Tropos Networks MetroMesh Router Installation Guide

Model 4210
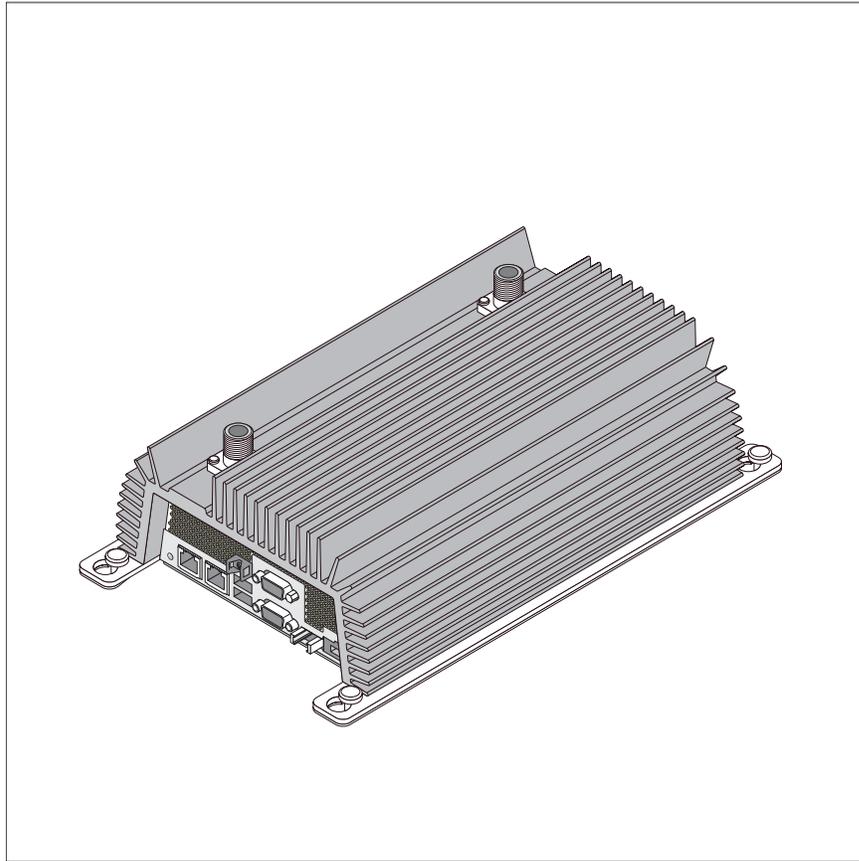
TROPOS networks

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Contents

# 1 Installing the Tropos 4210 MetroMesh Router

This guide explains how to install the Tropos 4210 MetroMesh Router. This chapter covers the following topics:

- "Preparing for Installation" on page 2
- "Installing the Tropos 4210 MetroMesh Router" on page 6
- "Remote Indicator" on page 9
- "Service Instructions" on page 10

Preparing for Installation

The next figure shows the router unit and dimensions.

Figure 1 Tropos 4210 MetroMesh Router
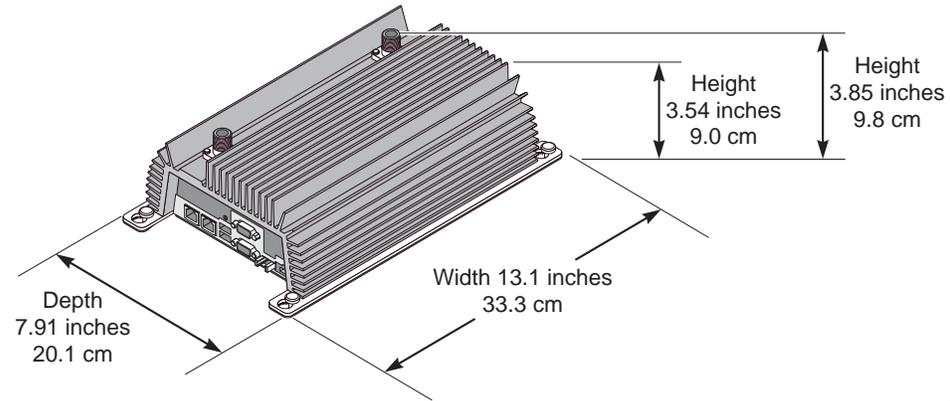
Package Contents

The Tropos 4210 router shipping package contains the following items:

- Tropos 4210 MetroMesh Router
- Tropos 4210 MetroMesh Router Installation Guide (this document)
- 2-pin power plug attached to router
- Fuse attached to router
- Screws, lock washers, nuts

Installation Accessories

You must supply the following accessories:

- 1/4-20 panhead machine screws with split lock washers
- Ethernet cable to connect the router to the laptop computer you plan to use for network access (crossover cable if no switch or hub is used)
- #18 AWG wiring to connect the router to vehicle power
- Antennas and antenna cables

The following items are optional:

- USB GPS receiver supporting standard NMEA 0183 sentences with cable (USB connector)
- Right angle antenna adapters

Selecting Locations

Tropos 4210 routers are radio devices, and as such, they are susceptible to common causes of interference that can reduce throughput and range. To ensure the best possible performance, follow these basic guidelines:

- Install antennas on the highest area of the vehicle (roof).
- If the vehicle has a light bar, install antennas at least three feet away from the bar.
- It is desirable to have the antenna cables as short as possible.
- Install the router away from other possible sources of 2.4 GHz WLAN interference, such as cordless phones, spy cameras, frequency hopping (FHSS) and DSSS LAN transceivers (non-802.11g), electronic news gathering video links, radars, amateur radios, land mobile radio services, local government sites (such as law enforcement), fixed microwave services, local TV transmission and private fixed point transmitters).
- The router is not weather-proofed, so install only in protected interior locations.

Choose a splash-resistant mounting surface that is at least 13 inches by 8 inches to provide sufficient space to screw the router into the surface. See FIGURE. It is not necessary to level the unit.

The Tropos 4210 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 17. Omni-directional antennas are best for systems requiring a signal distribution in more than one direction. To comply with regulatory RF exposure limits, locate antennas a minimum distance of 7.9 inches (20cm) from people. It is possible to use a single antenna; however, two antennas are strongly recommended.


(i) **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.

> (i) **Note**
>
> The device and the antennas must not be co-located or operate in conjunction with any other antenna or transmitter.

Figure 2 Tropos 4210 MetroMesh Routerwith Cable-Attached Antennas

Cables
from antennas
to unit

Main
Tx/Rx antenna

Aux
Tx/Rx antenna
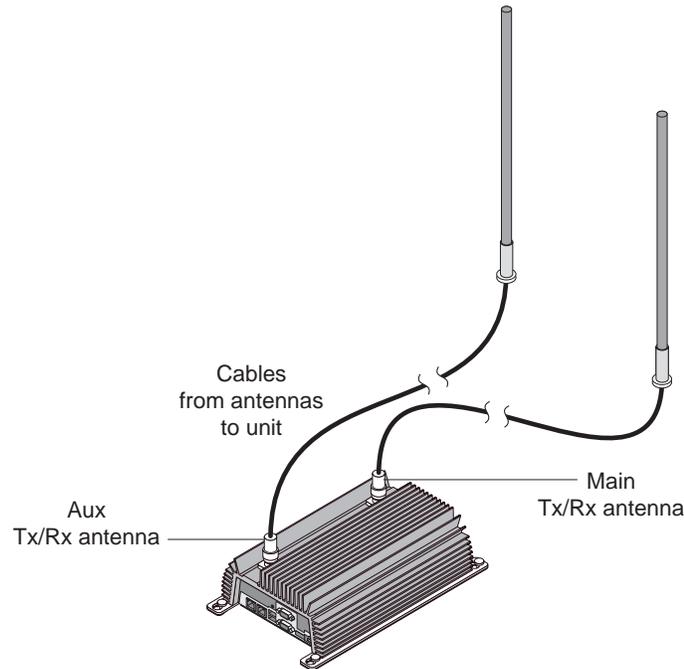
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RF Planning Guidelines

Tropos wireless routing technology is embedded in each Tropos 4210 MobileMesh router, allowing each router to work in almost any environment and with a wide range of network topologies. To maximize coverage range, locate the router in wireless-friendly areas. Try not to place them in areas that can block or interfere with transmission. 802.11g devices transmit in the 2.4 GHz frequency spectrum. This spectrum is shared by devices such as microwave ovens, portable phones, intercom systems and wireless alarm systems. Place each router in a location at least 15 to 20 feet from any other transmitter to prevent the possibility of interference.

Cable Connections and Power

Figure 3 shows the power and connector ports on the side panel of the Tropos 4210 router:

- The status indicator is red when the router is plugged in and has power. It is green when the router has a working IP address and network connectivity.

- The Ethernet Management (MGT) port is used to connect the router to the laptop computer that is used for network access. The LAN port is not currently used for the Tropos 4210 router.

- There are two USB ports, either one of which can be used to connect a GPS receiver.

- There are two RS-232 serial ports, one of which can be used to connect to a client PC. One RS-232 port is reserved for factory use.

- The fuse is user replaceable (see "Fuse Replacement" on page 11).

- The power plug accepts #18AWG wire.

The Tropos 4210 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.

> (i) **Note**
> The Tropos 4210 router does not have a power switch. The router 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 3 Connector Panel
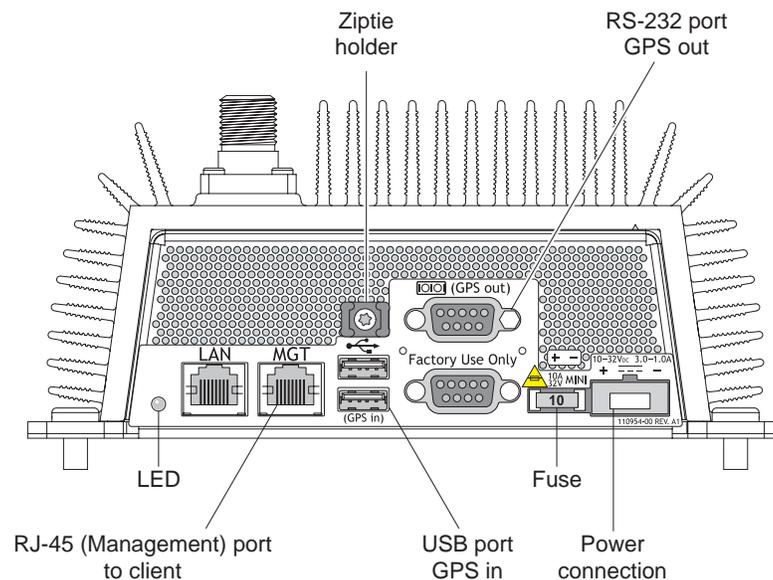
Installing the Tropos 4210 MetroMesh Router

Follow these steps to install the Tropos 4210 router:

1. Remove the router from the shipping box.

2. Drill four holes with a 7, 8, or 9 drill bit to create 0.203-inch holes in the mounting surface. Refer to Figure 4 for the mounting dimensions.

Figure 4 Preparing the Mounting Surface
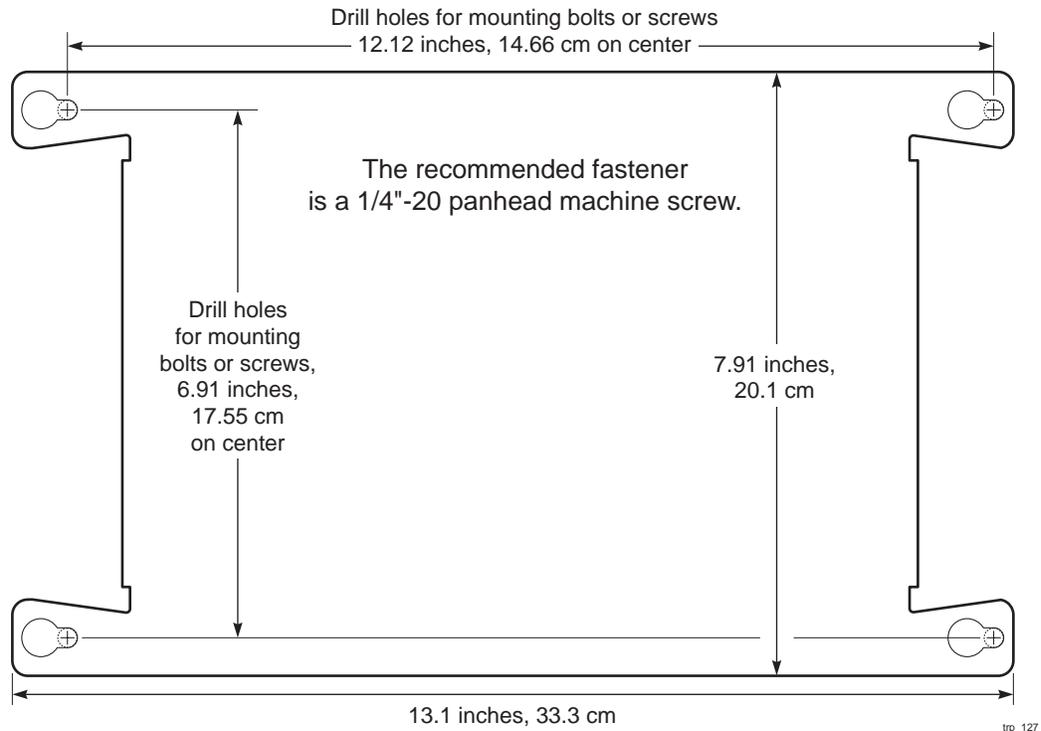
3. Screw the router to the mounting surface using 1/4"-20 panhead screws and lock washers (Figure 5).

Figure 5 Attaching the Router to a Mounting Surface
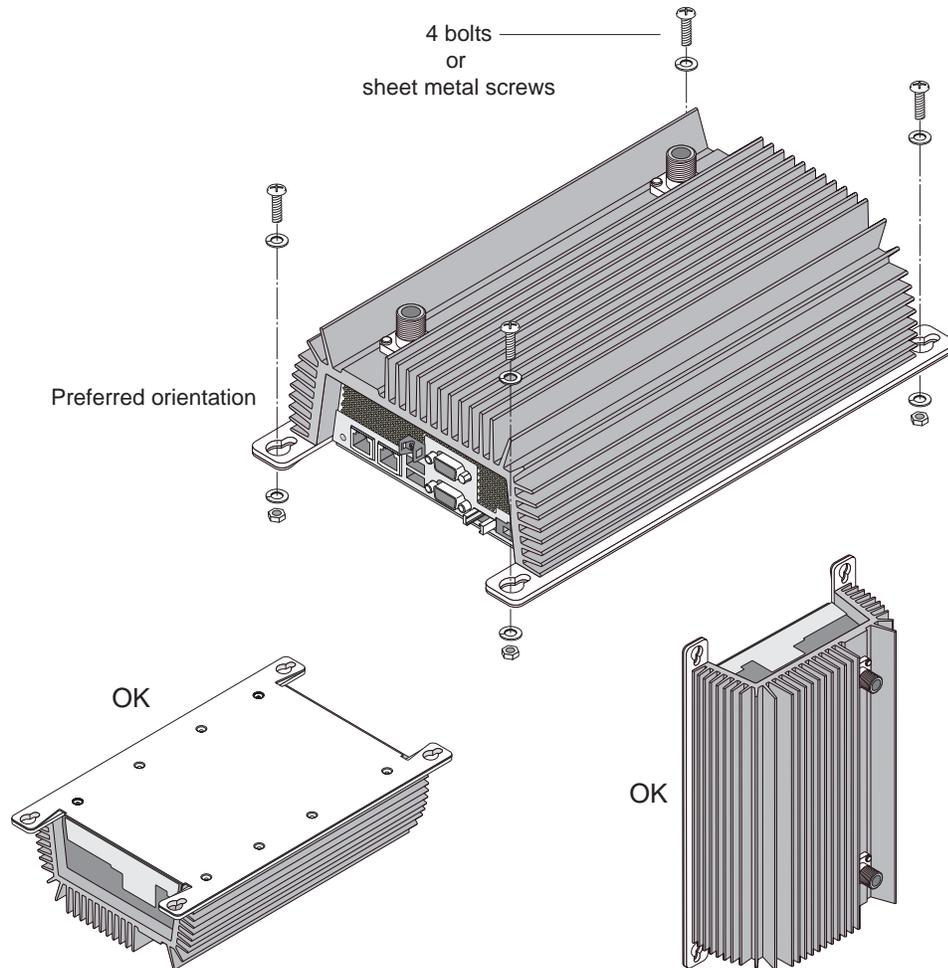
4. Attach antennas according to the instructions shipped with the antennas (see Figure 2 on page 4).

5. Connect a standard Ethernet crossover cable with RJ45 connectors from the Management port on the route to the Ethernet port on the client computer (Figure 6).

Figure 6 Ethernet Cable Connection

Ziptie holder

Connection to client (RJ-45)
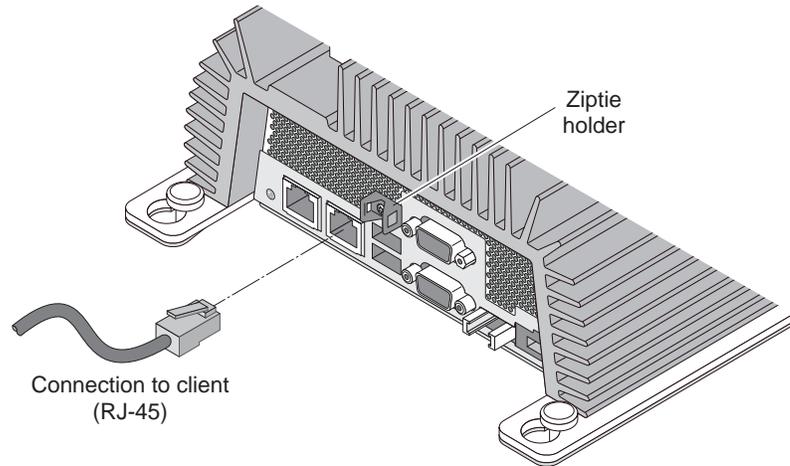
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6. If you plan to use a GPS receiver, mount the receiver according to the instructions shipped with the receiver. Connect the receiver cable to one of the USB ports on the router.

7. Use a small flat-head screw driver, if necessary, to remove the screws that attach the 2-pin power plug to the router.

8. For vibration security, use the ziptie to secure the RJ45 and USB connectors.

9. Trim 1/4-inch from the end of the #18AWG wire. Attach the red wire to the + side of the power plug and the black wire to the - side.

Figure 7 Power Plug Connection
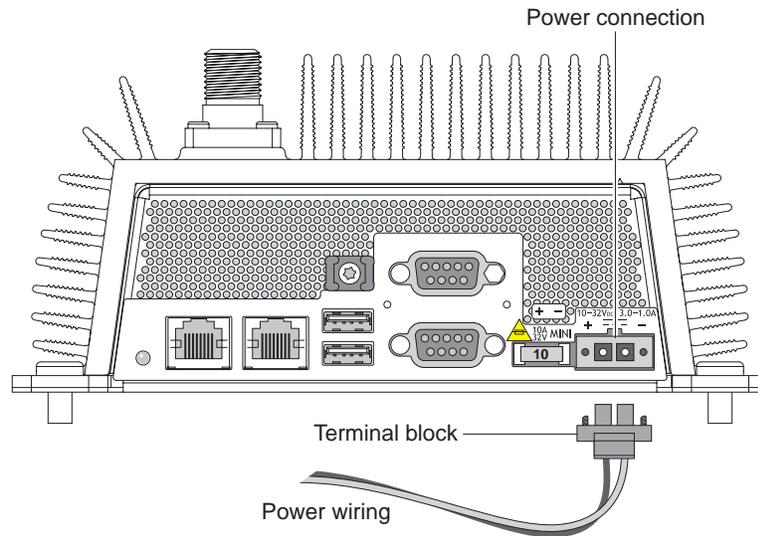
10. Return the power plug to its location on the router and screw down tightly. Note that the unit is powered as soon as the plug is connected and the other ends of the power wires are attached to vehicle power.

Remote Indicator

The Mesh Link Remote Indicator is a optional indicator that allows a user to determine whether the Tropos 4210 router is connected to the Tropos network without looking at the status LED. The indicator is assigned to pin 9 of the bottom Factory Use Only serial connector.

The Mesh Link Remote Indicator functions as follows:

- If the 4210 is not connected to the network: (the router is booting or off, or there is no RF signal), pin 9 is electrically disconnected from pin 5 (ground). This state corresponds to the status light being off or red.
- If the 4210 is connected to the network, pin 9 is electrically connected to pin 5 (ground). This state corresponds to the status LED being green)

It is a customer decision how the remote indicator should be used. Customers can set up a custom LED indicator to show that the unit is connected, or they can connect the indicator to a general load that turns on another device when the Tropos 4210 router is connected to the network. In either case, installing and operating the indicator requires knowledge and skill in basic electronics, wiring, and cable assembly. Figure 8 is a schematic drawing of the indicator.

Figure 8 Remote Indicator Schematic

Basic LED Operation
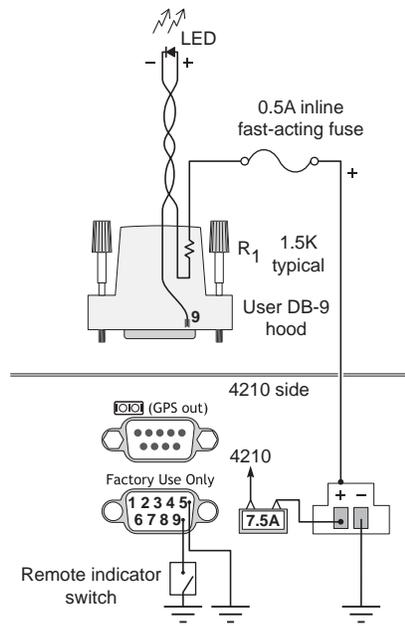
For Larger Loads (> 50mA)
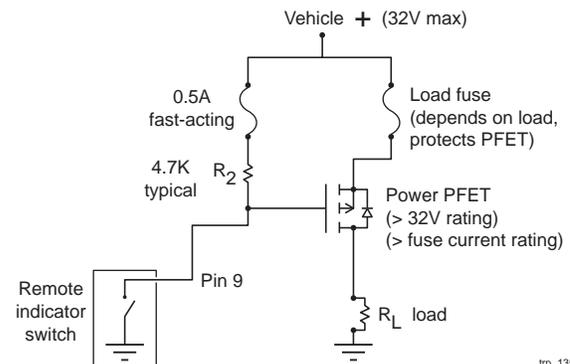
⚠ **Caution**
Voltage on pin 9 must always be greater than the voltage at pin 5 (ground). Pin 5 is
electrically connected to the chassis ground (negative ground). Maximum current from
pin 9 to pin 5 is 50mA. Maximum voltage on pin 9 at any time is 32V (the same as for
the Tropos 4210 router.) Exceeding these maximums can damage the remote indicator.

Service Instructions

This section contains service information for the Tropos 4210 router.

Resetting the Router

To perform a hardware reset of the router, unplug the router, pull the fuse out, or turn off the
vehicle power. Wait 10 seconds and then reconnect the plug, fuse, or vehicle power.

To reset the router configuration to factory defaults, use the Tropos Configuration Utility, as described in the *Tropos Networks User Guide*.

Fuse Replacement

The fuse is located to the right of the power plug. The transparent red color enables you to detect when the fuse has blown. Use needle-nose pliers or a fuse puller to pull the fuse out. Push the new fuse firmly into the fuse socket. To confirm that the new fuse is working, check the status light on the left side of the panel (see Figure 9).

Figure 9 Fuse Replacement
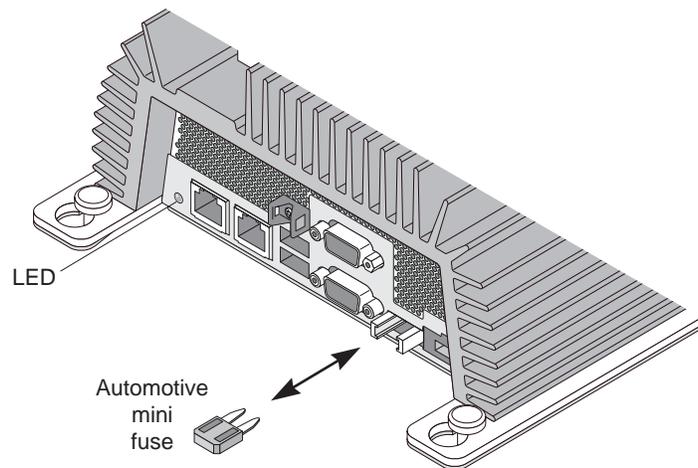
Clock Battery

> **(i) Note**
> The router has no internal user serviceable parts. The following information is intended for trained service personnel only.

The Tropos 5210 MetroMesh Routers have a real-time clock which is powered by a small lithium rechargeable battery. If the real-time clock fails, return the unit to Tropos Networks for servicing.

2 Compliance

This chapter lists notices, cautions, and warning messages required for compliance purposes. It contains the following sections:

- *"FCC Notice to Users and Operators"* on page 12
- *"Warnings and Cautions"* on page 13

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.

Warnings and Cautions

Warning
It is illegal to modify the construction of this product. Modifying the operating frequency or enhancing the transmit output power through the use of external amplifiers or other equipment is specifically disallowed by the "Telecommunications Act."

Warning
This device is for indoor use with conditions that no harmful interference to authorized radio stations results from the operation of this device. This device shall not influence aircraft security and/or interfere with legal communications as defined in the "Telecommunications Act." If this device is found to cause interference, the operator of this equipment shall cease operating this device immediately until no interference is achieved.

3 Product Specifications

This chapter contains the product specifications for the Tropos 4210 MetroMesh Router:

- "Physical Specifications" on page 14
- "Interfaces" on page 15
- "Power Options / Consumption" on page 16
- "Certifications" on page 16

Table 1 Physical Specifications

Physical Dimensions	Height	Width	Depth
Inches	3.85	13.1	7.91
Centimeters	9.8	33.3	20.1
Weight			
lbs - maximum	9.0	Includes all brackets	
Kg - maximum	6.35		
Temperature	**Min**	**Max**	
AC Powered Operating Range	-40C	70C	
Storage Range	-45C	85C	
Color	Unpainted metal		
Shock and Vibration			
Operational:	MIL-STD 810g		
Transportation:	ISTA 2A Random Bounce Random Vibration 6 Corner Drop Test		

Table 2 Interfaces

Data Interface	Maximum Distance (ft)	Connector
IEEE 802.3 10/100BaseT	1300 (10BaseT Half and Full Duplex Setting)	RJ45
	300 (100BaseT Half and Full Duplex Setting)	

Management Interface	Maximum Distance (ft)	Connector
IEEE 802.3 10/100Base T	1300 (10BaseT Full Duplex Setting)	RJ45
	300 (100BaseT Full Duplex Setting)	

Wireless Interface		
Standard	IEEE 802.11b/g Wi-Fi	
Frequency Range	2400 to 2485 MHz ISM Band	
Modulation	DSSS; DBPSK @ 1 Mbps, DQPSK @ 2 Mbps, CCK @ 5.5 and 11 Mbps OFDM @ 54, 48, 36, 24, 18, 12, 6	
Rx Sensitivity	-100dBm (1 Mbps) -95dBm (2 Mbps) -93dBm (5.5 Mbps) -91dBm (11 Mbps) -94dBm (6 Mbps) -93dBm (9 Mbps) -92dBm (12 Mbps) -89dBm (18 Mbps) -86dBm (24 Mbps) -83dBm (36 Mbps) -78dBm (48 Mbps) -76dBm (54 Mbps)	

Table 2 Interfaces (*continued*)

Rx Saturation	-5dBm (1 Mbps)
Maximum Power at Antenna Port	-5dBm (2 Mbps)
	-5dBm (5.5 Mbps)
	-5dBm (11 Mbps)
	-5dBm (6 Mbps)
	-5dBm (9 Mbps)
	-5dBm (12 Mbps)
	-10dBm (18 Mbps)
	-30dBm (24 Mbps)
	-35dBm (36 Mbps)
	-35dBm (48 Mbps)
	-35dBm (54 Mbps)

Antennas	
Antennas	External
Antenna Diversity	Transmit/Receive
Impedance	50 ohms
VSWR	1.5 : 1
Connectors (two)	N (female)
Indicator - Status Lamp	Red/Green/Blue

Table 3 Power Options / Consumption

DC: 10.0-32.0 VDC	20W/30S typical/max Polarity protected Negative return - common chassis ground	23W/60W	typical/max
Antenna Protection	<= 0.5μJ for 3kA @ 8/20μS Waveform EN61000-4-2 Level 4 ESD Immunity EN61000-4-5 Level 4 Surge Immunity		
Fuse	Automotive mini-blade 32 VDC 7.5A		

Table 4 Certifications

Certifications	
U.S.	CFR 47 FCC Part 15.C; Class B

4 Ordering Information

Table 5 contains ordering information for the Tropos 4210 Mobile MetroMesh router and related equipment. These items can be ordered from Tropos Networks, Inc.

Table 5 Tropos Ordering Information

Part No.	Description
42102100	Tropos 4210 Mobile MetroMesh Router, variable power, N connectors
RC009100	Right angle N-connector adapter: male/female
AN074090	One vehicle mounted 7.4dBi omni antenna and cable kit
AN074091	One vehicle magnetic mounted 7.4dBi omni antenna and cable kit
AN074095	One vehicle mounted 7.4dBi omni antenna (cable kit not included)
AN050090	One vehicle mounted 5.0dBi omni antenna and cable kit
AN050091	One vehicle magnetic mounted 5.0dBi omni antenna and cable kit
AN050095	One vehicle mounted 5.0dBi omni antenna (cable kit not included)
GR000350	Vehicle mounted GPS receiver with USB interface and cable
PS024002	24Vdc AC/DC power supply with adapter cable
Littlefuse 297010 or equivalent	ATO-mini fuse, 32Vdc 7.5A

5 Antenna Accessories

Table 6 contains accessory ordering information for mobile antennas:

Table 6 Mobile Antenna Accessories

Part Number	Description	Supplier
SF-245SPR	7.4dBi mobile antenna, N connector, black	www.cometantenna.com
MG-4N	Magnetic mount - N for 7.4dBi mobile antenna	www.cometantenna.com
5D4N	Bulkhead mount for 7.4dBi mobile antenna	www.cometantenna.com

Acronyms

The following acronyms are used in this document.

Table 7 Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
AWG	American Wire Gauge
C	Celsius
CAT	Category
CCK	Complementary Code Keying
CE	Conformite Europeene
CFR	Code of Federal Regulations
CISPR	International Special Committee on Radio Interference
CSA	Canadian Standard Association
dB	Decibels
dBi	Decibels Relative to an Isotropic Radiator
dBm	Decibels Referred to 1 Milliwatt
DBPSK	Differential-Binary Phase-Shift Keying
DC	Direct Current
DGT	Directorate General of Telecommunications (Taiwan)
DQPSK	Differential-Quadrature Phase-Shift Keying
DSSS	Direct-Sequence Spread Spectrum
EFT	Electrically Fast Transients

Table 7 Acronyms (*continued*)

EMC	Electromagnetic Compatibility
EN	IEC standard
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	Hertz
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP67	Ingress Protection Standard
ISM	Instrumentation, Scientific, and Medical band
ISTA	International Safe Transit Association
LAN	Local Area Network
Mbps	Megabits Per Second
MHz	Megahertz
MIL-STD	Military Standard
MPHPT	Ministry of Public Management, Home Affairs, Posts and Telecommunications (Japan)
N	Neutral
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NMEA	National Marine Electronics Association
OFDM	Orthogonal Frequency Division Multiplexing
RJ45	Registered Jack 45
RSS	Received Signal Strength
Rx	Receive
RXD	Receive Data
TUV	Technical Inspection Association

Table 7 Acronyms (*continued*)

Tx	Transmit
TXD	Transmit Data
UL	Underwriters' Laboratories
UPS	Uninterruptible Power Supply
VAC	Voltage (Alternating Current)
VCCI	Voluntary Control Council for Interference (Japan)
VDC	Voltage (Direct Current)
VSWR	Voltage Standing Wave Ratio
W	Watts

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