Tropos® Networks Mesh Router Installation Guide

Models 4310-XA and 4319-XA

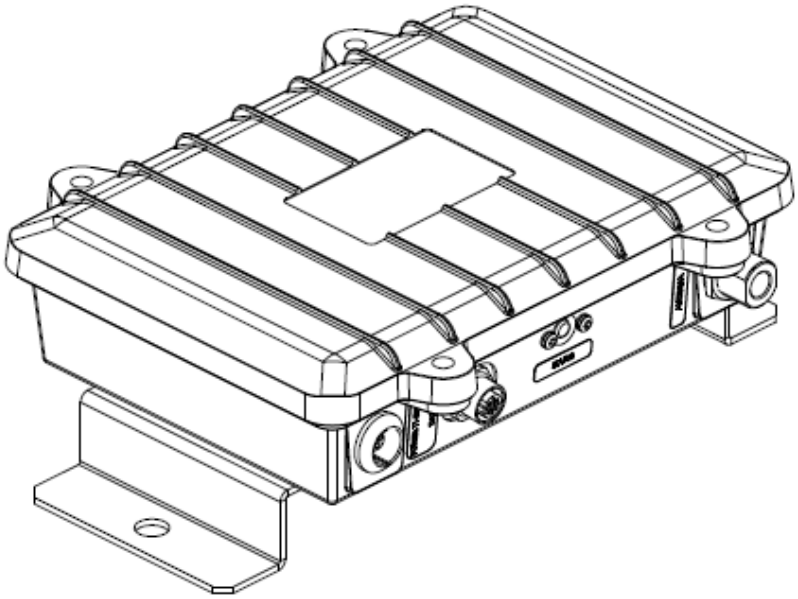


ABB
555 Del Rey Ave.
Sunnyvale, CA 94085 USA
www.abb.com/tropos
408-331-6800

Part No. 200483-00 Rev A0
2013_03_21

Power and productivity for a better world™

Copyright Notice

FCC Notice to Users and Operators

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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by using one of the following measures:

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

This Part 15 radio device operates on a non-interference basis with other devices operating at this frequency. Any changes or modification to said product not expressly approved by Tropos Networks could void the user's authority to operate this device.

FCC Part 90Y Notice for 4.9 GHz Operation

Operation in the 4.9 GHz band requires an FCC license. The following eligibility rules are specified in Part 90.1203 of the FCC rules:

- Entities providing public safety services as defined under section 90.523 are eligible to hold an FCC license for systems operating in the 4940-4990 MHz band. All of the requirements and conditions set forth in that section also govern authorizations in the 4940-4990 MHz band.
- 4.9 GHz band licensees may enter into sharing agreements or other arrangements for use of the spectrum with entities that do not meet these eligibility requirements. However, all applications in the band are limited to operations in support of public safety.

Contents

1 Installing the Tropos Mobile Mesh Router

This guide explains how to install the Tropos Mobile Mesh Router, Models 4310-XA-and 4319-XA. This chapter contains the following sections:

- Preparing for Installation
- Mount the Router
- Front Panel LED
- Service Instructions
- Service Instructions

Introduction

The Tropos 4310-XA and 4319-XA Mobile Mesh Routers are designed to provide mobile mesh router functionality in extremely harsh environments. They are IP-67 rated for outdoor installation and offer greater shock and vibration resistance than the standard Tropos Mobile Mesh Routers, the Tropos 4310 and Tropos 4319.

This document contains installation instructions for the following products:

- Tropos 4310-XA Router
- Tropos 4319-XA Router — Public Safety

Tropos 4310-XA Router

The Tropos 4310-XA router for the FCC regulatory domain has the following characteristics:

- 802.11b/g/n 2400-2483 MHz
- DC power, 11-55 VDC
- CPE 10/100BaseT Ethernet ports

Table 1 lists the Tropos 4310-XA router model.

Table 1 Tropos 4310-XA Router Models—FCC

Model	Description
43103000X	4310-XA: Mobile router, 2.4 GHz, DC power

Tropos 4319-XA Router — Public Safety

The Tropos 4319-XA router for licensed FCC public safety applications has the following characteristics:

- 802.11a, 4940-4990 MHz
- DC power, 11-55 VDC
- CPE 10/100BaseT Ethernet port

Note

Operation in the 4.9 GHz band requires an FCC license. The following eligibility rules are specified in Part 90.1203 of the FCC rules:

- Entities providing public safety services as defined under section 90.523 are eligible to hold an FCC license for systems operating in the 4940-4990 MHz band. All of the requirements and conditions set forth in that section also govern authorizations in the 4940-4990 MHz band.
- 4.9 GHz band licensees may enter into sharing agreements or other arrangements for use of the spectrum with entities that do not meet these eligibility requirements. However, all applications in the band are limited to operations in support of public safety.

Table 2 lists the Tropos 4319-XA router model for public safety applications.

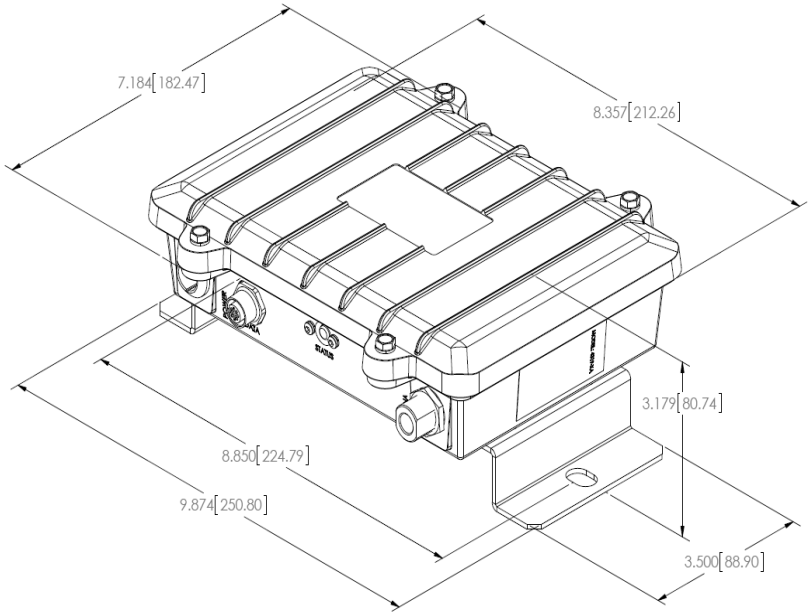
Table 2 Tropos 4319-XA Routers—Public Safety

Model	Description
43193010X	4.9 GHz, DC power

Preparing for Installation

Figure 1 shows the mobile router unit and dimensions.

FIGURE 1 Tropos Mobile Router



Installation Accessories

You must supply the following accessories:

- Hardware to mount the router
- Ethernet cable with M-12 connector to connect the router to the client device
- Power cable with LEMO connector
- Antennas and antenna cables

Selecting Router Locations

Tropos routers are radio devices, and as such, they are susceptible to common causes of interference that can reduce throughput and range. Follow these general guidelines when selecting an installation location:

- Install the router away from other possible sources of WLAN interference at 2.4 GHz or 4.9 GHz.
- Choose a mounting surface that is at least 13.25 inches by 8 inches to provide sufficient space to screw the router into the surface (Figure 1). It is not necessary to level the router.

Note
The router contains integral ESD protection and vehicle power conditioning, so external protection is not required.

Antenna Options

You can purchase any of the Tropos-approved, cable-attached antennas that are listed in "Ordering Information" on page 19 (see Figure 6 on page 19). Omni-directional antennas are best for systems requiring a signal distribution in more than one direction.

Caution
To comply with regulatory RF exposure limits, locate antennas a minimum distance of 7.9 inches (20cm) from people.

Note
Only use antennas that are approved by Tropos. Operating the unit with non-qualified antennas is a violation of U.S. FCC Rules Part 15.203(c), Code of Federal Regulations, Title 47.

Selecting Antenna Locations

The Tropos 4310-XA and 4319-XA Mobile Mesh Routers can be mounted on the outside of a vehicle with an antenna connected directly to the router or they can be mounted inside the vehicle with an antenna mounted outside the vehicle.

If possible, the router should be mounted outside the vehicle as this eliminates the need for the use of coaxial cable between the router and antenna. Use of coaxial cable introduces losses in the system which reduces the effective transmit power.

If an omnidirectional antenna is used, it should be mounted vertically. If the router is mounted externally and is situated so that its antenna connector is on the side, a right-angle N-connector should be used in order to get the antenna in a vertical orientation.

Tropos recommends the use of low loss coaxial cable such as LMR-240 or LMR-400 for connecting the router to an external antenna.

Follow these guidelines during installation:

- Install the antenna on the highest part of the vehicle so that it is clear of obstructions within at least a 3ft radius. Other antennas do not need to be considered as sources of obstruction.
- Install the antenna on the flattest area of the roof.
- Keep the antenna cable as short as possible.

Cable Connections and Power

Figure 2 shows the power and connector ports on the side panel of the mobile outer:

- The status indicator is red when the router is not connected to the Tropos network. It is green when the router has a working IP address and network connectivity.
- The CPE port is used to connect the router to a computer or other client device.

Figure 2 shows the connectors and indicators on the mobile router, from left to right they are:

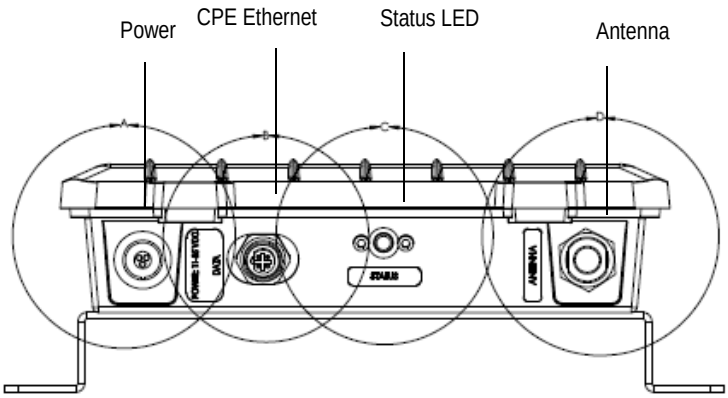
- Power: LEMO size 1k/1 circular push pull fixed receptacle, 3-pole female
- CPE Ethernet: 4-pole, circular M-12 D-coded female
- Status LED
- Antenna: N-type, male

The router is designed to be used with negative ground systems, such as motor vehicle power. There is no internal battery back-up, so the vehicle must be powered for the router to operate.

Note
The router requires quality shielded CAT5 Ethernet data cables.

Note
The router does not have a power switch. It is powered when the power plug is attached and then connected to vehicle power. To remove power from an installed router, remove the power plug, remove the fuse, or turn off vehicle power.

FIGURE 2 Connector Panel



Install the Router

Perform these tasks to install the router:

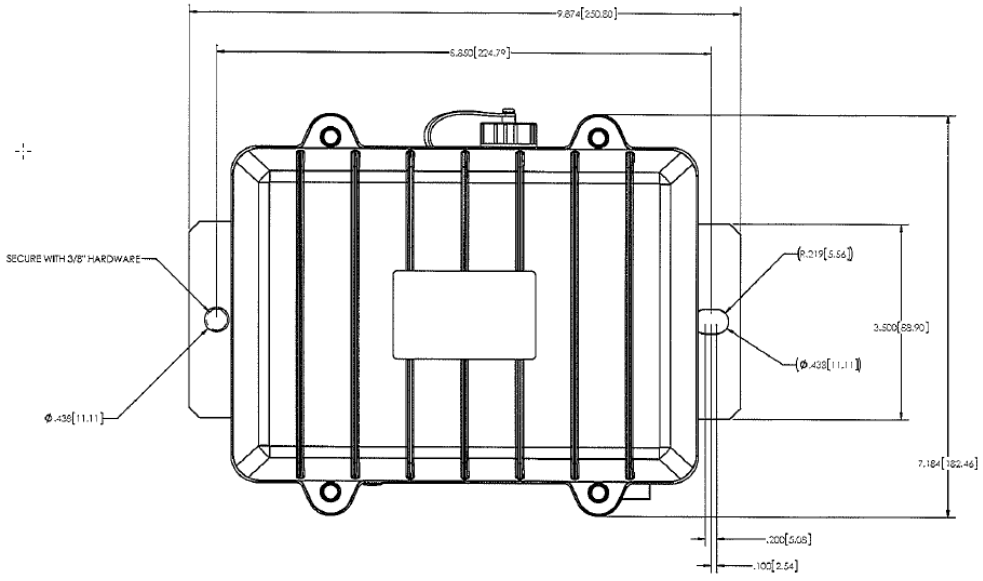
1. Mount the Router
2. Connect Power
3. Connect the CPE
4. Connect the Antenna

Mount the Router

The Tropos 4310-XA and 4319-XA routers have a metal mounting bracket attached for mounting the router to most types of surfaces. As shown in Figure 3, the mounting bracket has two holes for fasteners. These holes are 8.85" (224.79mm) apart on centers.

Use 3/8" or 10mm fasteners appropriate to the material on which the router is being mounted.

FIGURE 3 Router Mounting



Connect Power

Connect 11-55VDC to the POWER connector. The Tropos 4310-XA and 4319-XA use the following connector for DC power:

LEMO size 1k/1 circular push pull fixed receptacle, 3-pole female (LEMO part number EGG.1k.303.CLL)

The installer is responsible for providing the power cable that connects to the router's power receptacle. The correct LEMO part for the mating connector is:

FGG.1k.303.CLA

Figure 4 and Table 3 show the pin assignments for the DC power connector.

<<Updated figure needed>>

FIGURE 4 Pin Assignments for the DC Power Connector

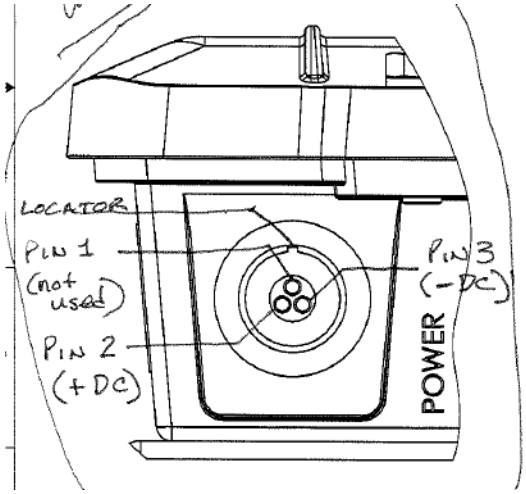


TABLE 3 Pin Assignments

Pin	Function
1	No connection
2	DC +
3	DC -

Connect the CPE

Connect the Ethernet CPE to the DATA connector:

4-pole, circular M-12 D-coded female

The installer is responsible for providing the Ethernet cable and connector.

Figure 5 and Table 4 show the wiring for the DATA connector.

<<Updated figure needed>>

FIGURE 5 Pin Assignments for the DC Power Connector

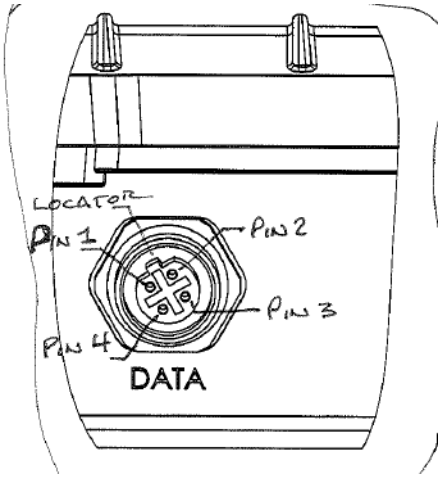


TABLE 4 Pin Assignments for CPE

Pin	Function
1	TX Data +
2	RX Data +
3	TX Data -
4	RX Data -

Connect the Antenna

Connect the antenna to the N-type connector on the router. Either connect an antenna directly to the N-connector (requires that the router be mounted outside of the vehicle) or use low-loss coaxial cable to connect the router to an antenna mounted outside of the vehicle. Always use the shortest length of cable possible. Always mount the antenna in a vertical orientation.

Front Panel LED

Table 5 lists the front panel LED states. Pin 9 is used for the Remote Indicator (“Service Instructions” on page 12).

Table 5 LED States

LED Color	Network State
Red	Not connected
Green	Connected

Service Instructions

There are no user-servicable items in the router.

2 Product Specifications

This chapter contains the product specifications for the Tropos 4310-XA and 4319-XA mobile routers:

- Physical Specifications
- Interfaces
- Power Options
- Certifications

Table 6 Physical Specifications

Specification	Value
Physical Dimensions (with mounting brackets)	
Inches	Height: 3.2 Width: 9.9 Depth: 7.2
Centimeters	Height: 8.1 Width: 25.0 Depth: 18.25
Weight	
lbs - maximum	3.0 (includes all brackets)
Kg - maximum	1.3
Temperature	**Min**
Operating Range	Min: -40° C Max: 70° C
Storage Range	Min: -40° C Max: 85° C
Shock and Vibration	
Operational:	MIL-STO-202E ETSI 30-19-2-4 T41.E Class 4M3
Transportation:	ISTA 2A

Table 7 Interfaces

Specification	Value
CPE Data Interface	
IEEE 802.3 10/100BaseT	• Auto sensing • 4-pole, circular M-12, D-coded female connector
802.11b/g/n Wireless Interface	
Standard	IEEE 802.11b/g/n Wi-Fi
Frequency Range	2400 to 2483 MHz ISM Band (CH 1-11) FCC Part 15
Modulation	802.11 g/n - OFDM (64-QAM, 16-QAm, QPSK, BPSK) 802.11 b
Rx Sensitivity	-100dBm (1 Mbps) -94dBm (6 Mbps) --76dBm (54 Mbps)
802.11a Wireless Interface	
Standard	IEEE 802.11a Wi-Fi
Frequency Range	4940 - 4990 MHz Public Safety (FCC Part 90)
Modulation	OFDM (64-QAH, 16-QAM)
Rx Sensitivity	-94dBm (6 Mbps) -76dBm (54 Mbps)
RF Interface	
Antennas	External
Lightning Protection	<= 0.5μJ for 3kA @ 8/20μS Waveform
Impedance	50 ohms
VSWR	1.5 : 1
Connector	N (female)
Indicator - Status Lamp	Red/Green

Table 8 Power Options

Specification	Value
DC	11-55 VDC 8W typical Polarity protected
ESD Protection	EN61000-4-2 Level 2 ESD Immunity EN61000-4-5 Level 4 Surge Immunity
Fuse	Automotive mini-blade 32 VDC 7.5A

Table 9 Certifications

Certifications
CFR 47 FCC Part 15; Class B (4310-XA) Industry Canada RSS210 (4310-XA) UL 60950-1 EN 60950 IEC 950 FCC CFR 47 Part 90 (4310-XA)

3 Approved Antenna Configurations and Attenuation Settings

This chapter lists approved antenna configurations and attenuation settings:

2.4 GHz Antenna

The information in this section applies to the Tropos 4310-XA mobile.

Table 10 lists antenna configurations.

ⓘ Note

CANADA ONLY: *This device has been designed to operate with the antennas listed in Table 10, and having a maximum gain of 12dBi. Antennas not included in this list or having a gain greater than 12dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.*

ⓘ Note

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the Effective Isotropic Radiated Power (EIRP) is not more than that permitted for successful communication.

Table 10 802.11b/g Antenna Configurations (2400-2483 MHz)

Antenna	Ordering Number	Measured Cond. Avg. Power (dBm)	Tx Attenuation Software Setting (dB)	Approximate EIRP (dBm)
7.4dBi omni, unit mounted (with cable) 7.4dBi omni, unit mounted (without cable) 7.4dBi omni, unit mounted (MAG-mount)	AN074090 AN074091 AN074095	28.6	0	36

Attenuation with External Antennas

If external antennas are used, it is necessary to adjust the transmit power attenuation to provide the correct power level for the router. Use the following formulas to compute the required attenuation level:

```
Gain’ (dBi) = Antenna Gain (dBi) - Cable Loss (dB)
```

802.11b/g:

```
Tx Antenna Setting (dB) =  0           if Gain’ < 7 dBi
                           Gain’ - 7   if Gain’ > 7dBi
```

4.9 GHz Antenna

The information in this section applies to the Tropos 4319-XA router.

Note
Operation in the 4.9 GHz band requires an FCC license. The following eligibility rules are specified in Part 90.1203 of the FCC rules:

- Entities providing public safety services as defined under section 90.523 are eligible to hold an FCC license for systems operating in the 4940-4990 MHz band. All of the requirements and conditions set forth in that section also govern authorizations in the 4940-4990 MHz band.
- 4.9 GHz band licensees may enter into sharing agreements or other arrangements for use of the spectrum with entities that do not meet these eligibility requirements. However, all applications in the band are limited to operations in support of public safety.

Note
To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the Effective Isotropic Radiated Power (EIRP) is not more than that permitted for successful communication.

Table 11 802.11a Antenna Configurations for Public Safety (4940-4990 MHz)

Antenna	Ordering Number	Channel Bandwidth / Operating Frequency (MHz)	Measured Conducted Power (dBm)	Tx Attenuation Software Setting (dB)	Approximate EIRP (dBm)
9.0dBi omni, magnetic mount	AN090049	20 4950 - 4980	20.0	4	29.0

Attenuation with External Antennas

If external antennas are used, it is necessary to adjust the transmit power attenuation to provide the correct power level for the router. Use the following formulas to compute the required attenuation level:

```
Gain’ (dBi) = Antenna Gain (dBi) - Cable Loss (dB)
```

802.11b/g:

```
Tx Antenna Setting (dB) =  0           if Gain’ < 7 dBi
                           Gain’ - 7   if Gain’ > 7dBi
```

802.11a:

```
Tx Antenna Setting (dB) =  4           if Gain’ < 9 dBi
                           Gain’ - 5   if Gain’ > 9 dBi
```

4 Ordering Information

Table 6 contains ordering information for the Tropos mobile routers and related equipment. These items can be ordered from Tropos Networks, Inc.

FIGURE 6 Tropos Ordering Information

Part No.	Description
43103000X	Tropos 4310-XA Mobile Mesh Router, variable power, N connectors
43193010X	Tropos 4319-XA Mobile Mesh Router, variable power, N connectors
RC009100	Right angle N-connector adapter: male/female
AN074090	One vehicle mounted 7.4dBi omni antenna and cable kit, 2400-2500 MHz
AN074091	One vehicle magnetic mounted 7.4dBi omni antenna and cable kit, 2400-2500 MHz
AN074095	One vehicle mounted 7.4dBi omni antenna (cable kit not included), 2400-2500 MHz
AN090049	9.0dBi omni antenna, 4.9 GHz, magnetic mount, 10 foot cable, N-male