtilt angle by trigonometry formula: $\tan^{-1}(\text{Building Height} / \text{Target Range})$. The max downtilt angle can be made to 30 degree by the provided pole mount downtilt kit.
- For the case of rooftop installation, we recommend the AX500-S unit be installed at the corners to reduce any signal reflection and blocking by building structures. In addition, we should keep a clearance of 0.5 meter at least above the wall or parapet. The clearance may vary depending on the downtilt angle, thickness of the wall/parapet and whether there are some other objects or building structures protruding out of building surface.
- The pole size should be 1 – 3 inches of diameter
- Example: Building rooftop

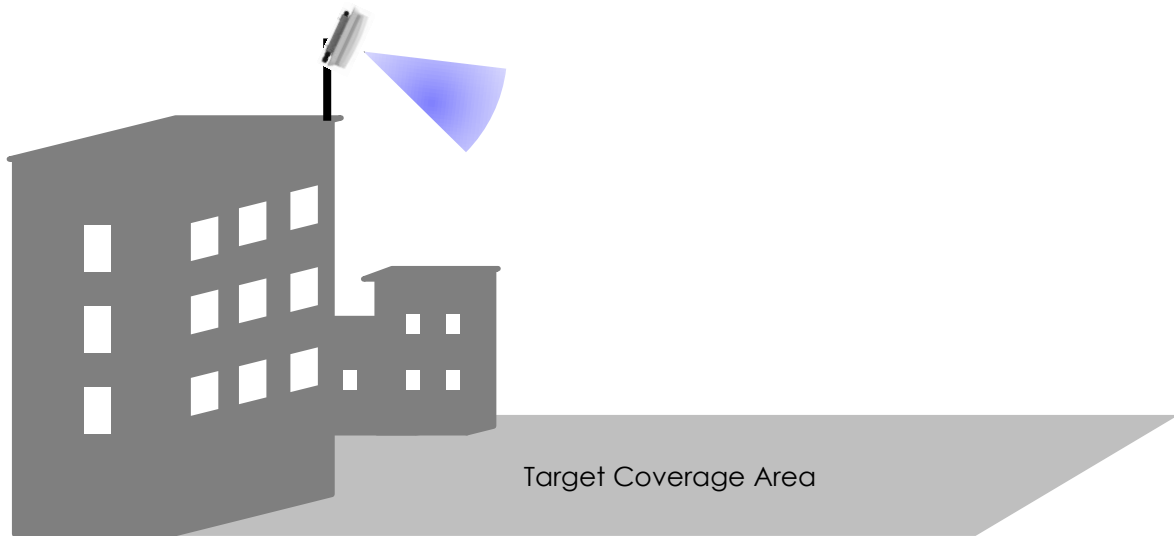


Figure 5-2 AX500-S Installation Scenario – Building Rooftop

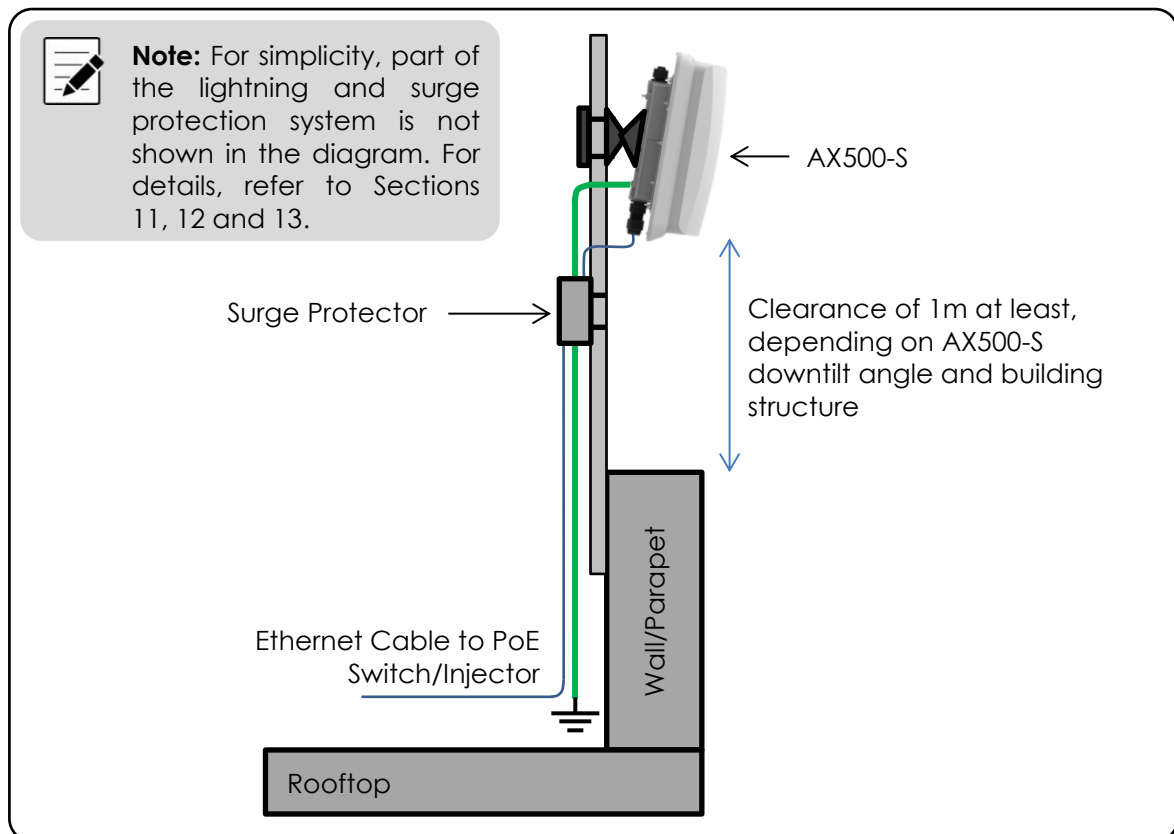
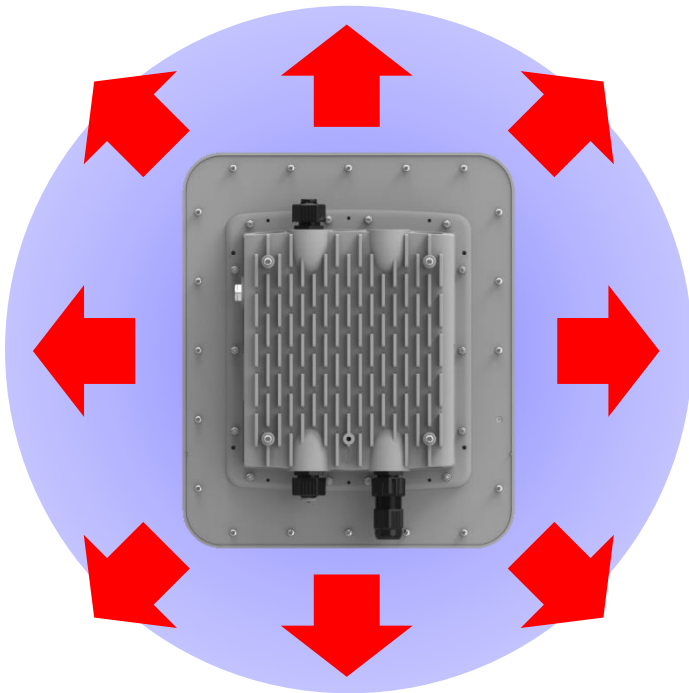


Figure 5-3 Clearance for AX500-S Installation at Building Rooftop

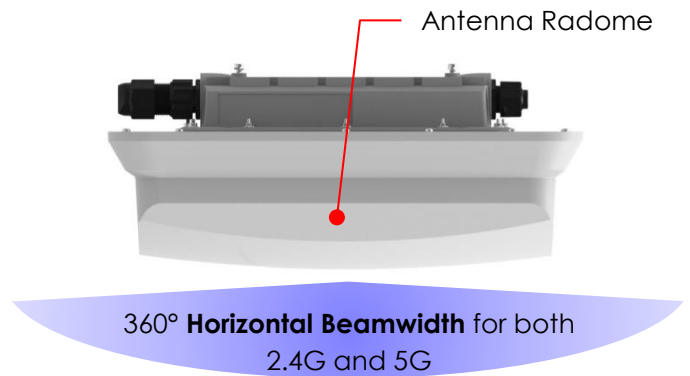
6. AX500-T Installation Options

6.1 Antenna Beamwidth and Orientation

AX500-T is an integrated-antenna AP model which is designed to provide omni coverage. When mounting AP on site, make sure the front antenna radome faces downwards to the target area.



Top View of AX500-T

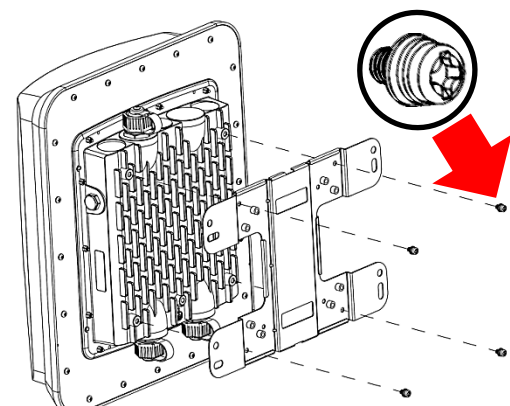


Side View of AX500-T

6.2 Pole Mount Installation

In this section, we will walk you through how to assemble the mounting accessories and mount the AP on a pole. The pole size should be 3 – 4 inches of diameter.

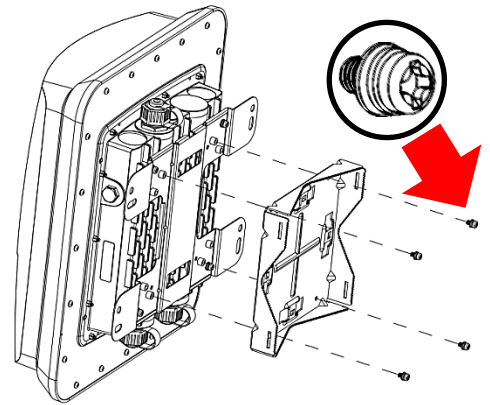
1



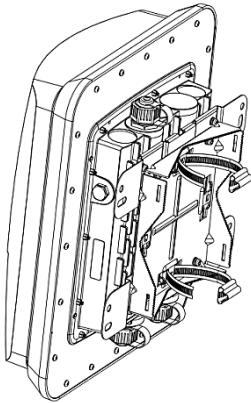
Place the spring and flat washers on the M4 round head screws and drive the screws to attach the mounting plate to the back of the Access Point.

2

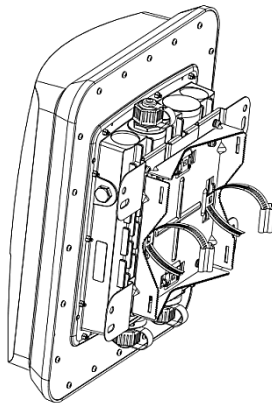
Place the spring and flat washers on the M4 round head screws and drive the screws to attach the pole mount bracket to the mounting plate.



3



For the Pole of Vertical Alignment



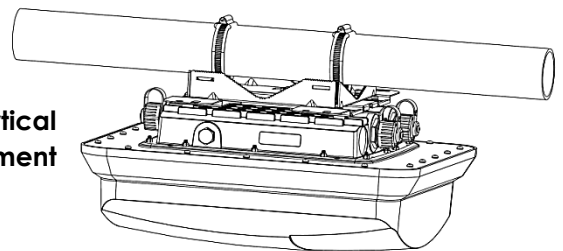
For the Pole of Horizontal Alignment

Thread the open end of the hose clamp through the two slots on the pole mount bracket.

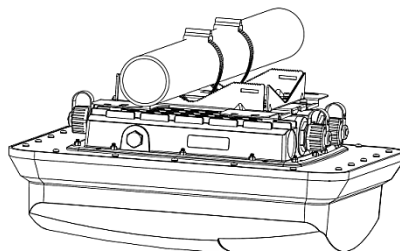
4

Determine where the AP is to be placed. Lock and tighten hose clamp to secure pole mount bracket to the pole.

For the Pole of Vertical Alignment



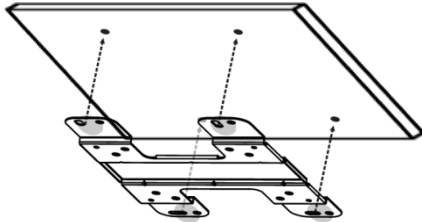
For the Pole of Horizontal Alignment



6.3 Ceiling Mount Installation

In this section, we will walk you through how to assemble the mounting accessories and mount the AP on two types of ceilings: (i) concrete wall; or (ii) drywall.

1

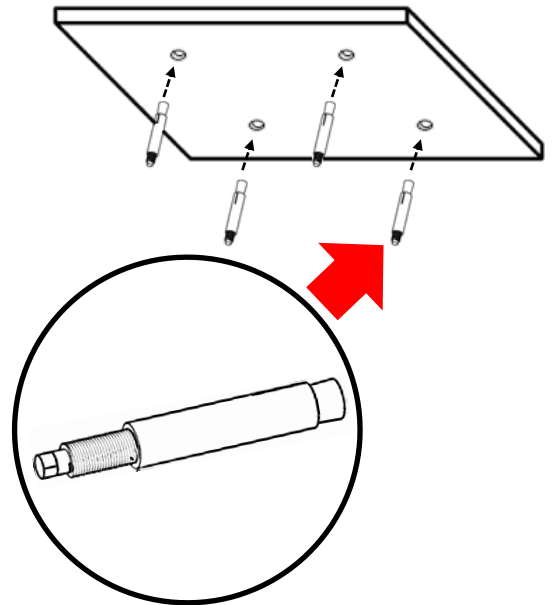


Determine where the AP is to be placed and mark location on the ceiling surface for the four mounting holes.

2

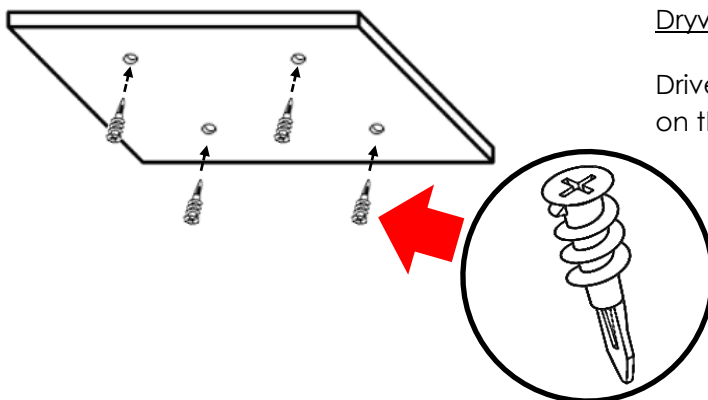
Concrete Wall Ceiling Mount:

Use the appropriate drill bit to drill four holes of 8mm diameter and 37mm depth on the markings and hammer the bolts into the openings.



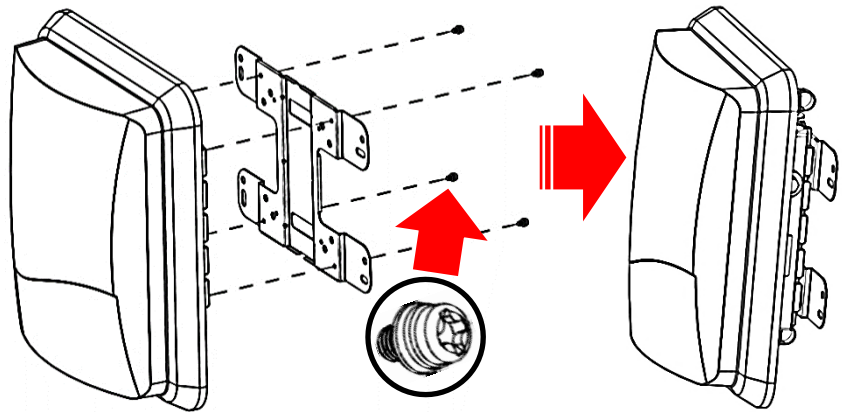
Drywall Ceiling Mount:

Drive the mounting screws into the ceiling on the markings.

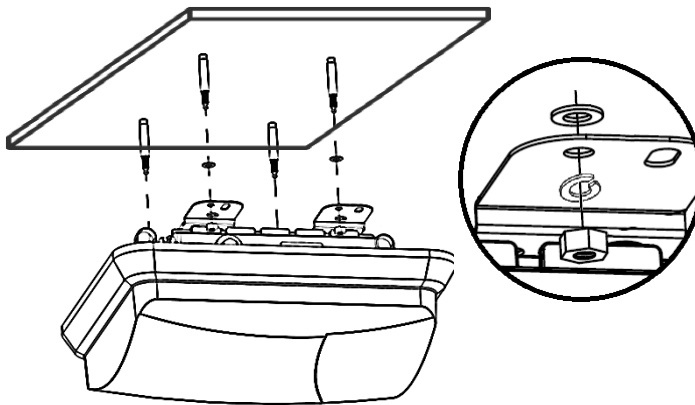


3

Place the spring and flat washers on the M4 round head screws and drive the screws to attach the mounting plate to the back of the Access Point.



4

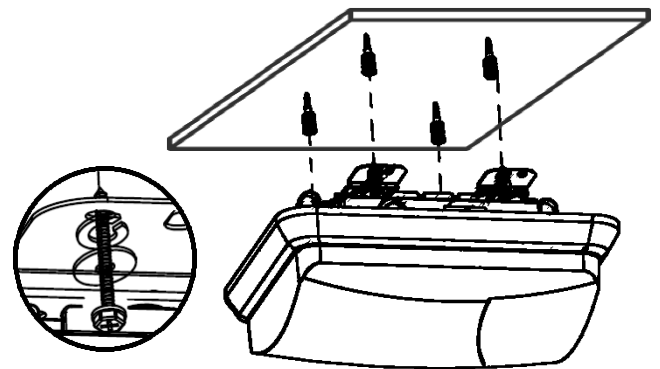


Concrete Wall Ceiling Mount:

Attach the device onto the ceiling by tightening the bolt's nuts with flat and spring washers to secure the mounting plate to the mounting surface.

Drywall Ceiling Mount:

Insert the screws through the flat and spring washers. Then attach the device onto the ceiling by tightening the screws to secure the mounting plate to the mounting surface.



6.4 Installation Scenarios

Pole Mount/Ceiling Mount

- The AX500-T unit should be installed on street level, i.e. not more than 10 meters above the target coverage area.
- The AX500-T unit should be mounted on ceilings or installed on horizontal poles instead of vertical ones. In addition, the size should be 3 – 4 inches of diameter.
- Example: Lamp post

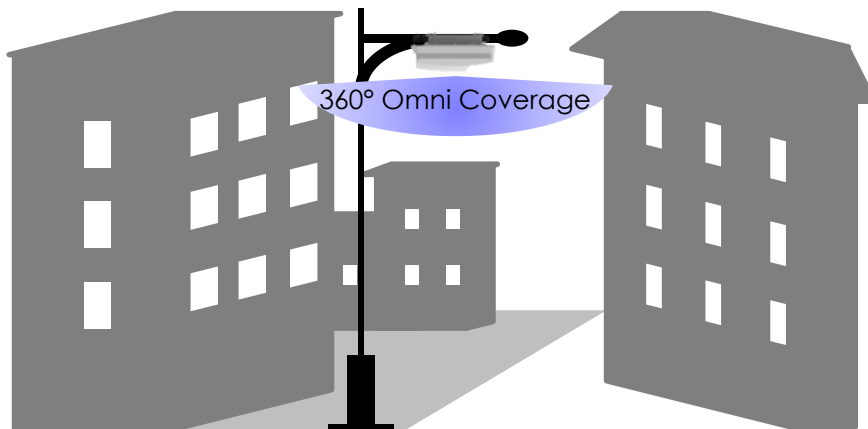


Figure 6-1 AX500-T Installation Scenario – Lamp Post

- Example: Stadium, Amphitheatre

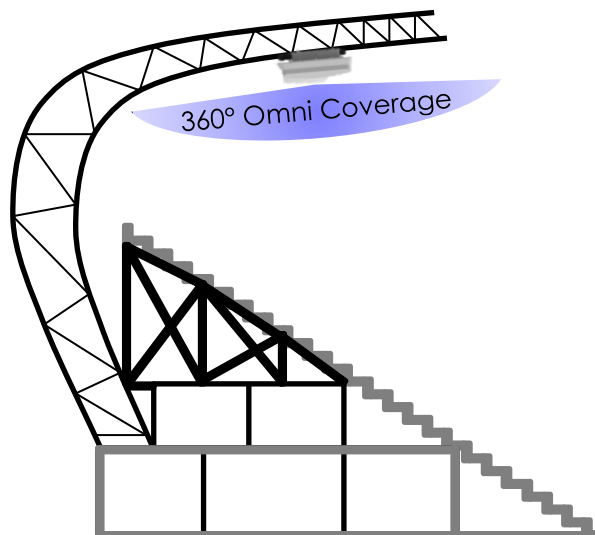


Figure 6-2 AX500-T Installation Scenario – Stadium, Amphitheatre

7. AX500-X Installation Options

7.1 Antenna Selection

AX500-X is an external-antenna AP model which is designed to provide more flexibility for deployment to meet various purposes and requirement. You can choose omni antennae or sector antennae for access coverage; or choose panel antennae or parabolic antennae for bridge link setup.

Some of the antenna models are listed below for your consideration.

2.4G Antennae:

#	Description	Part No.	Purpose
1	2.4GHz 5dBi Omni Antenna	SD.AN-2M05-00	For 2.4G omni access coverage
2	2.4GHz 8dBi Omni Antenna	NS.AN-2M08-00	For 2.4G omni access coverage
3	2.4GHz 15dBi Sector Antenna	SD.AN-2S15-00	For 2.4G sector access coverage

5G Antennae:

#	Description	Part No.	Purpose
1	5GHz 9dBi Omni Antenna	NS.AN-5M09-00	For 5G omni access coverage
2	5GHz 16dBi Sector Antenna	SD.AN-5S16-00	For 5G sector access coverage
3	5GHz 20dBi Panel Antenna	SD.AN-5P20-00	For 5G bridge link setup

The above antenna information is subject to change in future. Please contact us for the latest antenna models on offer if necessary.

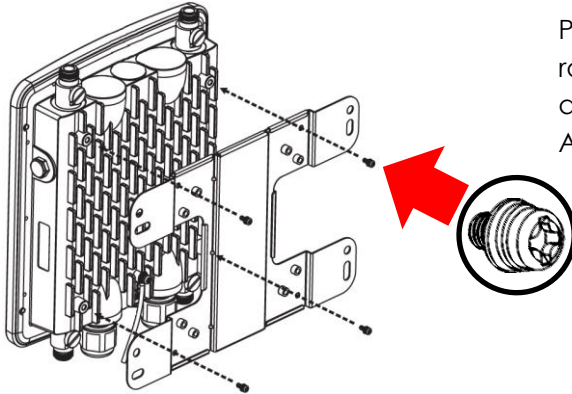


The bottom 2 x N-Male RF connectors (Ports 4 and 6) are for 2.4G external antennae while the top 2 ones (Ports 1 and 3) are for 5G external antennae. Make sure the 2.4G and 5G antennae are attached to the respective ports. Failure to do so will affect RF and coverage performance.

7.2 Pole Mount Installation

In this section, we will walk you through how to assemble the mounting accessories and mount the AP main unit on a pole. The pole size should be 1.5 – 2.5 inches of diameter.

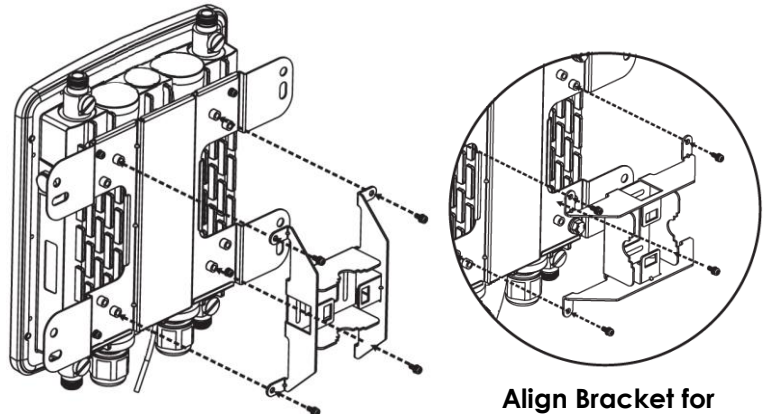
1



Place the spring and flat washer on the M4 round head screws and drive the screws to attach the mounting plate to the back of the Access Point.

2

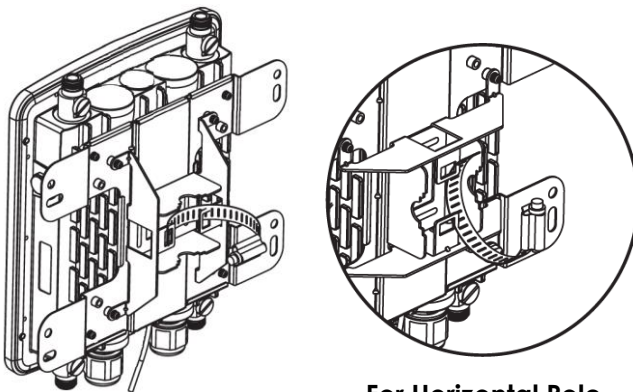
Align the pole mount bracket with the mounting plate. Drive the four M4 round head screws to attach the bracket to the mounting plate.



Align Bracket for Vertical Pole

Align Bracket for Horizontal Pole

3



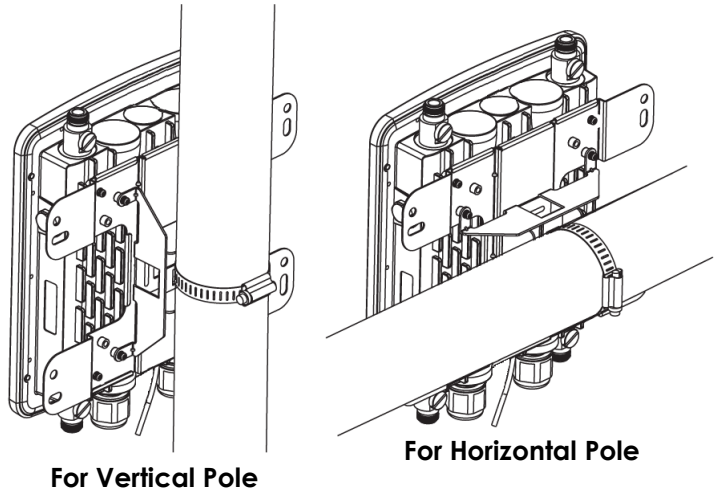
For Vertical Pole

For Horizontal Pole

Thread the open end of the hose clamp through the two slots on the pole mount bracket.

4

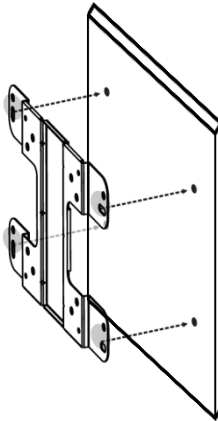
Determine where the AP is to be placed. Lock and tighten pole strap to secure pole mount bracket to the pole.



7.3 Wall Mount Installation

In this section, we will walk you through how to assemble the mounting accessories and mount the AP main unit on two types of wall: (i) concrete wall; or (ii) drywall.

1

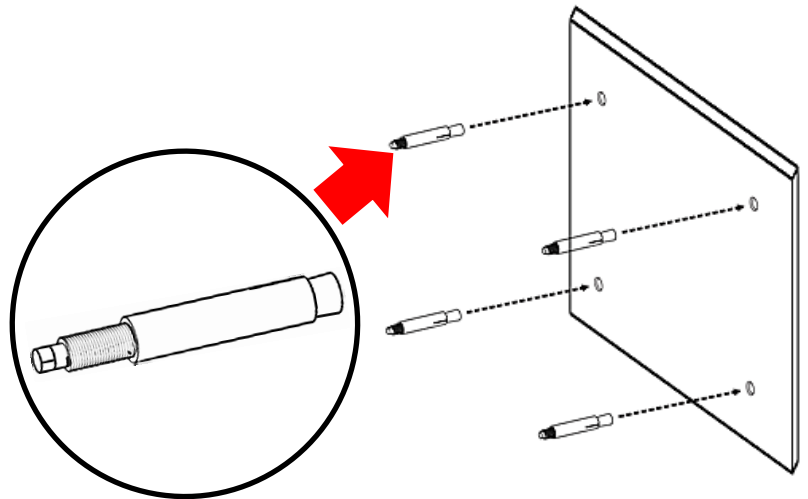


Determine where the AP is to be placed and mark location on the wall surface for the four mounting holes.

2

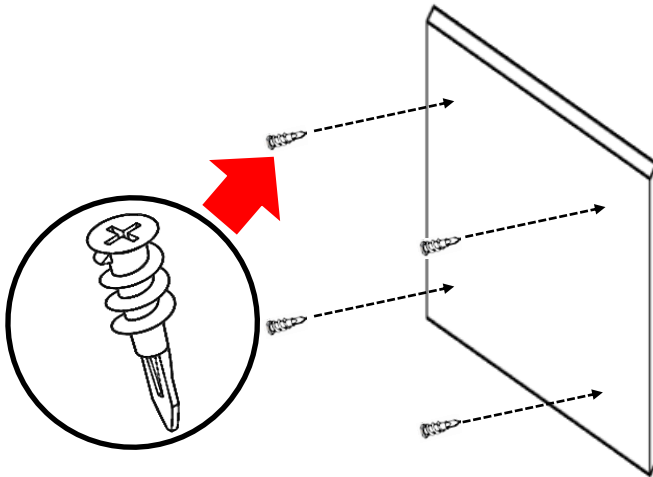
Concrete Wall Mount:

Use the appropriate drill bit to drill four holes of 8mm diameter and 37mm depth on the markings and hammer the bolts into the openings.



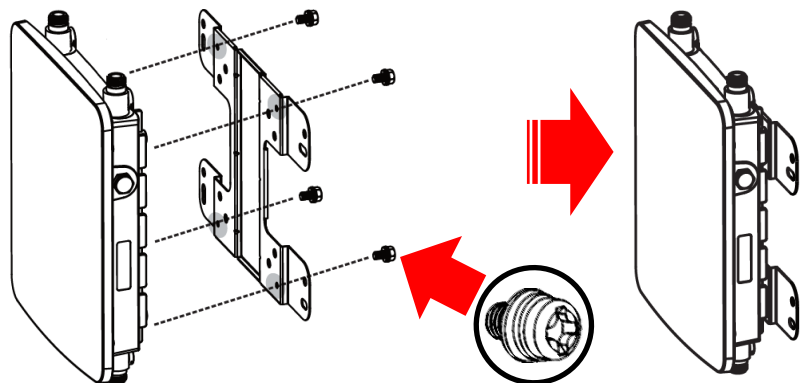
Drywall Mount:

Drive the mounting screws into the wall on the markings.

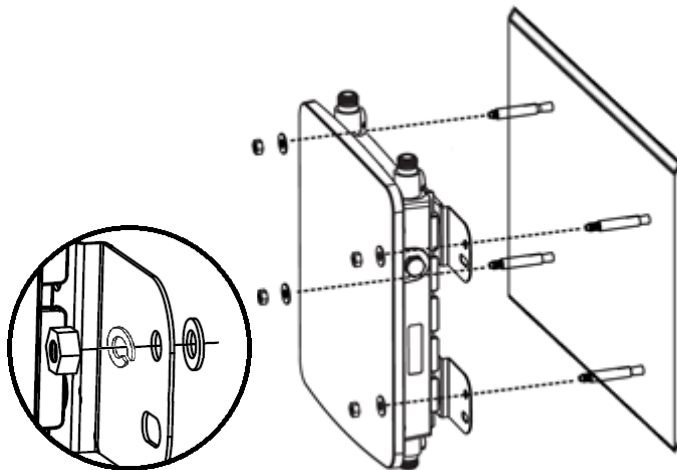


3

Place the spring and flat washers on the M4 round head screws and drive the screws to attach the mounting plate to the back of the Access Point.



4

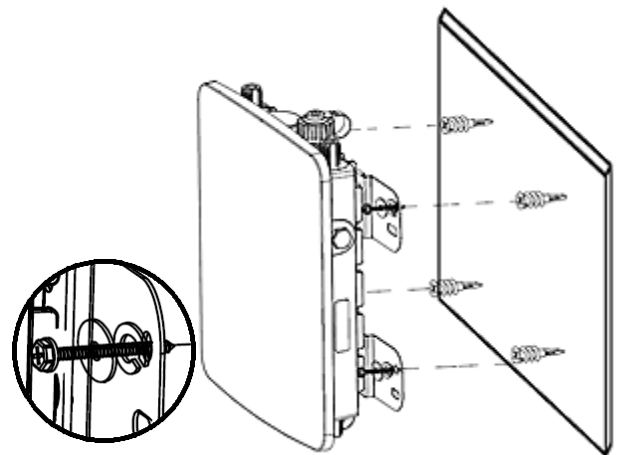


Concrete Wall Mount:

Attach the device onto the wall by tightening the bolt's nuts with flat and spring washers to secure the mounting plate to the mounting surface.

Drywall Mount:

Insert the screws through the flat and spring washers. Then attach the device onto the wall by tightening the screws to secure the mounting plate to the mounting surface.



7.4 Installation Scenarios

Omni Coverage

- Suitable for on-street-level installation, i.e. not more than 10 meters above the target coverage area.
- Example: Light post

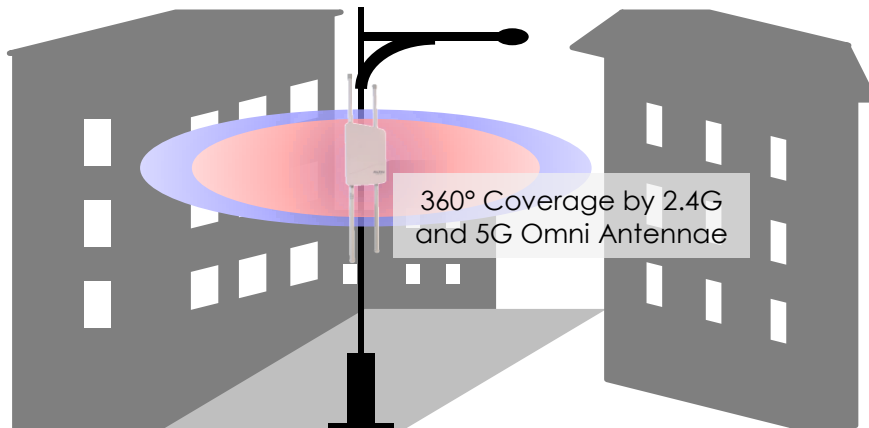


Figure 7-1 AX500-X Installation Scenario – Light Post for Omni Coverage

Sector Coverage and Bridge Link Setup

- Suitable for installation at high locations, i.e. building rooftop and tower. Recommend the building height should not be more than 50 meters. The higher the building, the more downtilt angle you should need for the sector antenna so that the front radome is pointed at the target coverage area. You can simply determine the downtilt angle by trigonometry formula: $\tan^{-1}(\text{Building Height} / \text{Target Range})$.
- For the case of rooftop installation, we recommend the antenna be installed at the corners to reduce any signal reflection and blocking by building structures. In addition, we should keep a clearance of 1 meter at least above the wall or parapet. The clearance may vary depending on the downtilt angle, thickness of the wall or parapet and whether there are some other objects or building structures protruding out of building surface.
- Example: Building rooftop

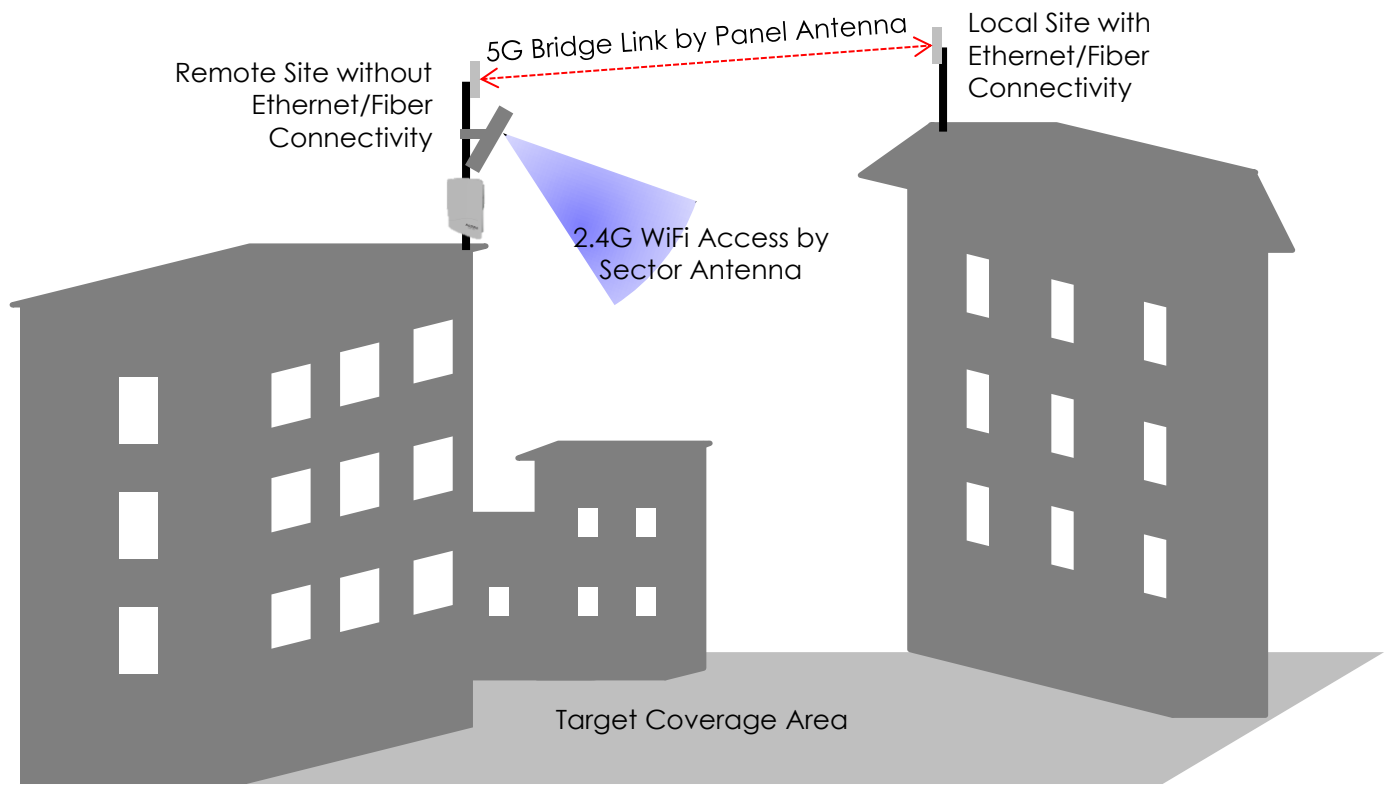


Figure 7-2 AX500-X Installation Scenario – Building Rooftop for Bridge Link Setup and Sector Coverage

8. Ethernet Cable Wiring and Pinout

Take note of the following points when crimping Ethernet RJ45 connectors.

1. The Ethernet cable should be either CAT 5e or CAT 6 type, outdoor rated, and shielded if the AX500 is installed in an outdoor environment. For details, refer to Section 12.1.
2. The Ethernet cable should be fed through the provided cable gland for waterproof protection if the AX500 unit is installed in an outdoor environment. For details, refer to Section 10.3.
3. T568B standard is recommended for RJ45 connector pin assignment. See Figure 8-1 for the color code for Ethernet connection.
4. Straight-through cable is preferred. The RJ45 connectors at both cable ends should have the same pinout.
5. Make sure the total length of Ethernet cable **MUST NOT** exceed 100 meters.

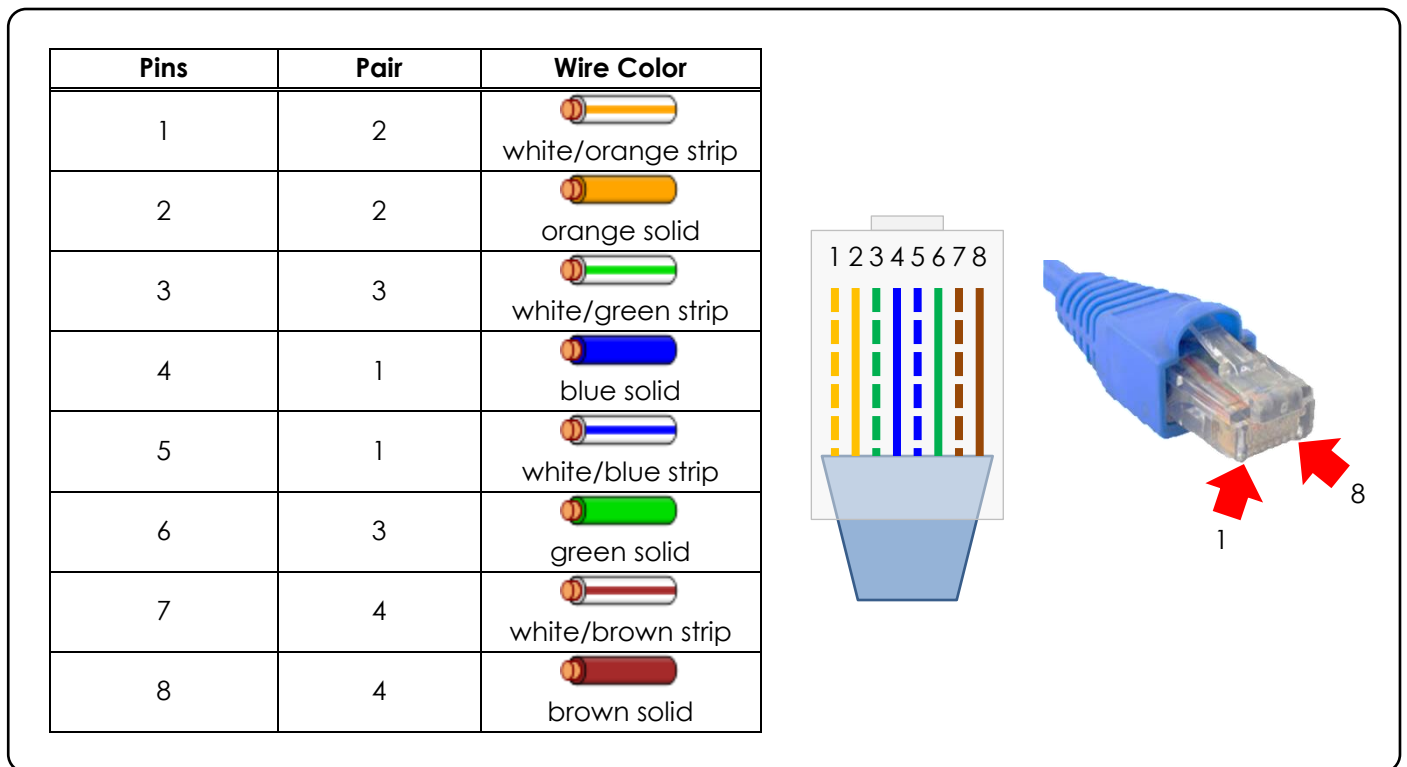


Figure 8-1 Ethernet RJ45 Connector Pinout

9. Power Options and Cable Connection Instructions

You can follow one of the options below to power up the AX500 unit.

Option 1: 802.3at-Compliant PoE switch

1. Connect Eth0 (PoE) port of the AX500 unit to an 802.3at PoE switch with an Ethernet cable.
2. Make sure the Power LED light is yellow/green and the LAN LED light is blue/green.
3. Make sure the cable length between the AX500 unit and the PoE switch **SHOULD NOT** exceed 100 meters.

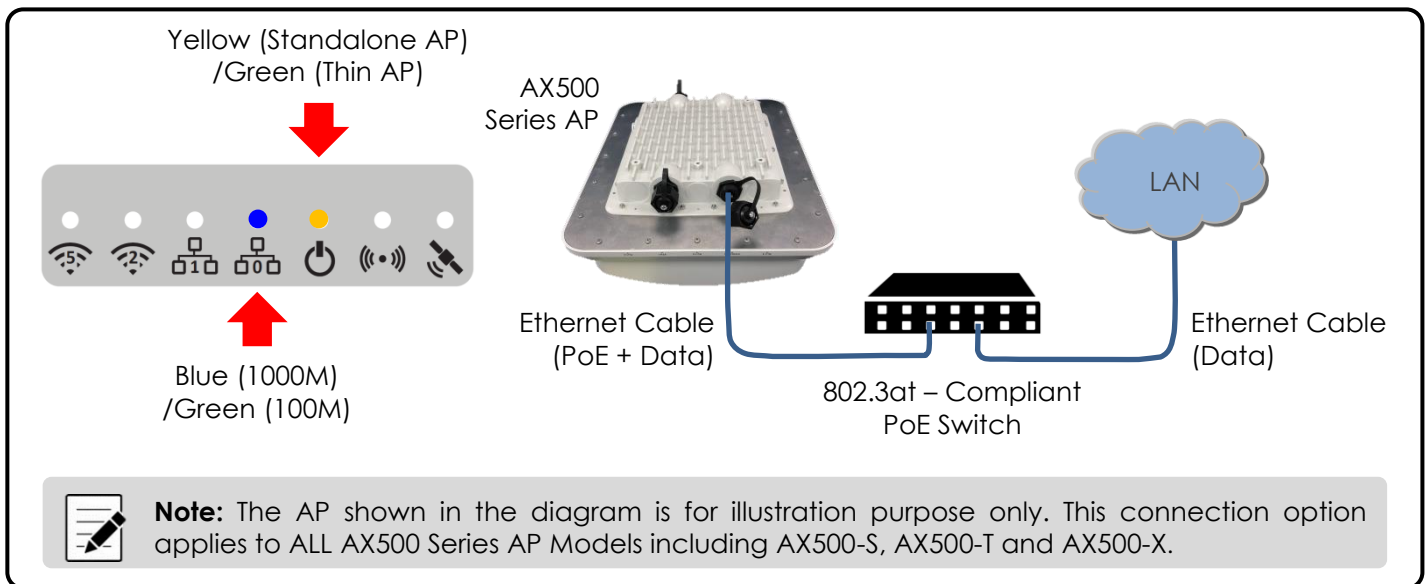


Figure 9-1 Power Option 1 for AX500 Unit – 802.3at PoE Switch

Option 2: PoE Injector (Ordered Separately)

1. Connect the PoE injector ports as described below via Ethernet Cables.

PoE Injector Ports

- | | |
|-------|--|
| - PoE | Go to AX500 Eth0 (PoE) port |
| - LAN | Go to backend device such as switch or router, or computer, or peripherals |

2. Connect the PoE Injector to AC power socket using a power cord (Not provided in the package).
3. Make sure the Power LED light is yellow/green and the LAN LED light is blue/green.
4. Make sure the cable length between the AX500 unit and the backend device **SHOULD NOT** exceed 100 meters.

Caution: Make sure cables are connected to correct ports of the PoE injector to avoid electrical damage to peripheral Ethernet port!

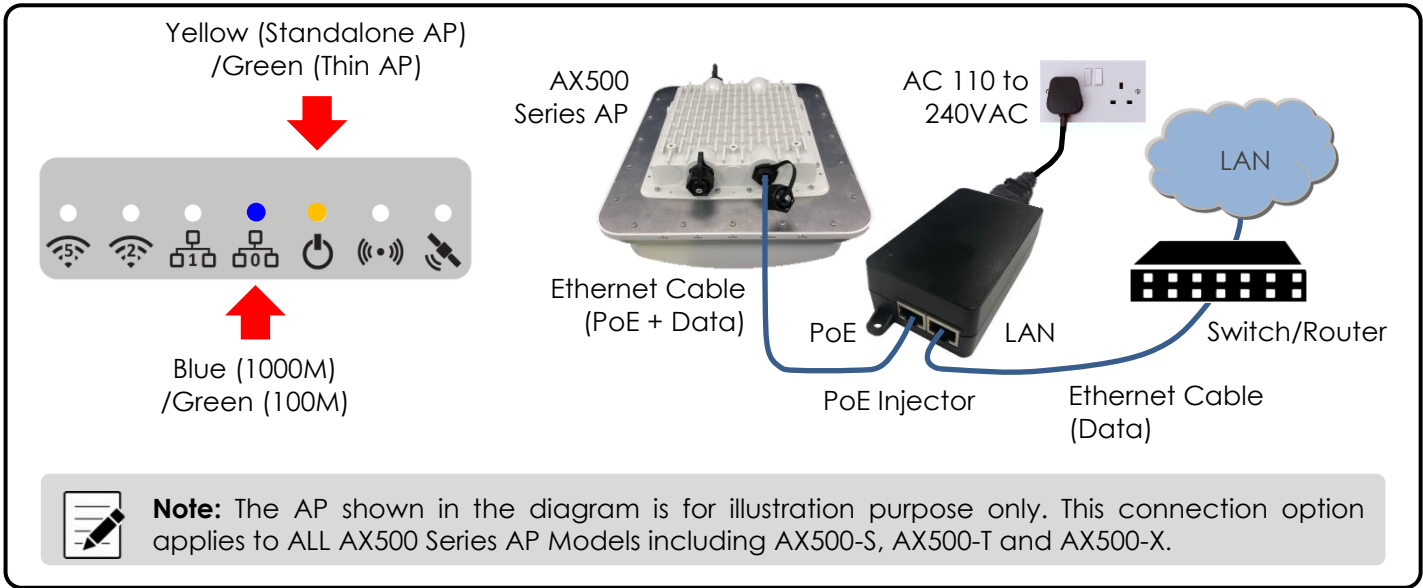


Figure 9-2 Power Option 2 for AX500 Unit – PoE Injector

10. Waterproof Protection

10.1 Introduction

Sealing materials are required to be applied to Ethernet and RF connectors for outdoor deployment. The first and foremost reason is to prevent water and moisture from entering the connectors. The second reason is to protect the RF connectors from gradual degradation due to UV radiation and pollution. Sunlight and weather will oxidize metal surfaces and cause DC resistance to increase on exposed mating surfaces. It is true that the RF connectors are supposed to be weatherproof, but if left exposed to weather conditions, they will tarnish and start to look rather ugly in a short time. A good taping job will also prevent the RF connectors from loosening up, which is a common occurrence for RF cables exposed to vibration and strong winds.

We recommend the following sealing materials for weatherproofing the connectors:

1. High-quality, all-weather, black plastic electrical tape, preferably 3/4" (19mm) wide to make it easier to manipulate the tape around the Ethernet and RF ports. The port is often first wrapped with a layer of electrical tape to make it easier to remove the second layer which is a butyl rubber layer. In addition, one or more layers of electrical tape are used as a final outer wrap to provide UV protection. We recommend the 3M Scotch Super 88 Vinyl Electrical Tape for this purpose.
2. High-quality, all-weather, black rubber mastic tape, preferably 1" (25mm) wide or less to make it easier to manipulate the tape around the Ethernet and RF ports. Rubber mastic tape is self-amalgamating - it chemically bonds to itself, forming a strong, waterproof joint. A layer of rubber mastic tape is applied around a connector joint to provide a weatherproof seal, often on top of a layer of electrical tape. We recommend the 3M Scotch 2228 Rubber Mastic Tape for this purpose.



Figure 10-1 Electrical Tape and Rubber Mastic Tape for Waterproofing connectors

10.2 Installation Tips

A few general rules about weatherproofing the Ethernet and RF ports:

1. Always apply the tape at temperature above 32°F to ensure adhesion. When working in cold weather, always protect your tape rolls by storing it under your coat and next to your body to keep the tape flexible. If the tape cannot be stretched elastically, it will not seal properly.

2. Do not stretch the tape to the point where it distorts. Only apply enough pressure to get a smooth wrap.
3. Smooth each wrapped layer of tape with your hands to ensure proper adhesion.
4. Do not pull the tape to tear it - always cut the tape. A pulled tape will most likely unravel, decreasing protection.
5. In warm climates where there will be long exposure to sunlight, it is a good idea to wrap an extra layer or two of electrical plastic tape over the rubber mastic layer to enhance UV protection.
6. For vertical runs of cable, the final layer of electrical tape should be wrapped from the bottom to the top, and overlap about 50% of the width of the tape. This will provide the same effect as shingles on a house. The water will run down across the joints without going into the joints.

10.3 Waterproofing Ethernet/Console Ports

Ethernet Cable Feed-Through

Seal the RJ45 cable Connector with the provided cable gland.

1. Feed the end of the cable through the cap nut, sealing sleeve and cable gland body as shown in the picture below.

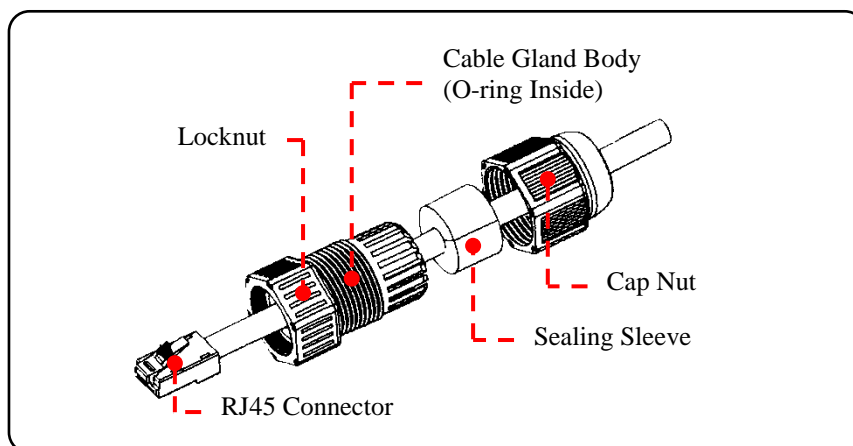


Figure 10-2 Ethernet Cable Feed Through Cable Gland

2. Connect the cable to the Ethernet Port.
3. Tighten the locknut to fix the cable gland body to the AP chassis.
4. Tighten the cap nut.

Before Tape Wrapping

In order to properly weatherproof Ethernet ports, there must be something to be done before tape wrapping.

1. Cut the straps of the Ethernet port cap nut or take the screw out of it if it hinders the subsequent tape wrapping.

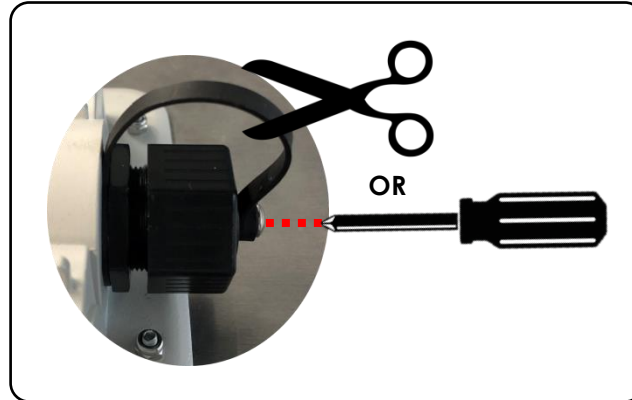


Figure 10-3 Detach Strap from Ethernet Port Cap

2. Cut the rubber mastic tape into 1/10" (2-3mm) by 4" (100mm) strips.
3. Wrap the strip around the base of each Ethernet port in the clockwise direction as shown in
4. Figure **10-4**. Take extra care to make sure that the rubber ring would not hinder the subsequent tightening of the cable gland or cap nut. This is to fill out the space at the port base after tightening.

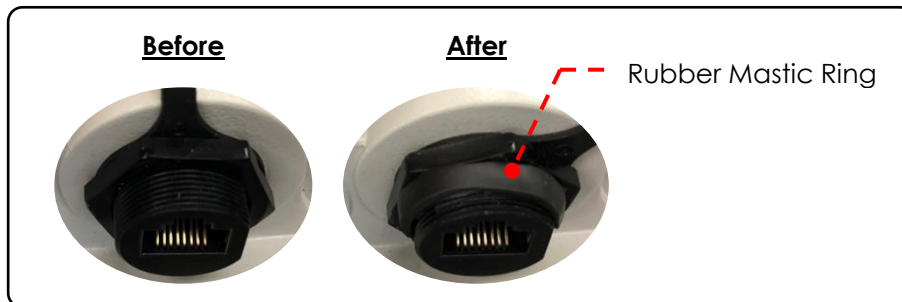


Figure 10-4 Rubber Mastic Ring around the Base of Ethernet Port

5. Cut the rubber mastic tape into 3/10" (7-8mm) by 4" (100mm) strips.
6. Wrap the strip around the cable gland body in the clockwise direction as shown in Figure 10-5. Take extra care to make sure that the rubber ring would not hinder the subsequent tightening of the cap nut. This is to fill out the space between the cap nut and the cable gland body after tightening.

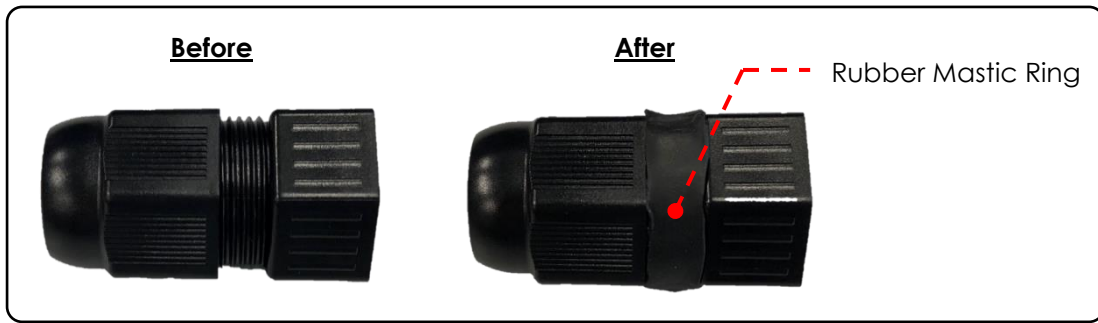


Figure 10-5 Rubber Mastic Ring around Cable Gland Body

Tape Wrapping around Ethernet Ports

1. Make sure the Ethernet cable and its connectors are absolutely dry.
2. Follow the above Section "Ethernet Cable Feed-Through" and Section 8 "Ethernet Cable Wiring and Pinout" to crimp the Ethernet cable.



Figure 10-6 Ethernet Cable Feed through Cable Gland with Rubber Mastic Ring around

3. Plug the RJ45 jack into the Ethernet port.

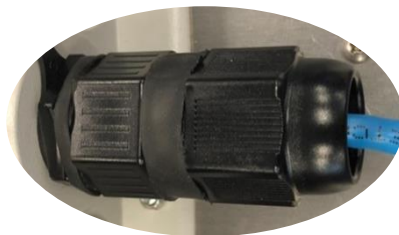


Figure 10-7 RJ45 Connector Plugged into Ethernet Port

4. Wrap **a layer of electrical tape** starting from the Ethernet cable, 1.5" (38mm) below the cable gland, up to the cable connector. Overlap the tape to half-width. The tape should cover the entire cable connector body.

The tape can be applied in one or more strips if necessary. A strip can be coiled onto an applicator such as a pencil. Apply only enough tension to get good adhesion and keep the tape smooth.

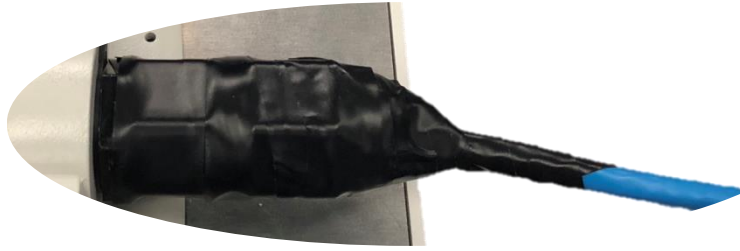


Figure 10-8 Electrical Tape Wrap around Ethernet Port and Cable

5. Start wrapping **a layer of rubber mastic tape** from the Ethernet cable, 1" (25mm) below the cable gland, up to the cable connector. Overlap the tape to half-width.



Figure 10-9 Rubber Mastic Tape Wrap around Ethernet Port and Cable

6. Finish the wrap by adding **one more layer (the 3rd layer) of electrical tape** to provide UV protection. Take extra care to make sure that the Ethernet connector is tightly sealed by pressing the tape edges together so that there are no gaps.

Tape Wrapping around Unused Ethernet/Console Ports

1. Make sure the Ethernet/Console ports are absolutely dry.
2. Tighten the cap nut. As described in Section “Before Tape Wrapping” Step 3, the rubber ring should not hinder the tightening. See Figure 10-10.
3. Wrap **a layer of electrical tape** in a bottom-up manner, i.e. for console port which is on the top, we start the wrapping from the port base up to the cap; for Eth 1 port which is on the bottom, we start the wrapping from the cap up to the port base. Overlap the tape to half-width. The tape should cover the entire port. See Figure 10-10.

The tape can be applied in one or more strips if necessary.

4. Start wrapping **a layer of rubber mastic tape** in the same direction as the first layer of electrical tape. Overlap the tape to half-width. See Figure 10-10.
5. Finish the wrap by adding **one more layer (the 3rd layer) of electrical tape** to provide UV protection. Take extra care to make sure that the Ethernet/Console port is tightly sealed by pressing the tape edges together so that there are no gaps.

Step 2

Tighten Ethernet Cap
Nut with Rubber Mastic
Tape around

Step 3

Wrap a layer of
electrical tape all over
the Ethernet port

Step 4

Wrap another layer of
rubber mastic tape all
over the Ethernet port

Figure 10-10 Waterproofing Unused Ethernet/Console Port

10.4 Waterproofing RF Ports



Note: This section applies to AX500-X model ONLY.

Before Tape Wrapping

In order to properly weatherproof RF ports, there must be something to be done before tape wrapping.

1. Cut the rubber mastic tape into 1/5" (5mm) by 4" (100mm) strips.
2. Wrap the strip around the base of each RF port in the clockwise direction as shown in Figure 10-11. Take extra care to make sure that the rubber ring would not hinder the subsequent tightening of the RF connector around the antenna port.

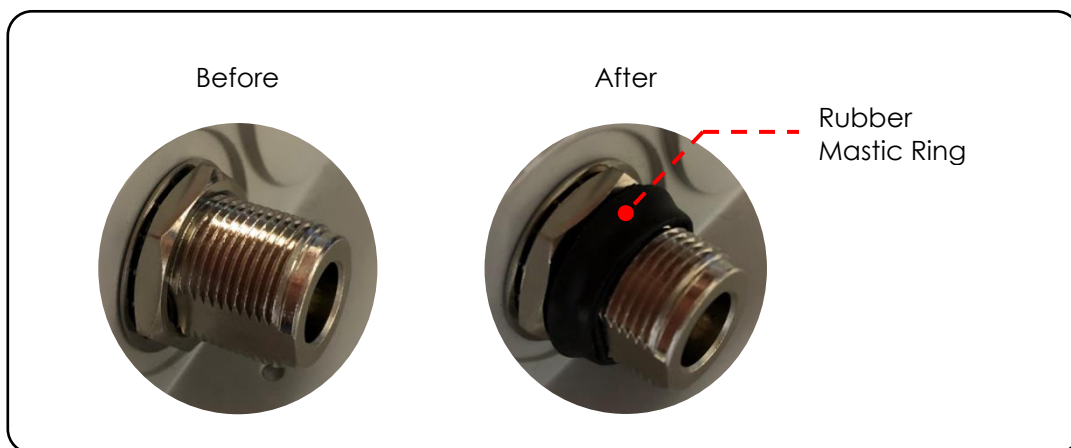


Figure 10-11 Rubber Mastic Ring around the Base of RF Port

Tape Wrapping around RF Ports

1. Make sure each RF cable/omni antenna and its connectors are absolutely dry.
2. Tighten the RF cable/omni antenna connectors around the antenna ports with a torque wrench to the proper torque limit to ensure that correct internal seals and surface contacts are made. If a torque wrench is not available, first tighten the connector to finger tight, then tighten it with a wrench for an additional 1/8 to 1/4 turn from the finger tight position.



Figure 10-12 Tighten the RF Cable/Antenna Connectors around the Antenna ports

3. Start wrapping **a layer of electrical tape** in a bottom-up manner, i.e. for RF ports 1 and 3, which are on the top, we start the wrapping from the port base up to the cable/antenna; for RF ports 4 and 6, which are on the bottom, we start the wrapping from the cable/antenna to the port base. Overlap the tape to half-width. The tape should cover the RF cable connector body, and part of the RF cable/antenna body, i.e. 1" (25mm) of body length.

The tape can be applied in one or more strips if necessary. A strip can be coiled onto an applicator such as a pencil. Apply only enough tension to get good adhesion and keep the tape smooth.



Figure 10-13 Electrical Tape Wrap around RF Port and Cable/Antenna

4. Wrap **a layer of rubber mast tape** in the same direction as the first layer of electrical tape. Overlap the tape to half-width. Finish the wrap at 1" (25mm) above the electrical tape and cut the tape. Take extra care to make sure that the RF connector to antenna port junction is tightly sealed. Press the tape edges together so that there are no gaps. Press the tape against the RF connector body.



Figure 10-14 Rubber Mastic Tape Wrap around RF Port and Cable/Antenna

5. Add **one more layer (the 3rd layer) of electrical tape** to provide UV protection. Overlap the tape to half-width. Finish the wrap at 1" (25mm) above the rubber mastic tape and cut the tape.

Tape Wrapping around Unused RF Ports

1. Make sure each RF port is absolutely dry.
2. Start wrapping **a layer of electrical tape** from the port base. Overlap the tape to half-width. The tape should cover the entire RF port. See Figure 10-15.

The tape can be applied in one or more strips. Apply only enough tension to get good adhesion and keep the tape smooth.

3. Wrap **a layer of rubber mastic tape** from the port base. Overlap the tape to half-width. Take extra care to make sure that the entire RF port is tightly sealed. Press the tape edges together so that there are no gaps. Press the tape against the RF port body. See Figure 10-15.
4. Finish the wrap by adding **one more layer (the 3rd layer) of electrical tape** to provide UV protection. Overlap the tape to half-width to wrap the entire RF port.

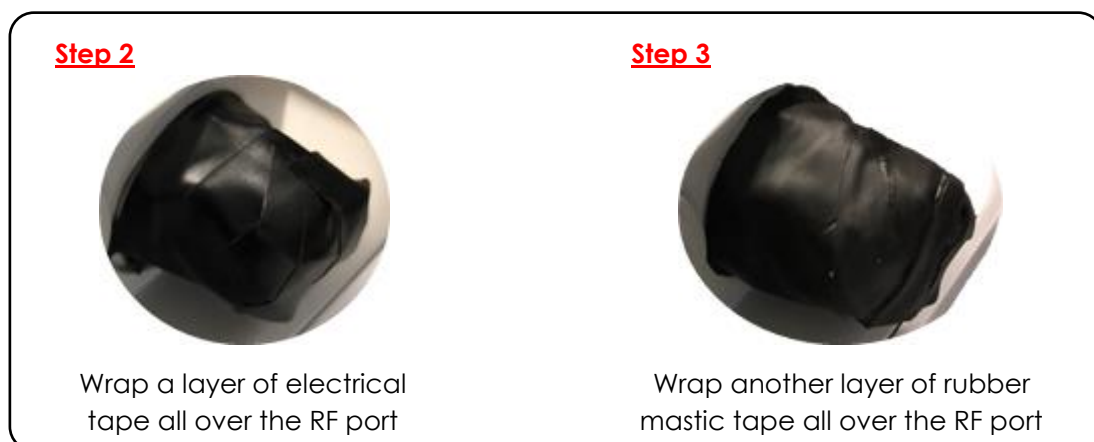


Figure 10-15 Waterproofing Unused RF Port

11. Grounding and Electrostatic Discharge (ESD) Protection

It is essential to properly ground the AP unit to protect it from electrostatic discharge (ESD), electrical damage and possible electric hazard. Failure to do so may result in equipment damage, human injury or even death.



Note: ESD can damage electronic components and cause latent damage that results in premature failure even if components remain functional.

Product warranty does not cover any damages resulting in part or in whole from improper grounding.

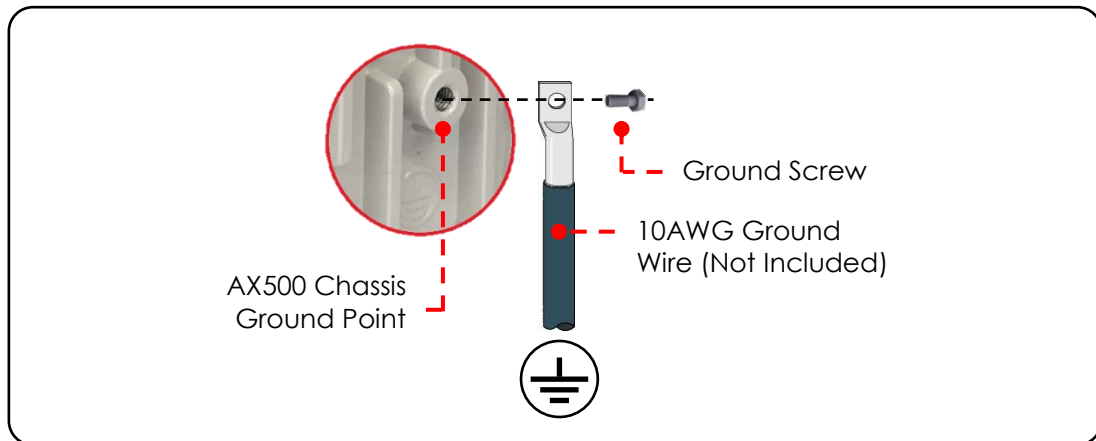


Figure 11-1 AX500 Chassis Grounding

An external ground wire must be installed. Use size 10 AWG ground wire (not included) and attach it to the chassis using the provided ground screw. Connect the other end of ground wire to a reliable earth ground point at site. Please consult premises' electrical engineers and follow local electrical codes and standards for proper grounding.

In addition, site engineers should always be grounded by wearing proper ESD grounding straps connected to the site earth ground point during equipment installation, maintenance and repairs.

12. Surge Protection

12.1 Ethernet Cable Selection

Type of Ethernet cable in outdoor deployment is critical. The Ethernet cable should be either CAT 5e or CAT 6, outdoor rated, and shielded. Specifically, the following types of Ethernet cable should be used for outdoor installation: screened fully shielded twisted pair (sFTP) cable, foiled twisted pair (FTP) cable, or shielded twisted pair (STP) cable.

Unshielded twisted pair (UTP) Ethernet cable and/or unshielded RJ-45 jack are not recommended in outdoor deployment due to increasing electromagnetic noise level. Furthermore, using shielded Ethernet cable with unshielded RJ45 jack between the AP unit and PoE injector is not recommended. Improperly grounded STP Ethernet cable acts as a magnet for static surges presented in the environment. Since the charges discharged improperly, it couples with the data lines or power lines of the PoE cable. As a result, the coupling high voltages which presents on the PoE cable may damage the AP. Therefore, it is very important that using shielded outdoor rated Ethernet cable together with shielded RJ45 jack for outdoor deployment.

The differentiation between unshielded twisted pair (UTP) Ethernet cable and foiled twisted pair (FTP) cable is that the latter has a small wire under the foil. This wire (preferably 2 cm longer than other wires), also known as the drain wire, should be wrapped around the outside of the shield when installing the shielded RJ45 plug. It is very important to have direct contact between the foil and the shield of the RJ45 connector.

Figure 12-1 shows a shielded, metal-enclosed RJ45 connector. First the boot is slid onto the cable, then the cable shield and drain wire are folded back, next the load bar is loaded with the eight inner cable conductors, then the load bar/cable assembly is inserted into the connector housing and crimped. Finally, the boot is slid over the assembly for additional strain relief.

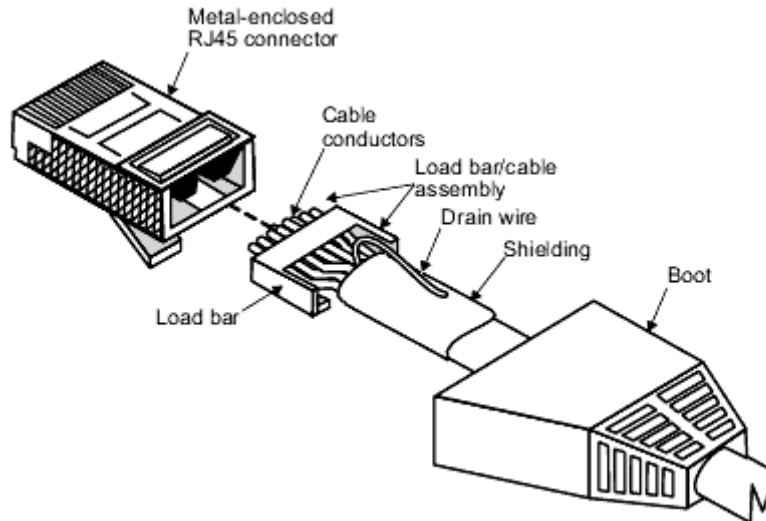


Figure 12-1 Shielded, Metal-enclosed RJ45 Connector

12.2 Ethernet Surge Protector Selection and Installation

It is **STRONGLY** recommended to install Ethernet surge protectors for outdoor AP deployment as it provides additional and effective protection for the AP against electrical surge via Ethernet cable.

To enhance the protection, make sure the surge protector is installed as close to the AP as possible. The Ethernet cable between the surge protector and the AP unit should be of shield type and the length of the cable run should be made as short as possible. At last, don't forget to ground the surge protector to a reliable earth ground point at site with a ground wire. For proper installation and grounding, please follow the installation guide provided by your surge protector supplier. If necessary, you may also consult premises' electrical engineers and follow local electrical codes and standards for proper grounding on site.

The table below lists the minimum requirement of Ethernet surge protector to use with AX500 product series without incompatibility issue. You can also contact us for the suitable models on offer if necessary.

Min Specifications of Surge Protector

- 2 x RJ45 Jacks for Interface Connection; one to the AP device and another one to the PoE switch/Injector
- CAT6 and CAT5e compatibility
- IEEE 802.11af/at PoE compliant
- PoE Mode A and B support for power
- Outdoor-rated and weatherproof if outdoor deployment needed
- Standard GR-1089 compliant or equivalent

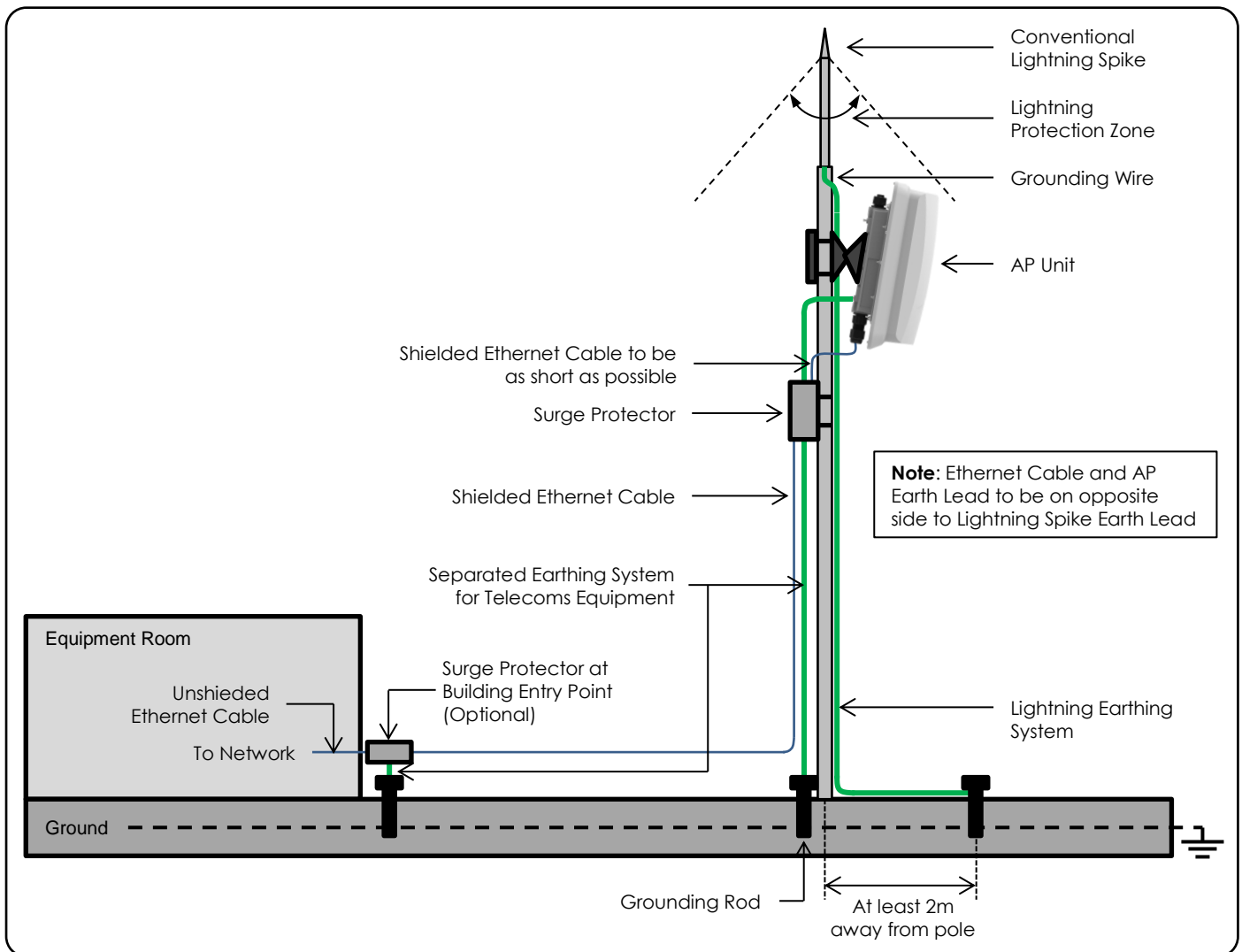


Figure 12-2 Lightning and Surge Protection for AX500 Outdoor Installation

To protect other LAN devices inside an equipment room or a rack, we recommend you install one more surge protector at the entry point to the building. Doing this can discharge the electrical surge into the ground before it entering the building to cause damages to the equipment.



Note: Inferior surge protector might increase the overall impedance of the entire Ethernet data path between the switch and the AP unit. The effective cable distance will suffer for this case, i.e. < 100 meters. You may need to assemble the same setup in the lab or office to ensure 1Gbps of connectivity before taking them all out for installation.

12.3 Other Deployment Tips for Surge Protection and Site Grounding Practices

Here are some more tips to improve the effectiveness of your surge protection system for fighting against lightning and power surges:

1. Don't directly bond Telecom Earth to Lightning Grounding System. There are many possible and unpredictable paths for surge current flow down to the Earth as long as it follows the path from high potential to low potential. A separate earth down conductor for the Lightning Spike and for the telecom equipment should be used.
2. Lay the earth wire of lightning ground on one side of the pole and run telecom earth & Ethernet wires on another side; Separation by the pole body can help minimize the electromagnetic induction between the two when they are running in parallel along the pole. Or even better, run the Ethernet cable inside of the mounting pole if possible. The mounting pole will act as insulation and help passing surges to ground.
3. Increased separation of lightning grounding spike earth connection and telecom earth connection. Connect the lightning grounding spike earth with 2m or more separation away from the telecom earth connection point.
4. Avoid sharp bends and loops in earth wires. Sharp bends (less than 8" radius) and loops/coils in the earth wires act as inductors and impede current flow. Use smooth bends when necessary.
5. Keep Ethernet cable run as straight as possible.
6. Ensure that the impedance of the equipment earthing network to ground is less than 5 ohms.
7. Ensure all interconnection points are well bonded, protected against corrosion and are low impedance. As a common practice, test the conductivity of the grounding system to ensure the installation is solid and electrically capable of grounding any ambient surge or static.

13. Lightning Protection

The entire antenna system including AP main unit and its associated components should be well protected against lightning strikes by a lightning protection system. Since the antennas are usually mounted in high places such as building rooftop, tower and high mast, they are very susceptible to lightning strikes, especially for the regions where lightning occurs with a high probability. Therefore, it is **STRONGLY** recommended to install a lightning protection system in the building and mounting structures to protect the devices.

For the buildings which have a complete lightning protection system, you should install the AP units and antennas under the "lightning protection zone" of the building lightning rod. You may consult the premise's site electrical engineers and find out suitable installation locations so that all the devices are protected under the zone.

If the installation location is not covered by the lightning rod, you should install a standalone lightning protection system for the antenna system. See Figure 12-2 for reference. The conventional lightning rod provides a protection cone under which we should install the antenna system. Besides, make sure all the mounting structures including poles, towers and high mast are well grounded. You may consult electrical engineers for the most appropriate lightning protection system design and implementation for each case.

While this guide gives a general guideline on lightning protection, the detail specifications of a lightning protection system must be provided by local electricians and must be maintained and checked periodically in accordance with local regulations. Altai does not provide any warranties as to the effectiveness of the suggested measures. The implementation of the suggested measures is at the customer's own discretion. Under no circumstances will Altai be liable for any consequences resulting from the implementation or lack of implementation of the suggested measures.

14. Console Connection

Procedures:

1. Connect a computer to the console port of AX500 unit with a console cable. The cable is not included in the package. In this example, we prepare a RJ-45-to-DB-9 console cable. The RJ45 connector goes to the console port and the RS232 DB9 serial connector goes to the laptop. An extra adapter of USB to RS232 DB9 may be required for laptop connection.

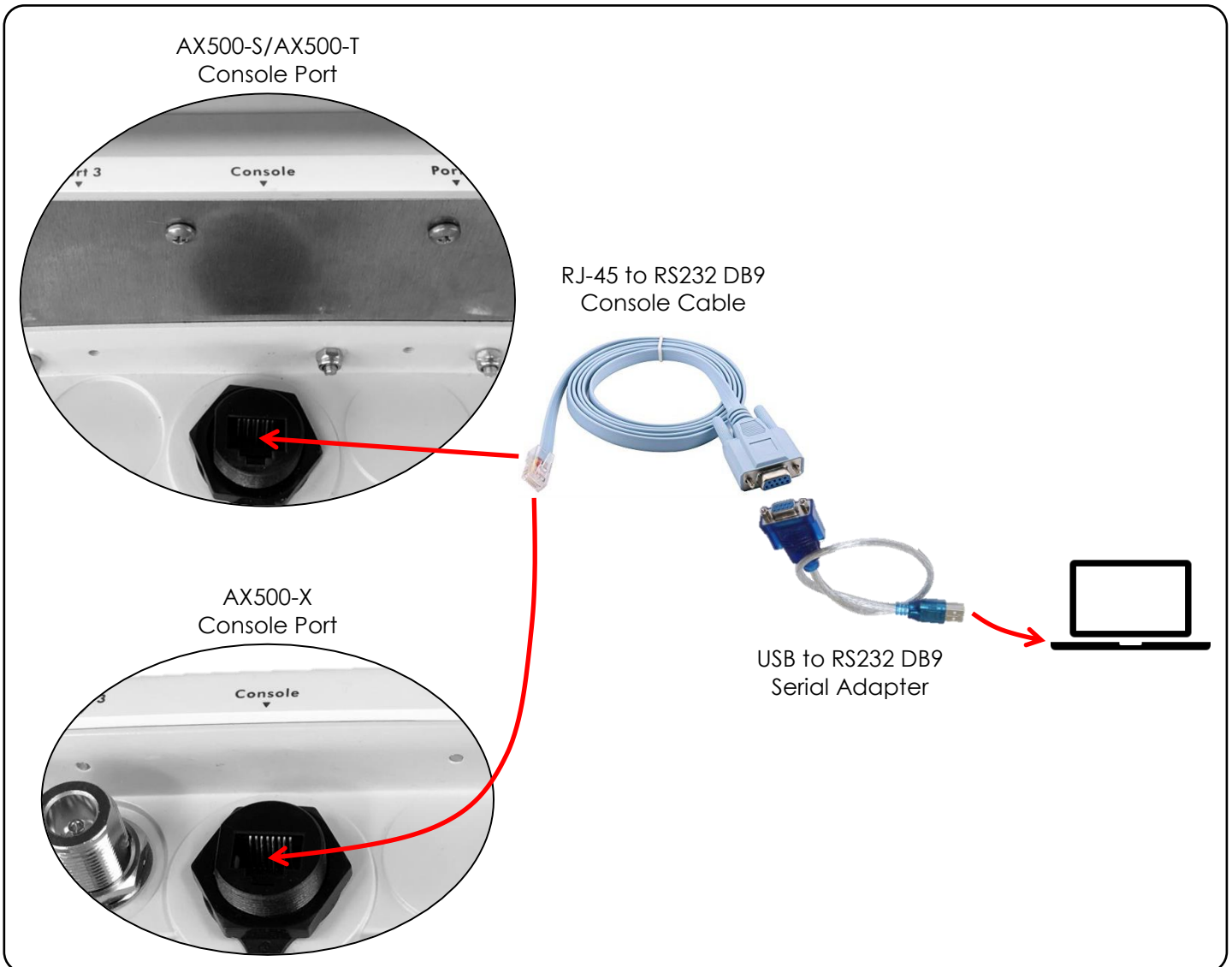
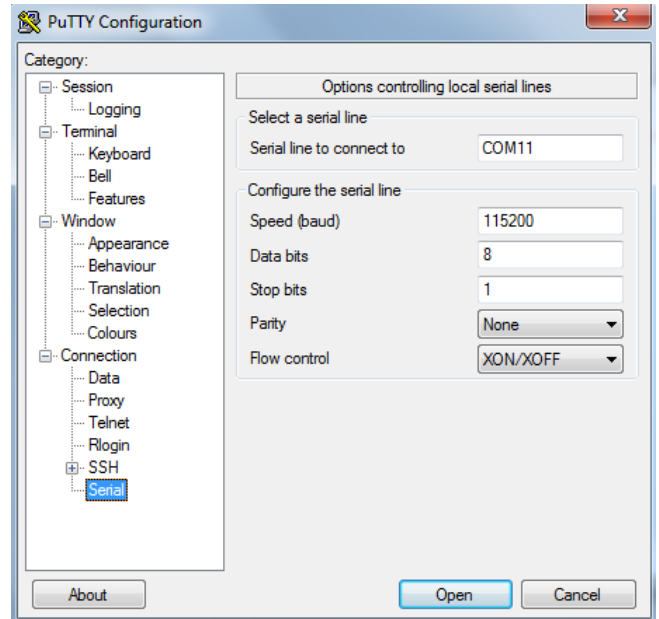


Figure 14-1 Console Cable Connection Setup

2. Open software terminal such as PuTTY or Xshell on your computer.
3. Use the following terminal settings for console connection:

- Baud rate: 115200
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow control: XON/XOFF



4. Default login username/password: admin/admin

```
SUPERWIFI login: admin
Password:

BusyBox v1.25.1 (2018-04-23 12:01:11 CST) built-in shell (ash)

/_____|>
\_____|>
<_____|>
|_| (()) Mobile Internet for Everyone
=== SuperWifi Base Station =====
Version: 3.1.3.501
Uptime: 586s
IP Address: 192.168.1.222
MAC Address: 00:19:be:2e:01:23
=====
admin@SUPERWIFI:~$
```

5. To end the session, input the cmd "exit".

```
admin@SUPERWIFI:~$ exit
Please press Enter to activate this console.

SUPERWIFI login:
```

15. Factory Reset

To reset the AX500 unit locally, open terminal session via console connection as described in Section 14. Two commands can be used, depending on whether to retain the AP network settings after reset.

Full Factory Reset:

Command	Description
<code>admin@SUPERWIFI:~\$ full_factory_reset</code>	To reset the AX500 unit completely. All settings should be removed and returned to the factory default state.

Factory Reset (Keep Network Settings):

Command	Description
<code>admin@SUPERWIFI:~\$ factory_reset</code>	To reset the AX500 unit. All settings should be removed and returned to the factory default state EXCEPT AP network settings, i.e. IP address, subnet mask, default gateway and management VLAN assignment.

16. Troubleshooting Q&A

Q1: I found my AX500 unit is in 10M/100M connection with a switch. What should I do to fix the problem?

Ans: It could be due to a couple of reasons. Please follow the procedures below to trace the root cause.

1. Make sure the Ethernet ports of both AP and the switch are configured as Auto Negotiation Mode. For AX500, you can go to the **WebUI: Configuration > Network > General > Ethernet Setting** to set it. Please note manual mode only runs on 10/100Mbps of connection. If necessary, try to set the AX500 unit to factory default state to rule out any possibilities caused by special configuration.
2. Double check the Ethernet cable length: The total length between the AP and the switch/router (via PoE injector if applicable) should not exceed 100 meters.
3. Bypass any devices in between, e.g. surge protectors, and have a direct Ethernet connection between the AP and the switch/router (via PoE injector if applicable) to check if the speed is still in 10M/100M. If so, go to the next item.
4. Visual inspection on the Ethernet ports of both AP and the switch and make sure no pins crooked or burnt are found. Some past experience even tells us that there may be some cases in which the pins were stuck and not able to be sprung back to its original position when unplugging the Ethernet cables. Poor pin contact may cause fallback in Ethernet speed. Therefore, please have a careful check on the Ethernet pin contact.
5. Check cable/cable connector quality: The workmanship of cable clamping can play an important role on the final negotiated speed. Poor workmanship results in high impedance and hence causes fallback in Ethernet speed. You can try to re-clamp the Ethernet connector and swap cables to crosscheck. In addition, make sure correct pin assignment is made according to Section 8.
6. If the above is all done and does not work, please contact our local partners or Altai technical support team.

Q2: I found my AX500 unit reboots itself. Checking the **WebUI: Status > Logs > syslog**, I spot some cold reboot messages triggered occasionally there. Any particular reason why it happened?

Ans: Cold reboot means the AP has been powered off and on again, i.e. power cycle. This issue is mainly hardware-related, e.g. product hardware defect, intentional power on/off and power chain problem delivering not sufficient power enough for the AP unit. To confirm whether it is the power chain problem, first check the power supply source and make sure it is stable enough all the time. Then follow the same procedures as described in Q1 to perform checking on configuration, cable length, additional resistance (surge protector), Ethernet pin contact, Ethernet wiring. All of these can be factors of insufficient power supply and hence leading to AP reboot.

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