Cambium Networks™

USER GUIDE

TD-90 Series

Accuracy

While reasonable efforts have been made to assure the accuracy of this document, Cambium Networks assumes no liability resulting from any inaccuracies or omissions in this document, or from use of the information obtained herein. Cambium reserves the right to make changes to any products described herein to improve reliability, function, or design, and reserves the right to revise this document and to make changes from time to time in content hereof with no obligation to notify any person of revisions or changes. Cambium does not assume any liability arising out of the application or use of any product, software, or circuit described herein; neither does it convey license under its patent rights or the rights of others. It is possible that this publication may contain references to, or information about Cambium products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that Cambium intends to announce such Cambium products, programming, or services in your country.

Copyrights

This document, Cambium products, and 3rd Party software products described in this document may include or describe copyrighted Cambium and other 3rd Party supplied computer programs stored in semiconductor memories or other media. Laws in the United States and other countries preserve for Cambium, its licensors, and other 3rd Party supplied software certain exclusive rights for copyrighted material, including the exclusive right to copy, reproduce in any form, distribute and make derivative works of the copyrighted material. Accordingly, any copyrighted material of Cambium, its licensors, or the 3rd Party software supplied material contained in the Cambium products described in this document may not be copied, reproduced, reverse engineered, distributed, merged or modified in any manner without the express written permission of Cambium. Furthermore, the purchase of Cambium products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Cambium or other 3rd Party supplied software, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.

Restrictions

Software and documentation are copyrighted materials. Making unauthorized copies is prohibited by law. No part of the software or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of Cambium.

License Agreements

The software described in this document is the property of Cambium and its licensors. It is furnished by express license agreement only and may be used only in accordance with the terms of such an agreement.

High Risk Materials

Cambium and its supplier(s) specifically disclaim any express or implied warranty of fitness for any high-risk activities or uses of its products including, but not limited to, the operation of nuclear facilities, aircraft navigation or aircraft communication systems, air traffic control, life support, or weapons systems ("High Risk Use").

This product is not restricted in the EU. Any High Risk is unauthorized, is made at your own risk and you shall be responsible for any and all losses, damage or claims arising out of any High-Risk Use.

Contents

Overview

This document provides pre-configuration set-up and operational instructions for the Cambium TD-90 antenna positioner. The positioner is designed to work with Cambium based Point to Point and point to multi-point solutions. This manual uses the Cambium PTP 700 series with integrated antenna to illustrate setup and operation.

Pinch point hazard: The TD-90 antenna positioner has potential pinch points while the system is in operation.

Do not install antenna aperture sizes that exceed 3 feet in diameter. The positioner is designed to handle any commercial antenna with a solid panel and surface area of 3 feet high by 3 feet wide or a 3-foot round diameter. Consult Cambium for aperture sizes greater than these dimensions.

Overview and TD-90 modes of operation

The TD-90 has three modes of operation identified as Mode 1, Mode 2, and Mode 3. All three modes provide automated alignment and require different levels of configuration. The TD-90 software is designed to default to Mode 3 if mode 1 is not defined and use mode 2 if GPS targeting data is available. A high-level description is provided below followed by a step by step walk through of each mode.

Mode 3 (Default): Sweep to acquire, followed by Scan Align, followed by step peak to optimize. This acquisition is done with no aid from GPS or Compass inputs.

Mode 2 (If GPS is available): Sweep to acquire, followed by Master/Slave sharing of GPS location (over the link), and followed by on board compass point based on GPS location, followed by Scan Align, followed by step peak to optimize. This mode uses on board GPS and compass to aid and tries to reduce Scan Align time.

Mode 1 (requires additional user input): Mode one allows for user input of target latitude, longitude, and altitude. If the user knows exactly where the two end points are located they may be entered and stored in the system. The TD-90 will then start up and read its onboard GPS for its current location and use the stored target latitude, longitude, and altitude to point. Once the initial pointing is done the system will still go through a narrower scan align and final step peak process to optimize. This mode uses the pre-determined target to remove the Sweep to acquire and minimize Scan align time.

Mode 3 operation (Default)

The TD-90 on power up will wait for a connection to a Cambium Radio. Once a connection is made between the TD-90 and Cambium radio, the TD-90 will begin a 360° sweep to acquire. The TD-90 will continue searching for another Cambium radio over the air. During the sweep to acquire process the radios are in the highest transmit power and lowest modulation rate. This process to establish an initial link can take between 2 to 15 minutes once both sides have been installed and powered up.

Once the radios establish any link and identify each other as the proper “Link Name” both TD-90 positioners immediately stop. The Cambium radios during configuration have been set to a “Master” and a “Slave” assignment. Each TD-90 is determined to be either a master or a slave by reading the radio attached locally to identify if it is the “Master” or “Slave” positioner.

- **Master and Slave scan and peak assignments:** The TD-90 connected to the Cambium radio which is assigned to be the “Master” is in control of the link and assigns both positioners a time to scan align and peak.
- **Master 1 Scan Align:** Full 360° scan with 5° steps and 5 second dwell time. The Master records signal strength levels at all 72 steps and returns to the highest recorded level.
- **Slave 1 Scan Align:** Waits for Master command to move, Full 360° scan with 5° steps and 5 second dwell time. The Slave records signal strength levels at all 72 steps and returns to the highest level recorded. Reports scan complete back to master.
- **Master 2 Scan Align:** 180° scan with 5° steps and 5 second dwell time. Master records signal level at each step returns to the highest recorded level.
- **Slave 2 Scan Align:** Waits for Master command to move, 180° scan with 5° steps and 5 second dwell time. Slave records signal level at each step returns to the highest recorded level. Reports scan complete back to master.
- **Master 1 peak:** Master 1 performs first step peak function.

- **Slave 1 peak:** Waits for Master command to move, performs first step peak function, reports peak complete back to master.
- **Master 2 peak:** Master performs final step peak function.
- **Slave 2 peak:** Waits for Master command to move, performs second step peak function, reports peak complete back to master.

Mode 2 operation

Mode 2 is identical at start up as mode 3. Each positioner sweeps to acquire until a radio link is established. The radios are both set to highest power and lowest modulation rate. Once the initial link is in place, each side requests GPS status of the opposite end. If both sides determine they have valid GPS then the unit will automatically enter into mode 2. If not the link acquistion will default back to mode 3 operation.

If GPS is valid enter Mode 2

The Master and Slave TD-90 positioners exchange coordinates by reading the on-board GPS sensor and passing it to the opposite end. Both sides then calculate a heading and use the on board compass sensor to point. The master coordinated scan align and peak process now begin.

- **Master 1 Scan Align:** 90° scan with 5° steps and 5 second dwell time. The Master records signal strength levels at all 18 steps and returns to the highest recorded level.
- **Slave 1 Scan Align:** Waits for Master command to move, 90° scan with 5° steps and 5 second dwell time. The Slave records signal strength levels at all 18 steps and returns to the highest level recorded. Reports scan complete back to master.
- **Master 2 Scan Align:** 45° scan with 5° steps and 5 second dwell time. Master records signal level at each step returns to the highest recorded level.
- **Slave 2 Scan Align:** Waits for Master command to move, 45° scan with 5° steps and 5 second dwell time. Slave records signal level at each step returns to the highest recorded level. Reports scan complete back to master.
- **Master 1 peak:** Master 1 performs first step peak function.
- **Slave 1 peak:** Waits for Master command to move, performs first step peak function, reports peak complete back to master.
- **Master 2 peak:** Master performs final step peak function.
- **Slave 2 peak:** Waits for Master command to move, performs second step peak function, reports peak complete back to master.

Mode 1 operation

Mode 1 requires that the operator know the target end location prior to deployment. The target end latitude, longitude, and altitude must be entered into the TD-90 set-up page and saved.

If TD-90 is set to Mode 1 operation

The Master and Slave TD-90 positioners on power up will read on board GPS and calculate a heading based on the stored target end coordinates. The TD-90 will then use on board compass to point at the calculated heading. The master coordinated scan align and peak process now begin.

- **Master 1 Scan Align:** 90° scan with 5° steps and 5 second dwell time. The Master records signal strength levels at all 18 steps and returns to the highest recorded level.
- **Slave 1 Scan Align:** Waits for Master command to move, 90° scan with 5° steps and 5 second dwell time. The Slave records signal strength levels at all 18 steps and returns to the highest level recorded. Reports scan complete back to master.
- **Master 2 Scan Align:** 45° scan with 5° steps and 5 second dwell time. Master records signal level at each step returns to the highest recorded level.
- **Slave 2 Scan Align:** Waits for Master command to move, 45° scan with 5° steps and 5 second dwell time. Slave records signal level at each step returns to the highest recorded level. Reports scan complete back to master.
- **Master 1 peak:** Master 1 performs first step peak function.
- **Slave 1 peak:** Waits for Master command to move, performs first step peak function, reports peak complete back to master.
- **Master 2 peak:** Master performs final step peak function.
- **Slave 2 peak:** Waits for Master command to move, performs second step peak function, reports peak complete back to master.

TD-90 Pre-Configuration

The TD-90 is designed to be pre-configured before deployment to allow for auto acquisition once installed in the field. Follow the steps outlined in this section to pre-configure your TD-90 for deployment.

Pre-Config requirements Mode 2/3 (Default mode)

Prerequisite for operation

- **TD-90:** Mode 2 and 3 operation requires that a user enters the IP address of the Cambium Radio into the TD-90 setup page.
- **Cambium Radio:** The Cambium radios must be configured as a pair with the same “Link Name” and a “Master and “Slave” assignment of the radio pair.

Pre-Config requirements Mode 1

Prerequisite for operation

- **TD-90:** Mode 1 operation requires that a user enters the IP address of the Cambium Radio into the TD-90 setup page as well as provide the target Latitude, Longitude, and Altitude of the distant end radio. This mode should only be used if the deployment of the positioners at each end is well understood.
- **Cambium Radio:** The Cambium radios must be configured as a pair with the same “Link Name” and a “Master and “Slave” assignment of the radio pair.

Pre-Config instructions for Modes 1, 2 and 3

Follow the step by step instructions in this section to successfully setup a TD-90 antenna positioner.

Step 1

Connect a TD-90, PoE power supply injector, and Laptop as outline in the four steps below and shown in figure Step 1 - Setup of TD-90 to pre-configure .

1. Connect the range cable to the TD-90
2. Connect the other end labeled “TD-90” to the “ODU” port of the Power Injector
3. Plug the LAN side of the Power injector into a laptop
4. Plug the Power Injector into an AC or DC source to power the TD-90. You will see the orange and Green LED’s light up to indicate the unit is powered.

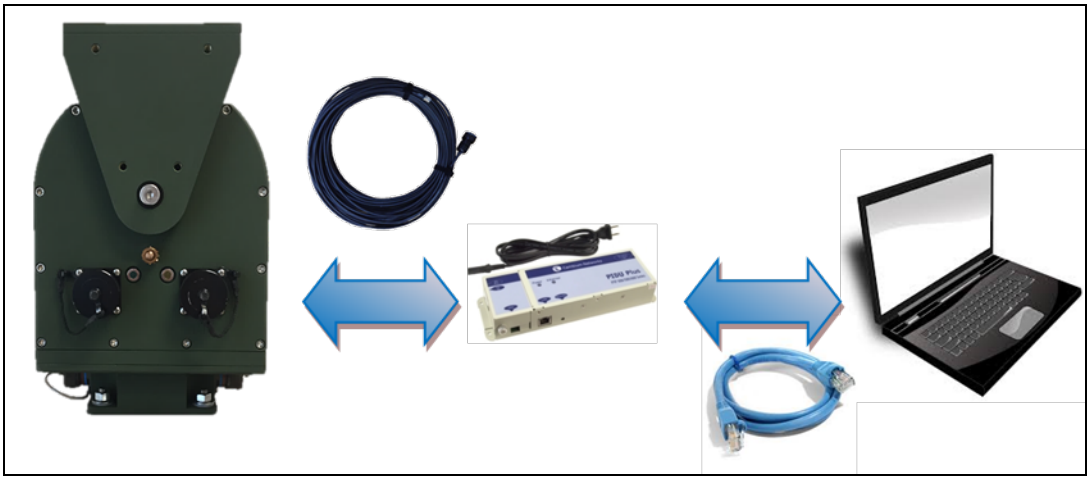


Figure 1 : *Step 1 - Setup of TD-90 to pre-configure*

Step 2

Using a Laptop computer, open your **Network and Sharing Center** as shown below and select **Change adapter settings** on the upper left-hand side as highlighted below.

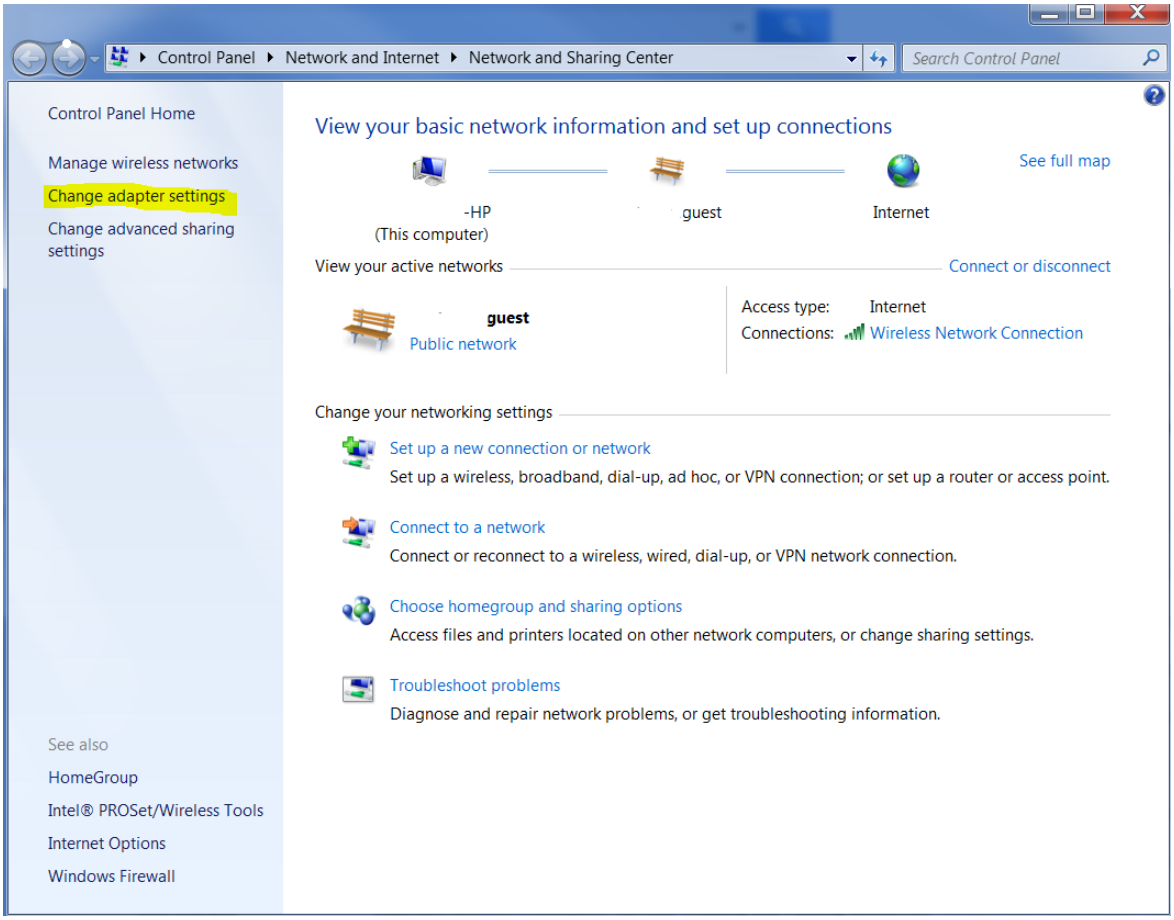


Figure 2 : *Step 2 - Change adapter settings*

Step 3

Select **Local Area Connection** as highlighted below.

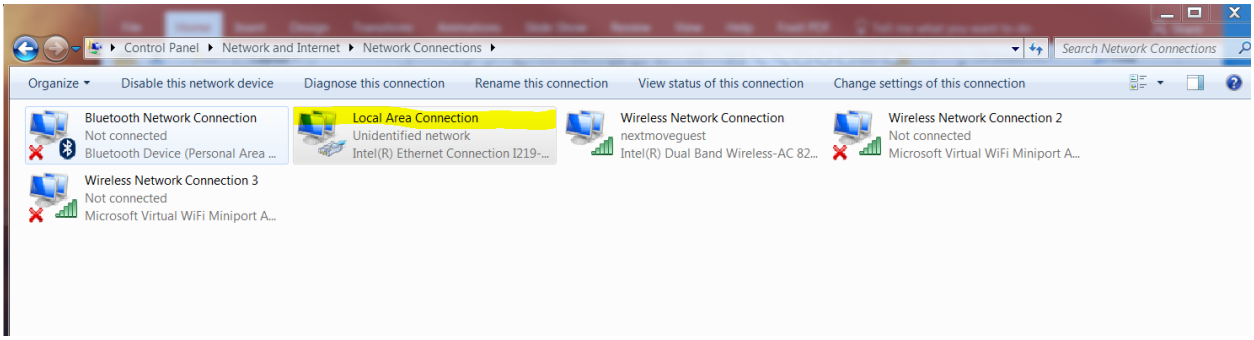


Figure 3 : *Step 3 - Local Area Connection*

Step 4

Select **Properties** as highlighted below

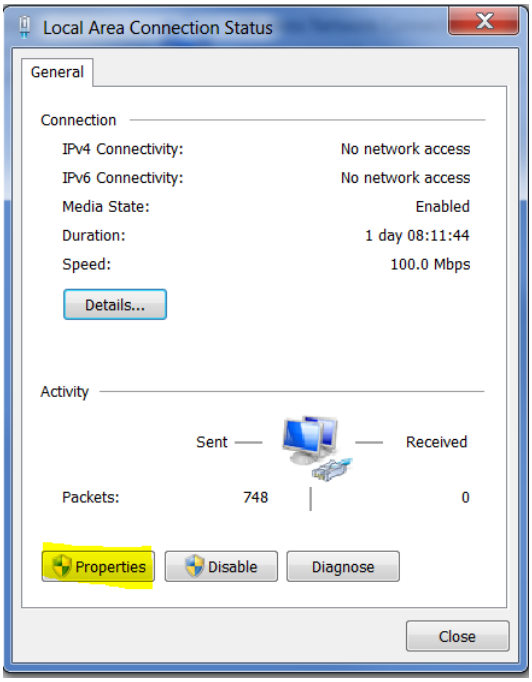


Figure 4 : *Step 4 - Select "Properties"*

Step 5

Select **Internet Protocol Version 4 (TCP/IPv4)** by doubling clicking over it (as highlighted below)

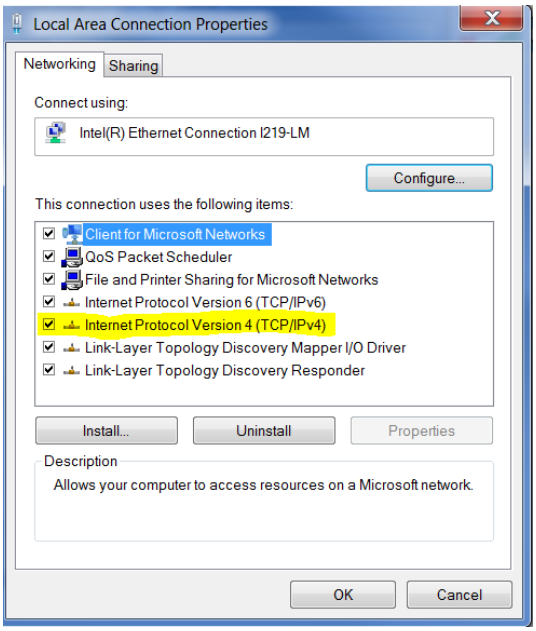


Figure 5 : *Step 5 - Select Internet Protocol Version 4 (TCP/IPv4)*

Step 6

1. Select **Use the following IP address**.
2. Assign your computer a 169.254.1.102 IP address and a subnet mask of 255.255.255.0 as shown below.
3. Click **OK** after complete and close all network windows.

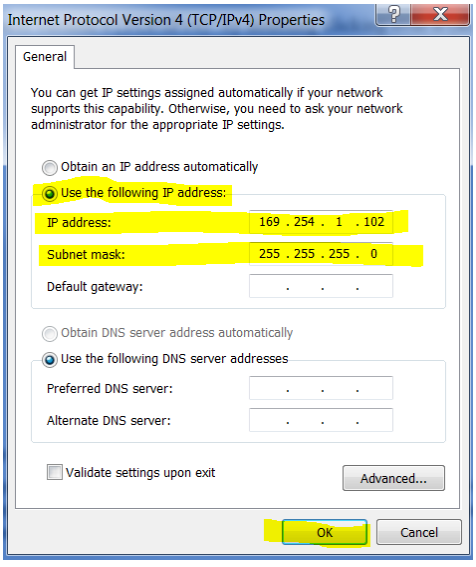


Figure 6 : *Step 6 - IP and Subnet Mask Settings*

Step 7

Open a Google Chrome or Mozilla Firefox browser and type the **default IP address 169.254.1.245** and the TD-90 home page will open to the System Summary.

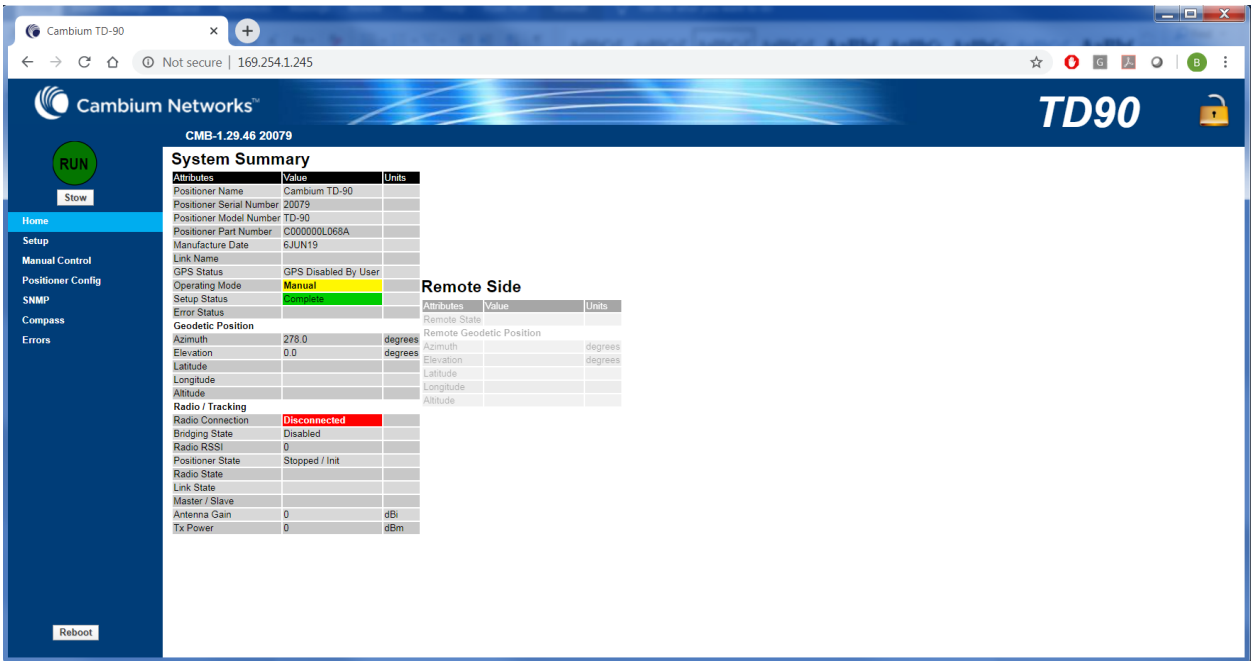


Figure 7 : *Step 7 - Home page with System Summary*

Step 8

Select **Setup** on the left side menu to display the **System Setup** table.

Here you may change the TD-90 default IP address, subnet Mask, and Gateway.

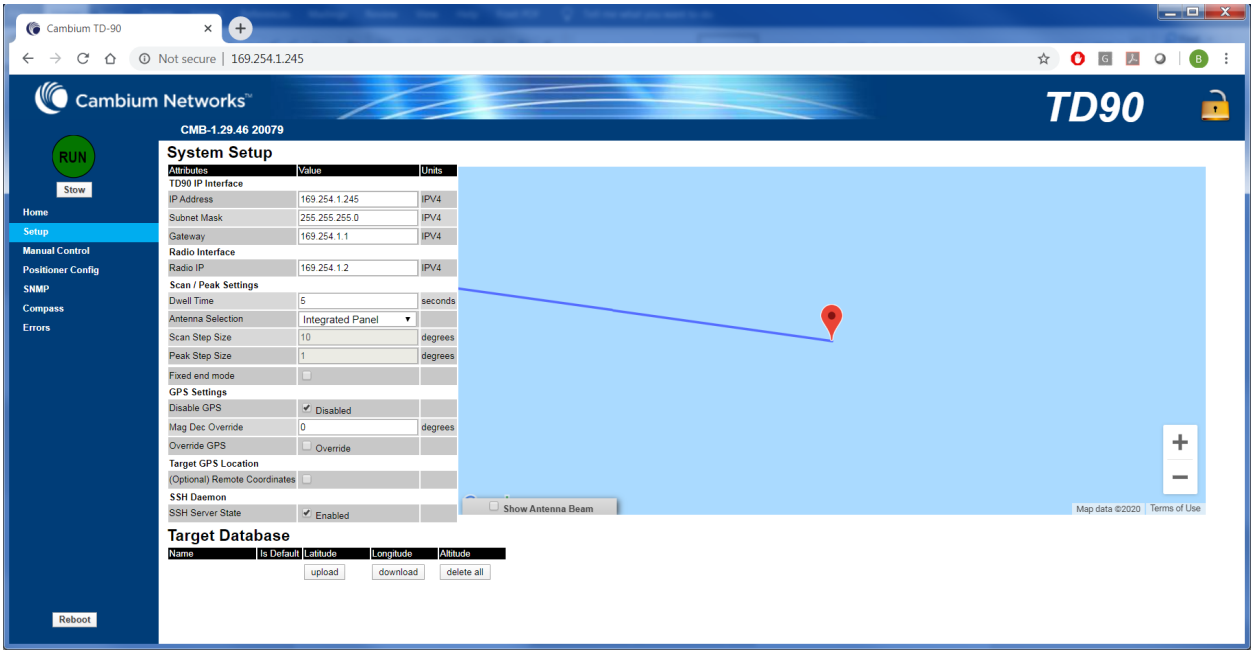
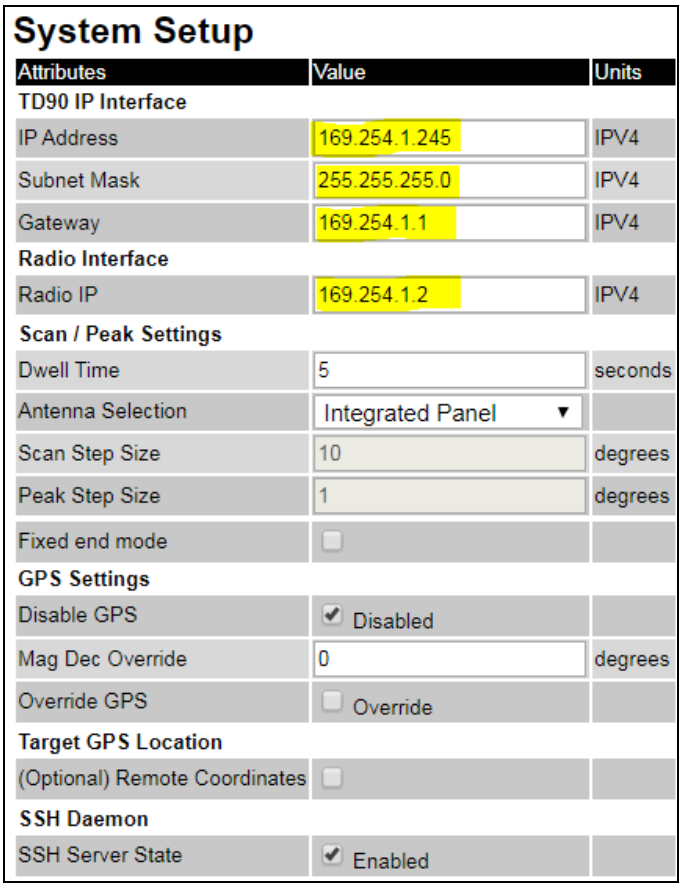


Figure 8 : *Step 8 - System Setup page*

Step 9

For Mode 2 and 3 operations, enter in a valid IP Address, Subnet Mask, Gateway for the TD-90. Followed by the IP address for the radio. Example shown below identifies the 4 fields.



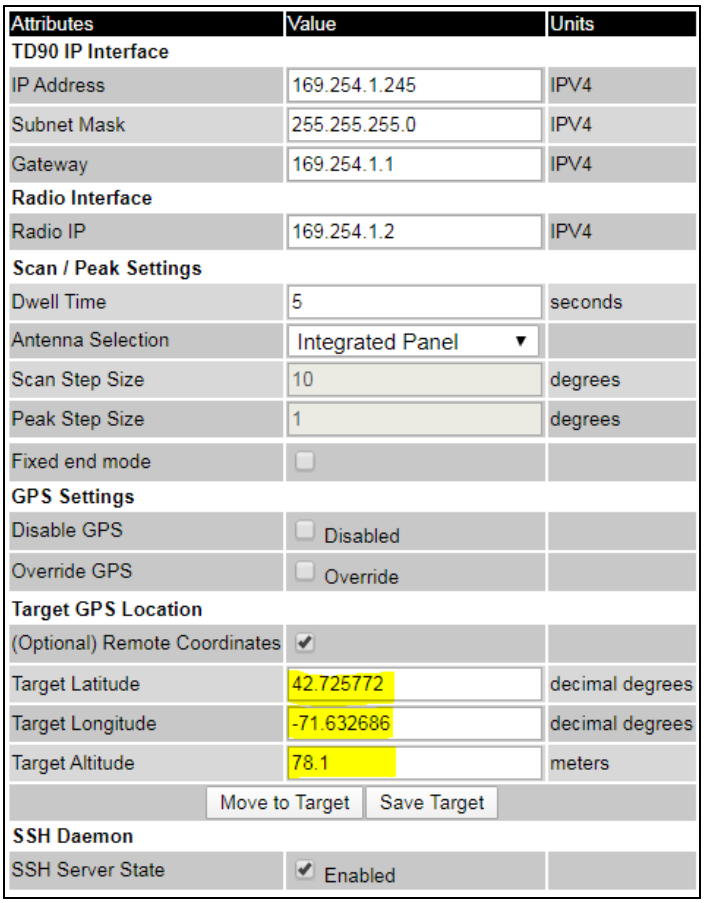
System Setup

Attributes	Value	Units
TD90 IP Interface		
IP Address	169.254.1.245	IPV4
Subnet Mask	255.255.255.0	IPV4
Gateway	169.254.1.1	IPV4
Radio Interface		
Radio IP	169.254.1.2	IPV4
Scan / Peak Settings		
Dwell Time	5	seconds
Antenna Selection	Integrated Panel ▼	
Scan Step Size	10	degrees
Peak Step Size	1	degrees
Fixed end mode	☐	
GPS Settings		
Disable GPS	☑ Disabled	
Mag Dec Override	0	degrees
Override GPS	☐ Override	
Target GPS Location		
(Optional) Remote Coordinates	☐	
SSH Daemon		
SSH Server State	☑ Enabled	

Figure 9 : *Step 9 - Mode 2 and 3 setup requirements*

Step 10 (Optional Mode 1 setup)

Mode 1 operation requires entry of Remote Coordinates. Under System Setup check the box marked "(Optional) Remote Coordinates". Enter in the Target Latitude, Target Longitude, and Target Altitude as highlighted below. Once entered press the "Save Target Location" button to store the target.



Attributes	Value	Units
TD90 IP Interface		
IP Address	169.254.1.245	IPV4
Subnet Mask	255.255.255.0	IPV4
Gateway	169.254.1.1	IPV4
Radio Interface		
Radio IP	169.254.1.2	IPV4
Scan / Peak Settings		
Dwell Time	5	seconds
Antenna Selection	Integrated Panel ▼	
Scan Step Size	10	degrees
Peak Step Size	1	degrees
Fixed end mode	☐	
GPS Settings		
Disable GPS	☐ Disabled	
Override GPS	☐ Override	
Target GPS Location		
(Optional) Remote Coordinates	☑	
Target Latitude	42.725772	decimal degrees
Target Longitude	-71.632686	decimal degrees
Target Altitude	78.1	meters
Move to Target / Save Target		
SSH Daemon		
SSH Server State	☑ Enabled	

Figure 10 : *Step 10 - Optional Mode 1 Setup*

Quick steps for deployment

The Quick steps to operation section provides the essential steps to get your TD-90 up an operational. Follow the step by step directions below and refer to the other sections of the manual for a more detailed review of operation.

Step 1 - Mount TD-90 to tower or mast

In most cases your TD-90 will be installed in a link kit which may provide a tool-less installation on a mast or tower. If not, install your TD-90 on a base plate. You may refer to the TD-90 Base mount surface and dimension section for more detail mounting if needed.

Figure 1 : *Step 1 - TD-90 mounted on stand*

Step 2 - Mount TD-90 antenna adapter bracket

Mount the tool-less antenna adapter bracket across the elevation axis as shown and fasten to top plate using captive thumb screws.

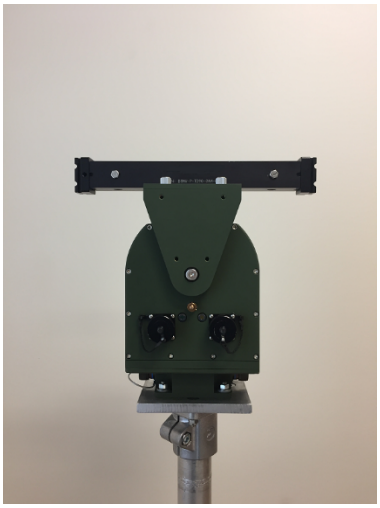


Figure 2 : *Step 2 - TD-90 with antenna adapter bracket*

Step 3 - Mount Cambium Radio

Mount the Cambium Radio to the antenna adapter bracket by sliding the radio adapter end into the antenna mount bracket. Be sure to place the radio on the side marked “Front” and pin the radio to the bracket using the captive pin.

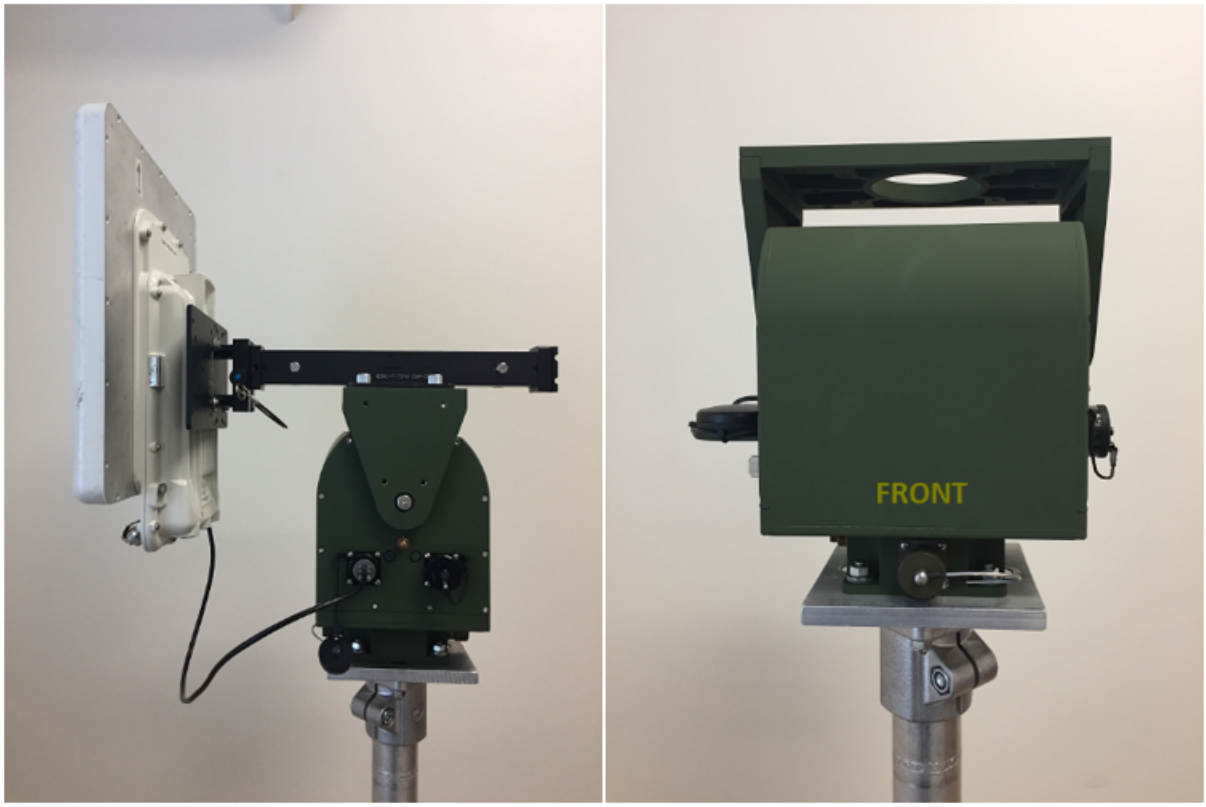


Figure 3 : *Step 3 - TD-90 with antenna adapter bracket and cambium mounted to front*

Step 4 - Connect the Radio to TD-90

Connect the Cambium Radio to the TD-90 using the weather tight Ethernet Connector labeled “PSU”.

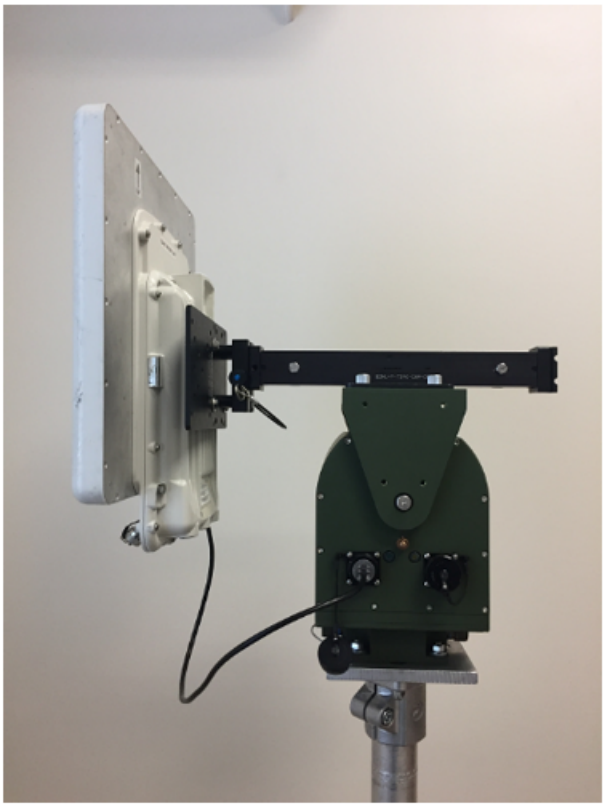


Figure 4 : *Step 4 - TD-90 with Ethernet connected to “PSU”*

Step 5 - Connecting the TD-90 for operation

The following connections outlined below must be in place for proper operation:

- Connection A: **FROM** Cambium Radio **TO** PSU (Completed in step 4)
- Connection B: TD-90 Range cable **FROM** TD-90 **TO** Qty 2 Cambium Power Injector
    - Plug Breakout end of cable labeled “TD-90” into Power Injector port labeled “ODU”
    - Plug Breakout end of cable labeled “PSU” into Power Injector port labeled “ODU”

Note

Plug Cambium Networks Power Injectors into AC or DC source

- Connection C: **FROM** TD-90 Power Injector port labeled “LAN” port **TO** Ethernet switch
- Connection D: **FROM** PSU Power Injector port labeled “LAN” port **TO** Ethernet switch
- Connection E: Connection E is optional for monitoring purposes. **FROM** switch **TO** laptop. If the TD-90 and radio are configured properly then there is no need to connect a laptop for auto link

establishment to take place. See TD-90 Pre-Config instructions for more details.

Figure 5 : *Step 5- From – To connection diagram*

Step 6 - Power Up

Once power is applied at each PoE injector, both the radio and the TD-90 will boot up. An orange LED will indicate link activity between the TD-90 and the radio followed by a solid green LED to indicate the TD-90 controller is up. Once the green LED comes up the TD-90 should start enter the pre-configured mode 1, 2, or 3.

TD-90 Mechanical and Electrical Interfaces

The TD-90 is a two axis mechanical rotating positioner with an embedded controller that communicates with the radio and drives the antenna to automate the process of establishing the line of sight radio link. The TD-90 requires some mechanical and electrical setup in order for this process to be successful. This section details the TD-90 base mount and antenna mount surfaces along with identifying each connector, its purpose, and the individual pinouts.

TD-90 Base Mount Surface and Dimensions

The TD-90 has a 4.25 inch square base plate with 4 equal spaced 0.400 inch through holes. The recommended mounting hardware is 5/16 inch or 8 millimeter bolts. Cambium will often provide additional adapter plates for the specific application such as mast or tower mount kits.

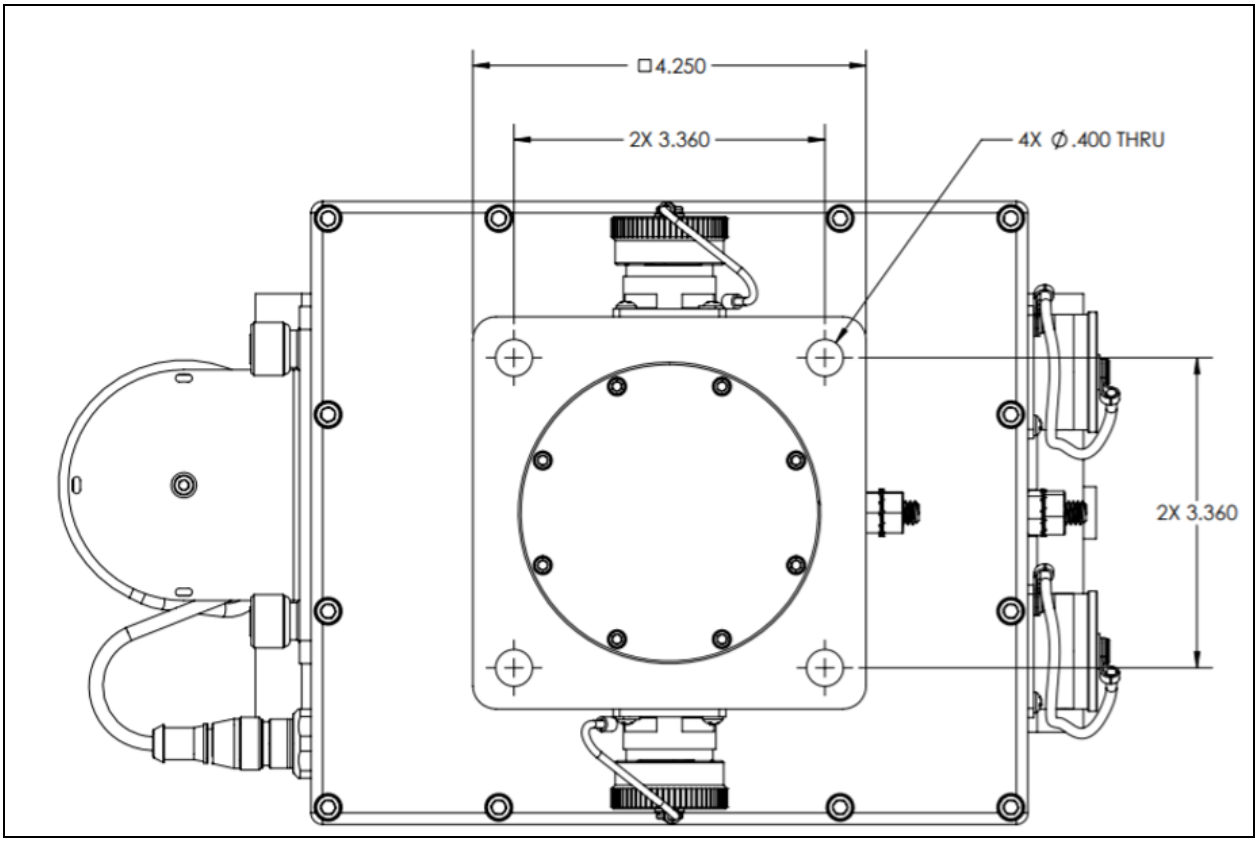


Figure 1 : *Bottom view of TD-90 with dimensioned hole pattern*

Antenna Mount Surface and Dimensions

The TD-90 has an 8.95 inch by 4.75 inch top plate with two hole-patterns and two alignment holes. The inner hole pattern with .250-20 threaded holes is most commonly used with the removable Cambium antenna mount adapter bar. The outer .312-18 threaded hole-pattern provides a secondary mounting surface for future or non-standard antenna mount brackets.

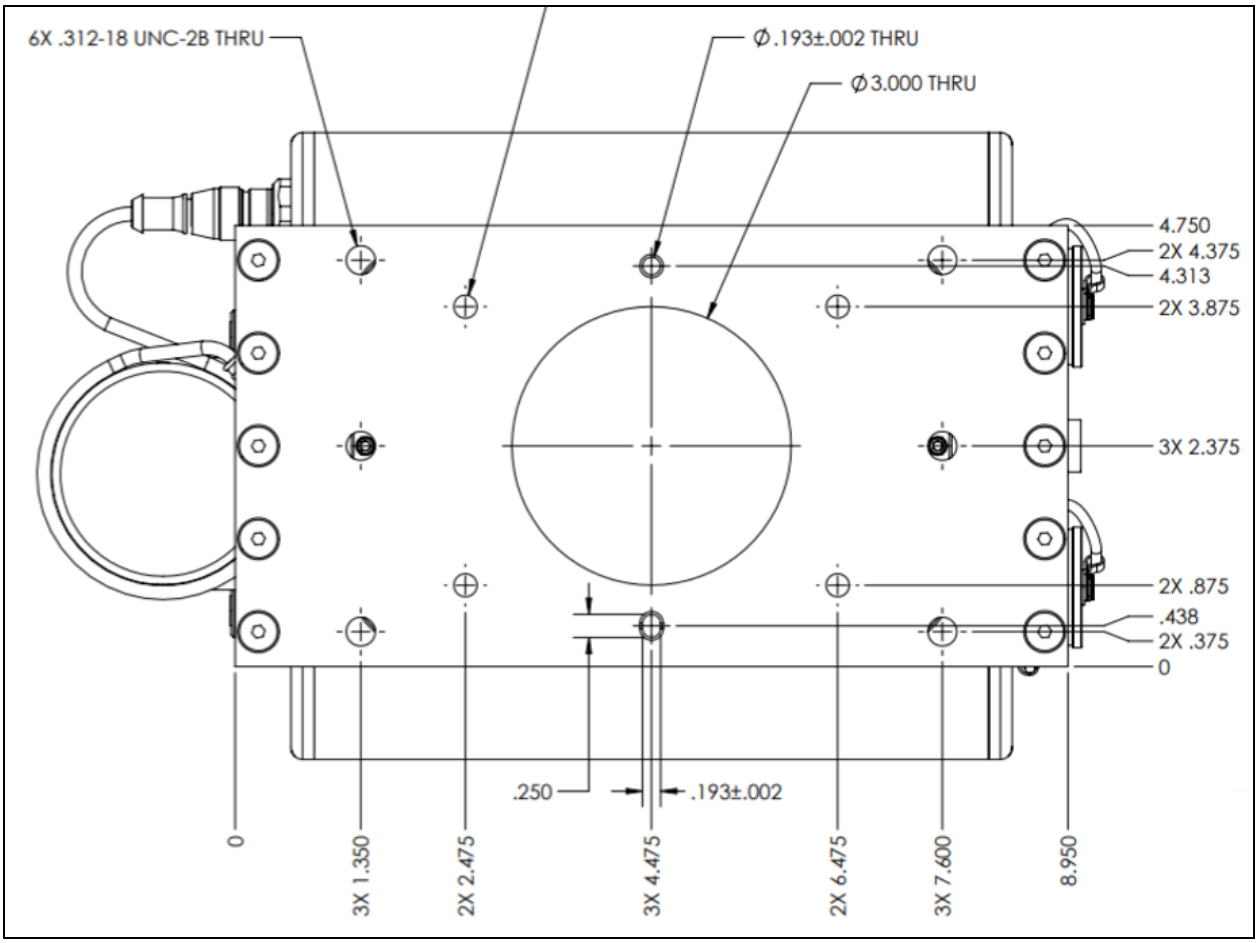


Figure 2 : *Antenna mount surface with dimensioned hole pattern*

TD Interface Details

The images and tables in this section identifies interfaces on all 4 sides of the TD-90.

Front View of TD-90

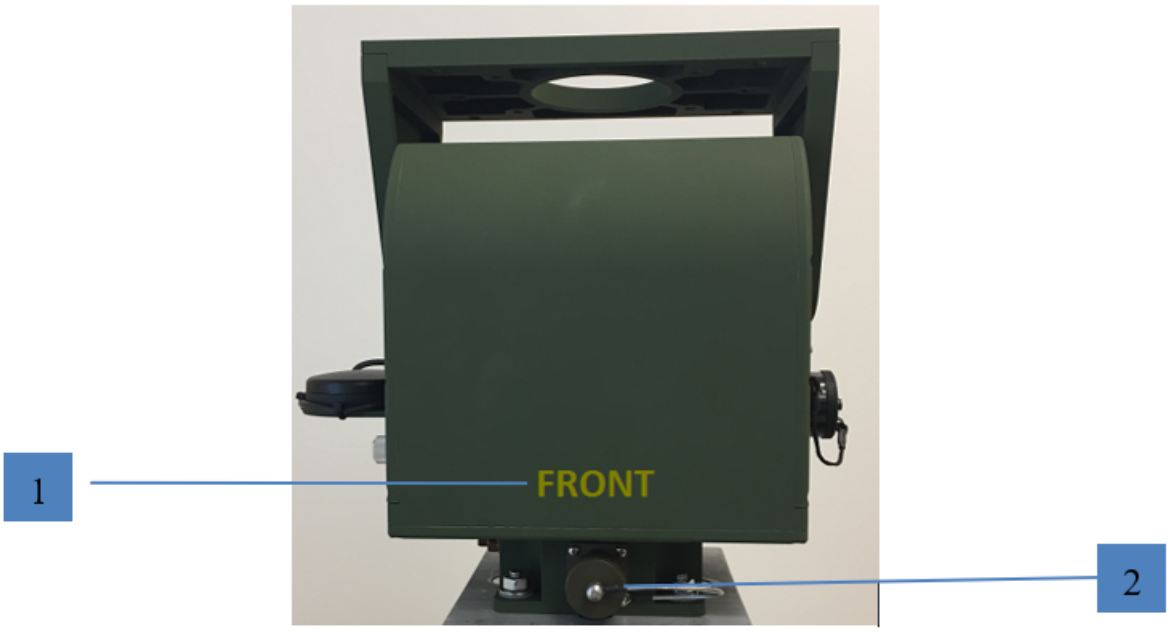


Figure 3 : *Front View of TD-90*

Callout	Description
1	"Front" surface to identify the side the antenna mounts. The TD-90 built in compass is referenced to this surface.
2	Optional DC power input. Accepts 24-52VDC input. 5 Pin male connector part number D38999/20WD5PN. Mating connector is D38999/26WD5SN. Connector pinout is provided below.

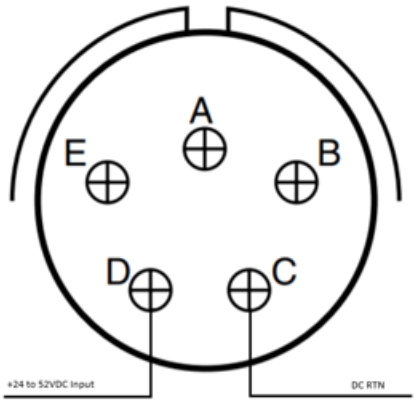


Figure 4 : *Connector Pinout for optional DC power input*

Left Side View of TD-90

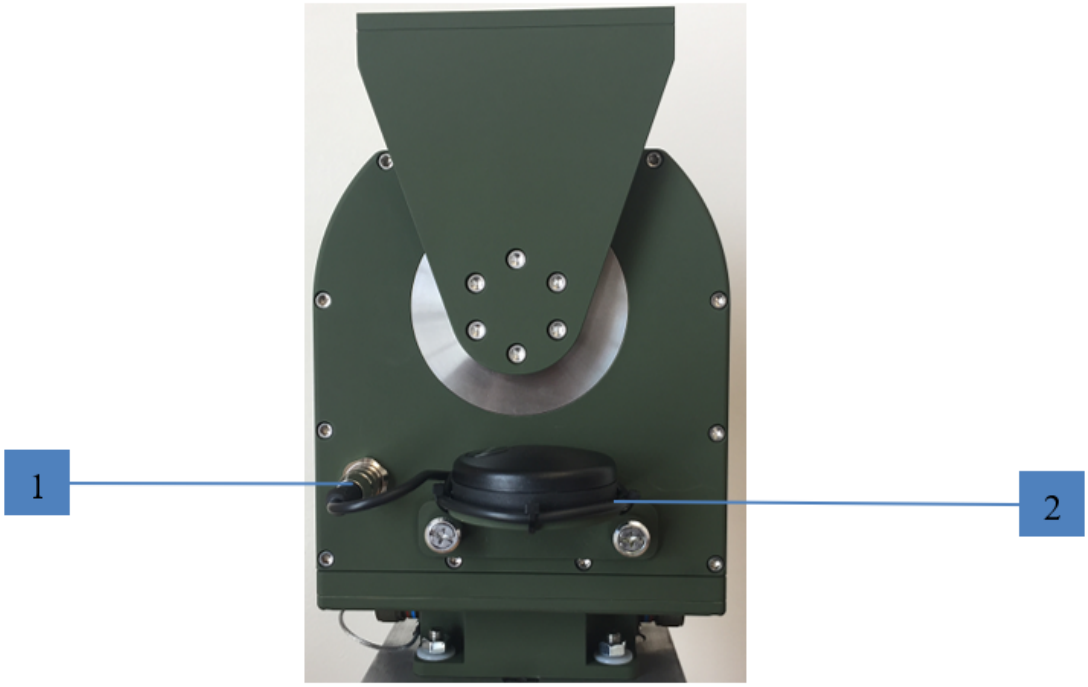


Figure 5 : *Left Side View of TD-90*

Callout	Description
1	GPS Connector. Allows connection to removable GPS provided with the system. Pinout provided below.
2	Removable GPS antenna puck. Provides local coordinates to TD-90 positioner.

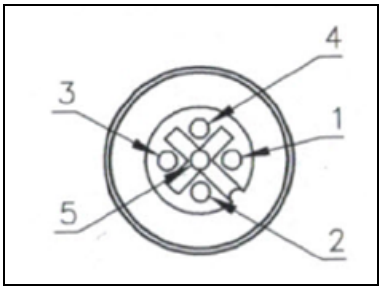
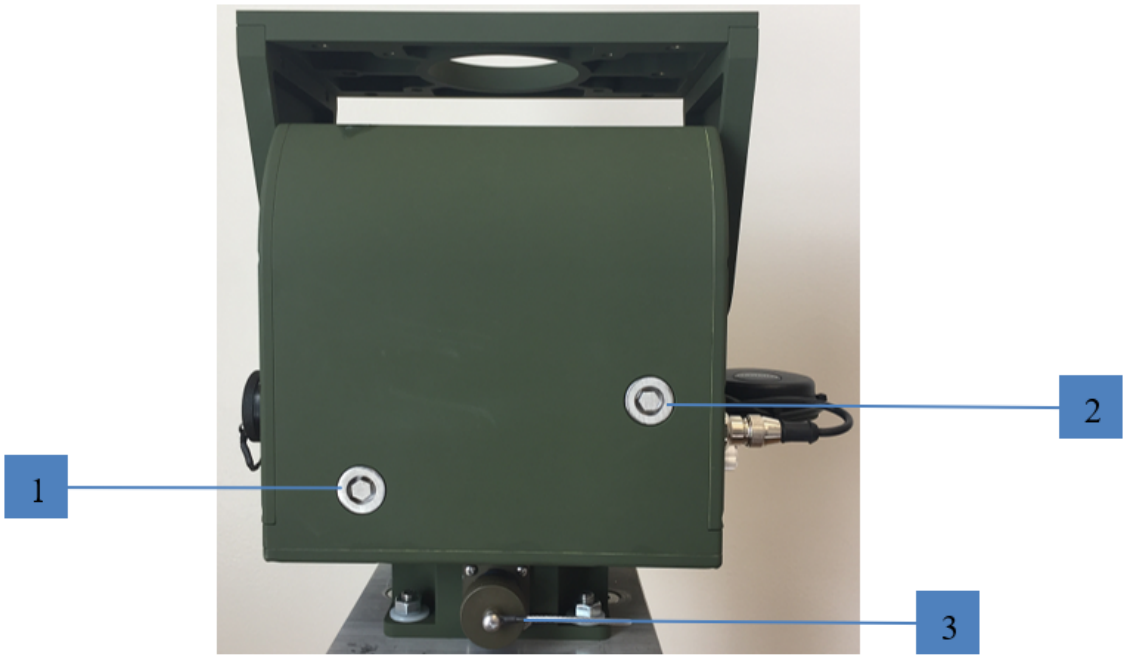


Figure 6 : *Connector Pinout for GPS input*

Pin No.	Description
1	Signal Ground
2	+5VDC power
3	RS-232 Rx
4	RS-232 Tx
5	+12VDC (not used)

Rear View of TD-90



Callout	Description
1	Azimuth manual drive access cap. Requires 5/16 inch socket to remove cap and expose manual drive shaft. 5/16 inch socket also drives the manual shaft.
2	Elevation manual drive access cap. Requires 5/16 inch socket to remove cap and expose manual drive shaft. 5/16 inch socket also drives the manual shaft.
3	TD-90 data and power input. Provides qty 3 Power over Ethernet (PoE) which provide TD-90 power and data, Cambium Radio power and data, and an out of band Cambium Ethernet connection for radios that are managed on a second IP Ethernet port. The pinout for the TD-90 data and power input is provided below.

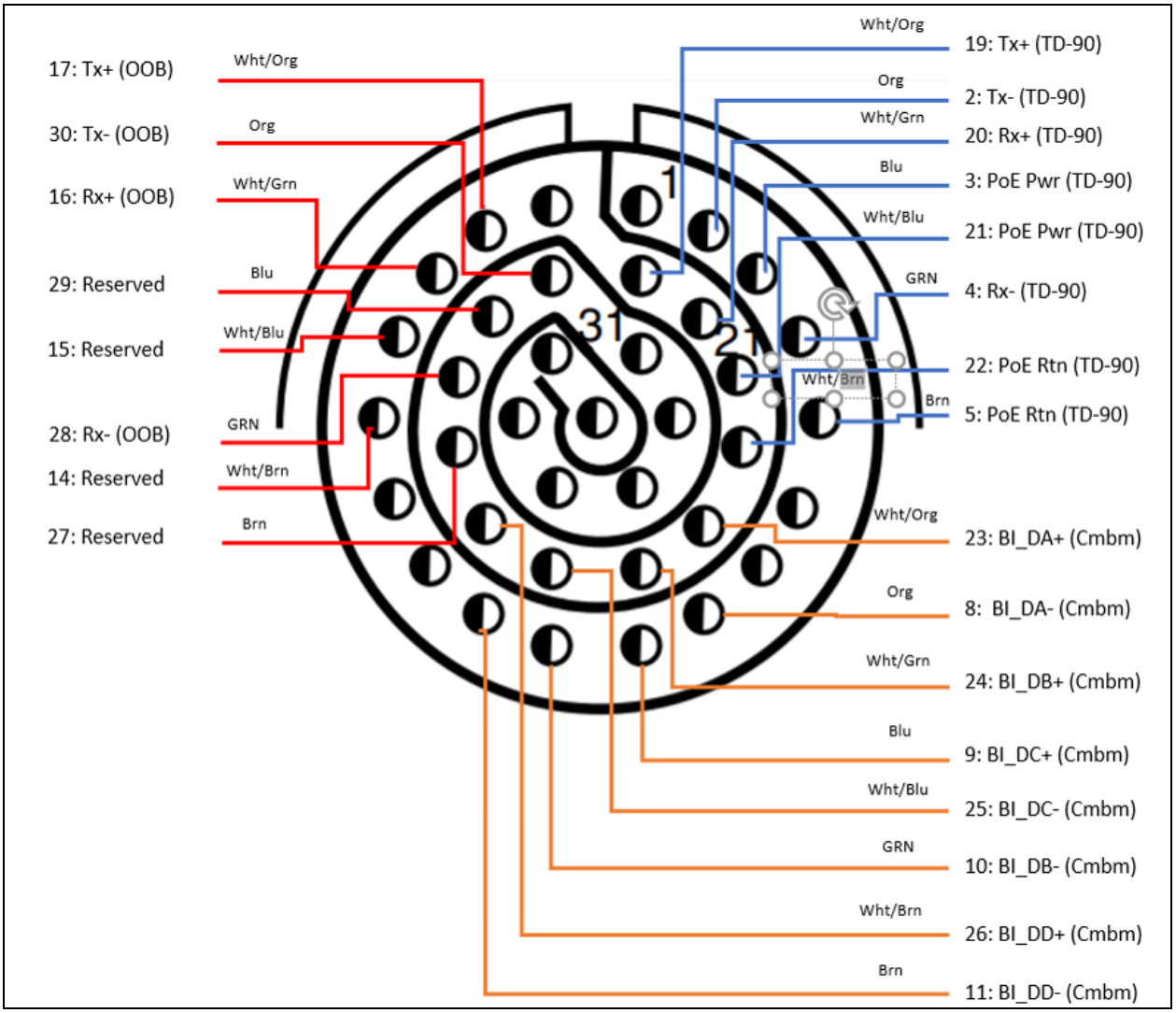
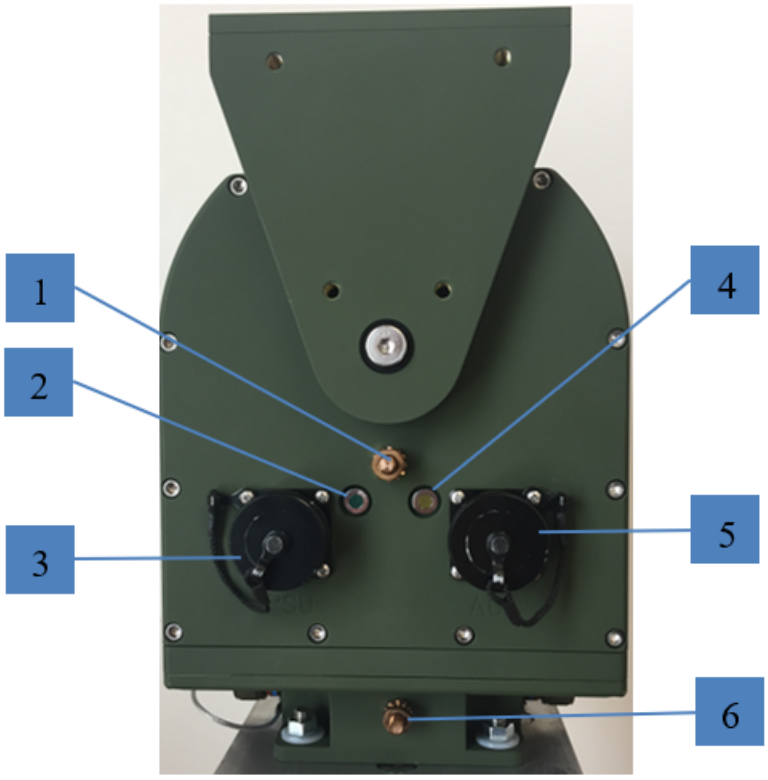


Figure 7 : *Connector Pinout for TD-90 Data and Power input*

Right Side View of TD-90



Callout	Description
1	Upper ground stud. Above azimuth ¼ -20 inch ground stud passes to below azimuth ¼ -20 inch ground stud.
2	Power and Status LED indicator. Solid green = Power on and normal operation, slow blink (2Hz) = waiting for connection to radio, fast blink = Error
3	The Primary S U (PSU) is the Ethernet pass-thru connector for the Cambium radio that provides a connection point for the radio above the azimuth axis of rotation.
4	Link Activity LED. This indicator will come up first during the boot process and begin to blink to indicate Ethernet link activity between the TD-90 and the Radio.
5	AUX out of band Ethernet pass thru. Provides a secondary Ethernet connection to the Cambium radio for users that want to manage the radio on a secondary network.
6	Lower ground stud. Below azimuth ¼ -20 inch ground stud. Tied to upper ground stud and allows Earth ground connection from radio to be passed to the static side of the TD-90.

Pass through Pinouts for PSU Ethernet		
PSU Ethernet Pass-thru (Sealed RJ-45)	TD-90 Data and Power (37 Pin D38999)	Description
1	23	Transmit +
2	8	Transmit -
3	24	Receive +
4	9	PoE 48-56VDC
5	25	PoE 48-56VDC
6	10	Receive -
7	26	PoE Rtn
8	11	PoE Rtn

Pass through Pinouts for AUX Ethernet		
PSU Ethernet Pass-thru (Sealed RJ-45)	**TD-90 Data and Power (37 Pin D38999)**	**Description**
1	17	Transmit +
2	30	Transmit -
3	16	Receive +
4	29	PoE 48-56VDC
5	15	PoE 48-56VDC
6	28	Receive -
7	14	PoE Rtn
8	27	PoE Rtn

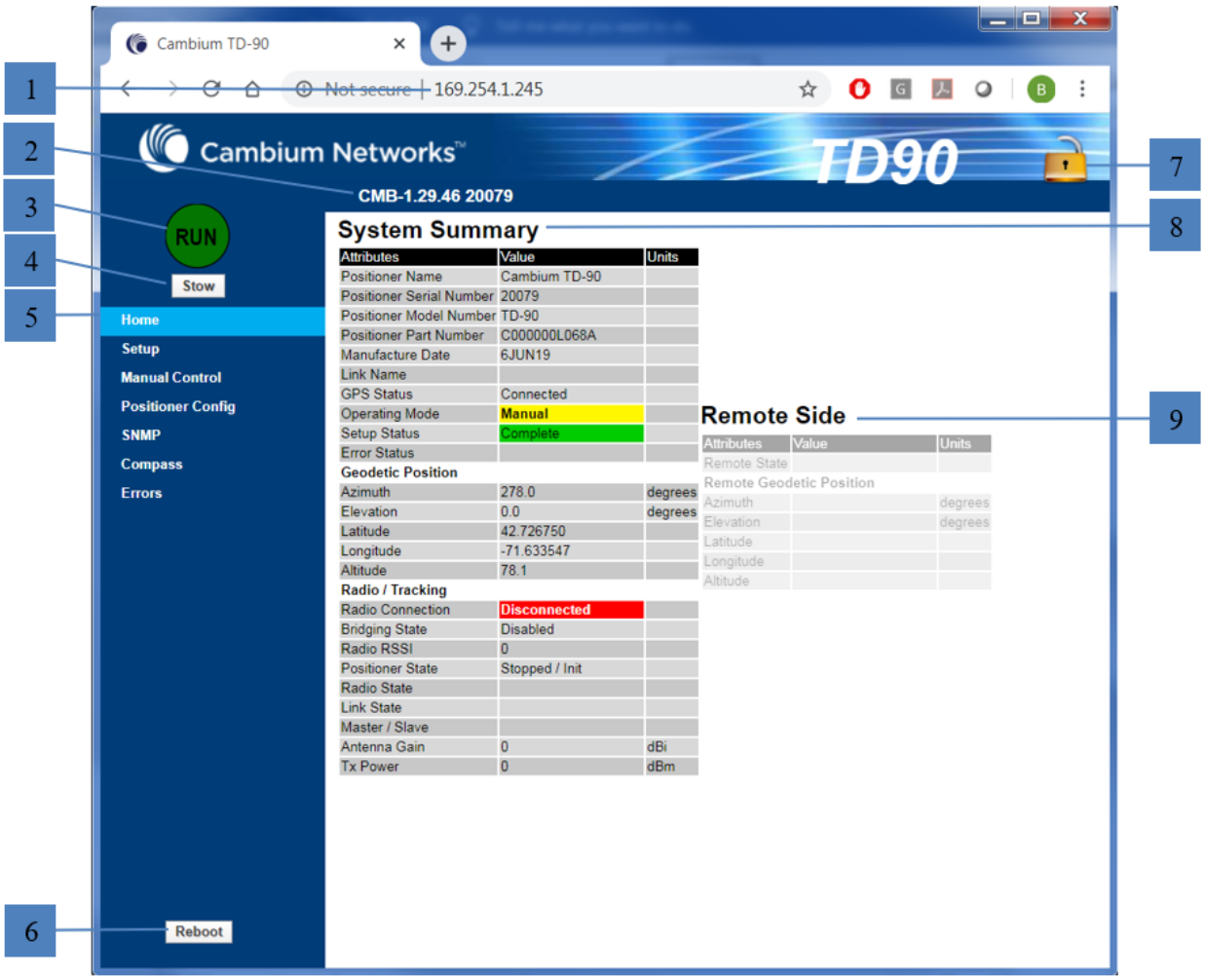
Web Based User Interface

The Cambium Networks TD-90 web based user interface provides control and status pages for a user to pre-configure the system for operation, monitor the system status, and/or perform manual control of the system. This section provides screen shots and details the six available control or status pages on the TD-90 user interface.

TD-90 Home

The TD-90 Home page is the default launch page that will appear after opening a web browser and navigating from the browser window to the TD-90 web hosted control. The default IP address assigned to a TD-90 is 169.254.1.245

The callout's below point to the various controls and status provided on the home page and are described in the table below.



Home Page Descriptions	
Callout	**Description**
1	Default IP address for Cambium TD-90. IP address may be changed on the Setup page
2	Displays the current software revision loaded on the TD-90 embedded controller.
3	The “STOP” button will appear when the system is in a “Run” state. Clicking over the “STOP” button stop the TD-90 from moving. If the “STOP” button is pressed it will be replaced with the “Run”button (shown below). The “RUN” button places the TD-90 back into operation. The positioner will also default back to run with a power cycle. 
4	The “Stow” button will move the positioner to the predetermined stow position. The default stow location is 0° Azimuth and 0° Elevation. The stow location may be changed on the positioner config page
5	Page select menu. Default is Home. The blue bar indicates the current page. Press over and highlight the “Home” “Setup” “Manual Control” “Positioner Config” “Compass” or “Errors” page to navigate between pages.
6	“Reboot” button. The Reboot button forces the TD-90 to reboot the on-board control software.
7	The Lock feature allows the user to lock or unlock the positioner. Pressing over the padlock icon will toggle the postioner between locked and unlocked states. When locked the positioner will not move on startup and will lock the user interface. The lock feature is typically used once a link is established and the operator does not want the positioner to auto acquire on startup. When locked the entire interface is greyed out and unusable. The operator must first unlock positioner before normal operation is restored. 
8	The System Summary Table provides status of the TD-90 positioner, Orientation, and Radio and Tracking status. A separate table is provided below with additional details on the System summary table.

Home Page Descriptions	
Callout	Description
9	The Remote Side table is only active when a radio link is established. The remote side table provides details of the TD-90 and radio on the opposite end of the link. A separate table is provided below with additional details on the Remote Side table.

System Summary	
Attributes	**Description**
Positioner Name	TD-90 positioner may be named to identify as a unique name. The TD-90 may be named under the Positioner Config page under “Unit Name”
Positioner Serial Number	Identifies the unique serial number assigned to the TD-90
Positioner Model Number	Displays Cambium model number
Positioner Part Number	Displays Cambium part number
Manufacturer Date	Displays manufacturer date of positioner by day, month, year. Example 6JUN19 is the 6th of June 2019.
Link Name	This field is populated by the Cambium radio and will display the link name assigned to the radio
GPS Status	Provides connection status to the GPS puck.
Operating Mode	Provides the current operating mode of the TD-90
Setup Status	Provides status of the setup page. The status will read “Complete” if a minimum of a Radio IP address is entered.
Error Status	Display’s an error code should the unit enter an error state. Error status is also visually displayed on the “Errors” page
Geodetic Position	
Azimuth	Displays the TD-90’s Azimuth angle is Geodetic frame which is the TD-90’s Azimuth with reference to true north.
Elevation	Displays the TD-90’s Elevation angle with reference to Geodetic frame (330 from Horizon)

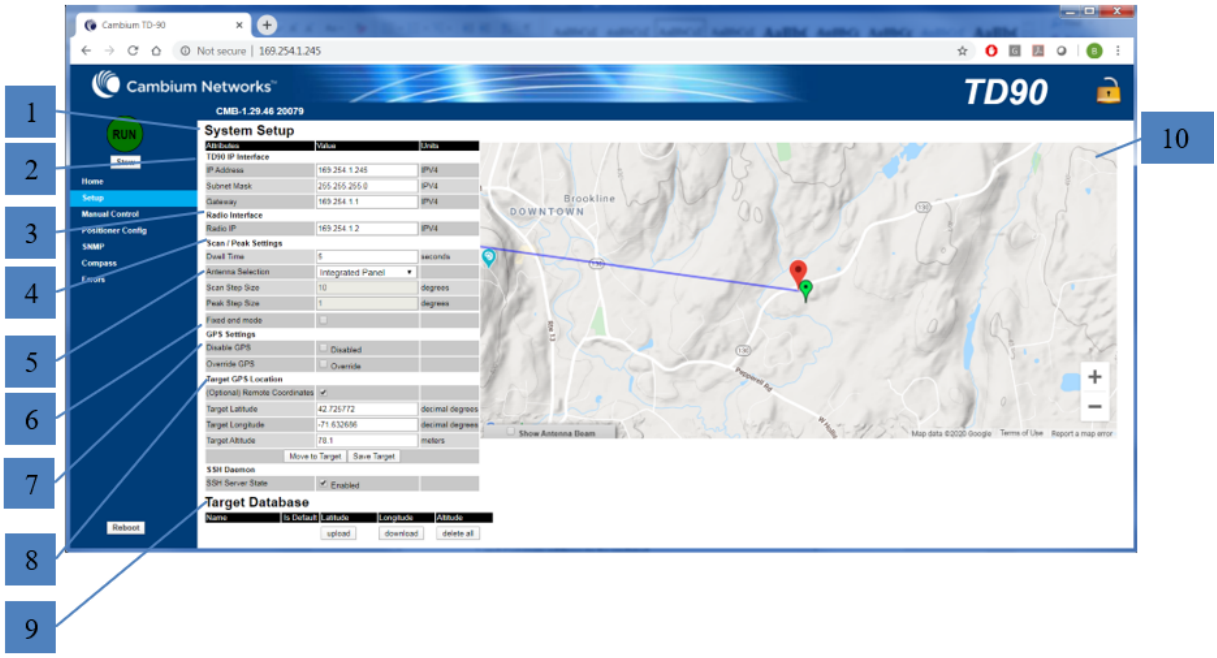
System Summary	
Attributes	**Description**
Latitude	Displays current angular distance North or South of the earths equator. North of equator = Positive and South of equator = Negative
Longitude	Displays current angular distance east or west of the meridian at Greenwich UK
Altitude	Distance in meters above sea level
Radio / Tracking	
Radio Connection	Provides radio connection status between the local TD-90 and its radio "Disconnected" or "Connected"
Bridging State	Enabled or Disabled, provides status of Data bridge between radio pair
Radio RSSI	Provides current signal strength of the local side radio
Positioner State	Current Mode or operation the local TD-90 is in. Examples would be mode 1, 2/3, or Seek, Peak, etc
Radio State	Current status of local TD-90 raido. Acquiring, searching, or Registering.
Link State	Current status of radio link (pair of radios)
Master/Slave	Indicates if the TD-90 is connected to the Master or Slave Radio. The TD-90 is assigned the Master or Slave positioner based on the radio installed on the positioner.
Antenna Gain	Provides antenna gain of antenna attached. This information is pulled off of the radio attached to the TD-90
Tx Power	Displays current Tx power the Cambium radio is transmitting

Remote Side	
Attributes	**Description**
Remote State	Remote side status of TD-90 positioner state.
Remote Geodetic Position	
Azimuth	Displays the remote side TD-90's Azimuth angle is Geodetic frame which is the TD-90's Azimuth with reference to true north.
Elevation	Displays the remote side TD-90's Elevation angle with reference to Geodetic frame (330 from Horizon)
Latitude	Displays the remote side TD-90 current angular distance North or South of the earths equator. North of equator = Positive and South of equator = Negative
Longitude	Displays the remote side TD-90 current angular distance east or west of the meridian at Greenwich UK
Altitude	Displays the remote side TD-90 distance in meters above sea level

TD-90 Setup

The TD-90 Setup page provides a single page dedicated for setup and pre-configuration of a TD-90 positioner to work in Mode 1, 2, or 3.

The callout's below point to the various controls that are unique to the "Setup" page and are described in the table below. All other controls and status that are common to each page are defined in this section under the "Home" page.

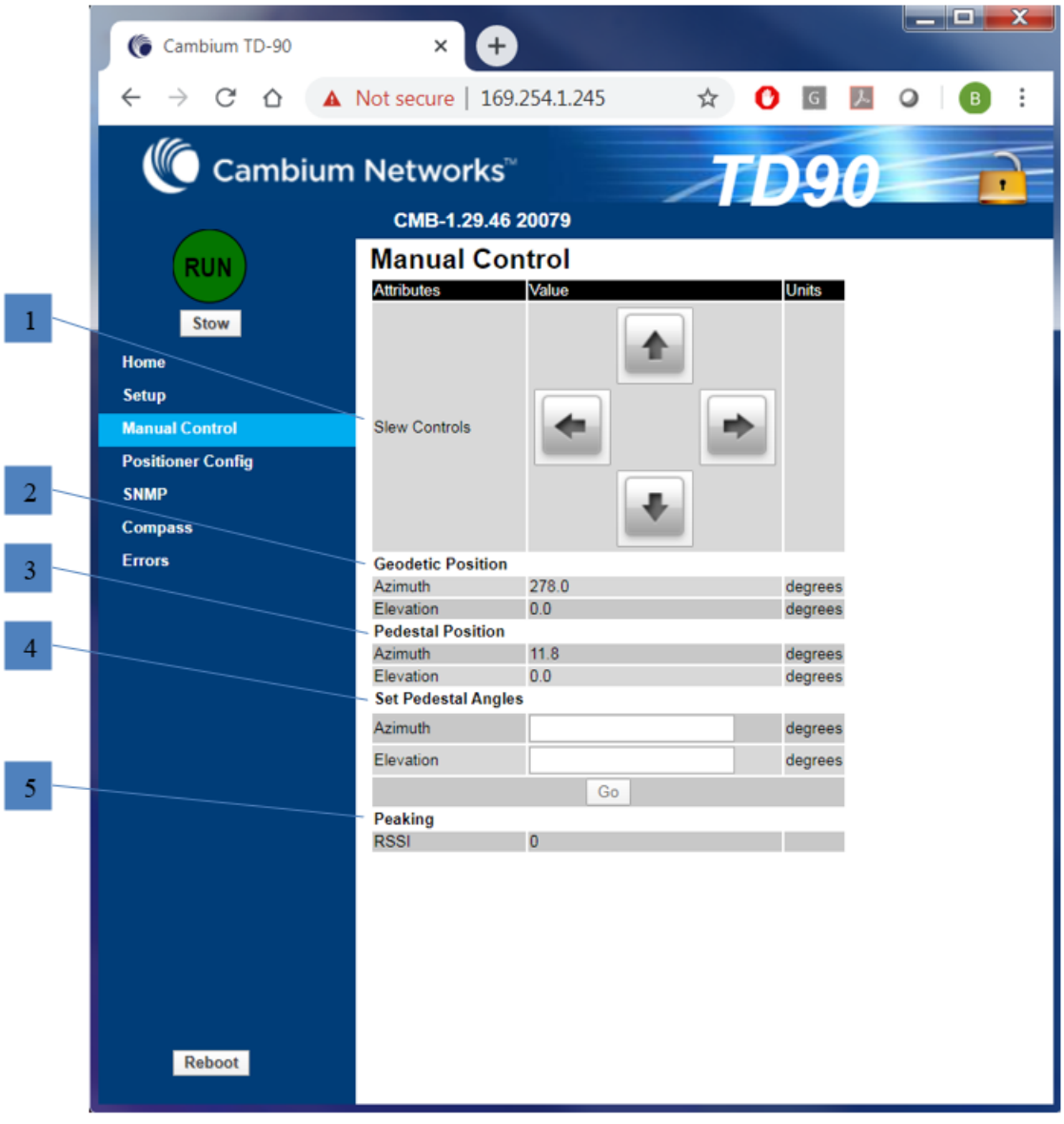

1
2
3
4
5
6
7
8
9
10
Cambium Networks
TD90
CMB-1.29.46 20079
System Setup
RUN
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
Target Database

Setup Page Descriptions	
Callout	**Description**
1	The System Setup table provides a single table to walk users through a TD-90 setup for Modes 1, 2, or 3 operations.
2	The TD90 IP Interface allows the TD-90 IP Address, Subnet Mask, and Gateway address to be updated
3	The Radio Interface is the location to enter the IP address of the radio that is planned for deployment with the TD-90. The Radio IP address is required for Mode 1, 2, and 3 operations
4	The Scan / Peak settings are used to set up how the TD-90 will move during the Scan Align and Peak processes and how long the TD-90 will dwell each time it takes a step. The default settings are 5 second Dwell, 5° Scan Step Size, and 1° Peak Step Size.
5	Antenna Selection allows the user to select which cambium antenna is used for the link. Selections include Integrated Panel, 2 foot parabolic, 3 foot parabolic and custom.
6	The Fixed end mode lets a TD-90 know that the opposite end of the link does not have a TD-90. This disables the Master/Slave control and allows a TD-90 to drive through the auto alignment process without coordination between the two ends.
7	GPS Settings allow the user to disable the onboard GPS and over ride using manually entered GPS coordinates
8	The Target GPS location check box places the TD-90 into mode 1 operation. Once the box for "(Optional) remote coordinates" is checked it will allow manual entry of a target latitude and longitude to be entered. **It is important to note that by using Mode 1, it will place the TD-90 in a mode where it will point to the user entered coordinates and it will not search and auto find. This mode is intended for deployments where each end is well known.**
9	The Target Database allows the operator to store multiple target locations for Mode 1 operation. The operator may also select one target to be used on startup. The target database can be built in real time by manual entry and storage of points or uploaded from a file. Target databases may also be downloaded to be shared with other TD-90's.
10	If an Internet connection is available the TD-90 will display a map which will locate the TD-90 at the center and display a blue line to show its current heading. The map is pulled over the internet from google maps. This map is not necessary for operation but provides a nice visual when a internet connection is available.

TD-90 Manual Control

The TD-90 Manual Control page provides a tool to manually move a TD-90 positioner by slewing around or commanding to a specific azimuth and elevation.

The callout's below point to the various controls that are unique to the **Manual Control** page and are described in the table below. All other controls and status that are common to each page are defined in this section under the **Home** page.

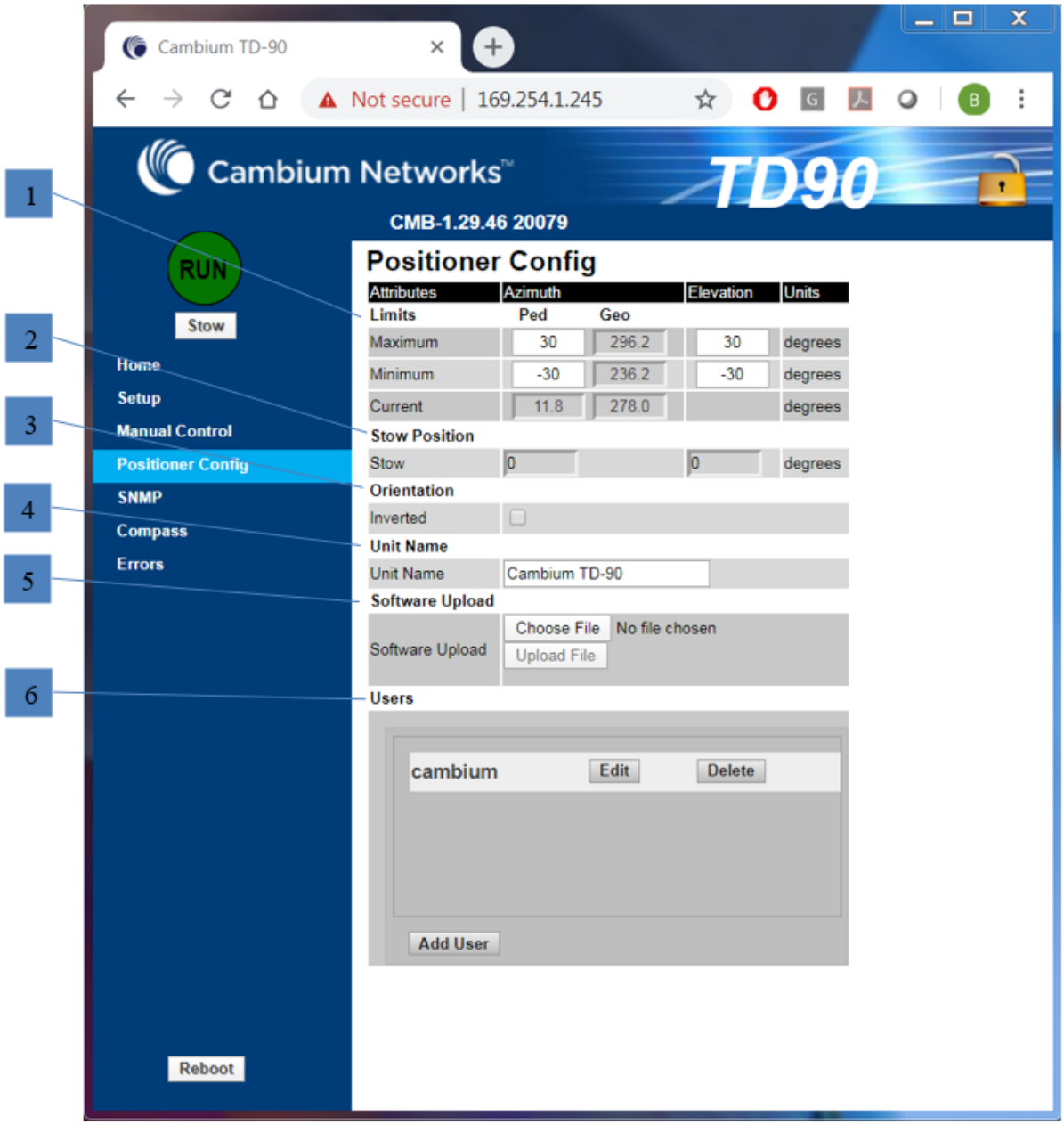


Manual Control Page Descriptions	
Callout	**Description**
1	The Slew Controls allow a user to slew a TD-90 Up, Down, Left, or Right using the arrow buttons
2	The Geodetic position displays the Azimuth and Elevation with reference to True North = 0 Azimuth and Horizon = 0 Elevation
3	The Pedestal position displays the pedestal angles with reference to the TD-90 center of travel in both axis = to 0
4	Set Pedestal Angles allows a user to manually enter in a commanded Azimuth and Elevation angle and press “Go” to execute. The command angle is always in pedestal coordinates but displayed in both Geo and Pedestal frame.
5	The Peaking indicator displays the radios current Receive Signal Strength Indication (RSSI) if a local connection between the radio and the TD-90 is in place.

TD-90 Positioner Config

The TD-90 Positioner Config page provides a tool to set TD-90 positioner configuration items such as pedestal limits, stow position, orientation of installation, and unit name. It also allows updates of TD-90 software when new software updates are available.

The callout’s below point to the various controls that are unique to the **Positioner Config** page and are described in the table below. All other controls and status that are common to each page are defined in this section under the **Home** page.

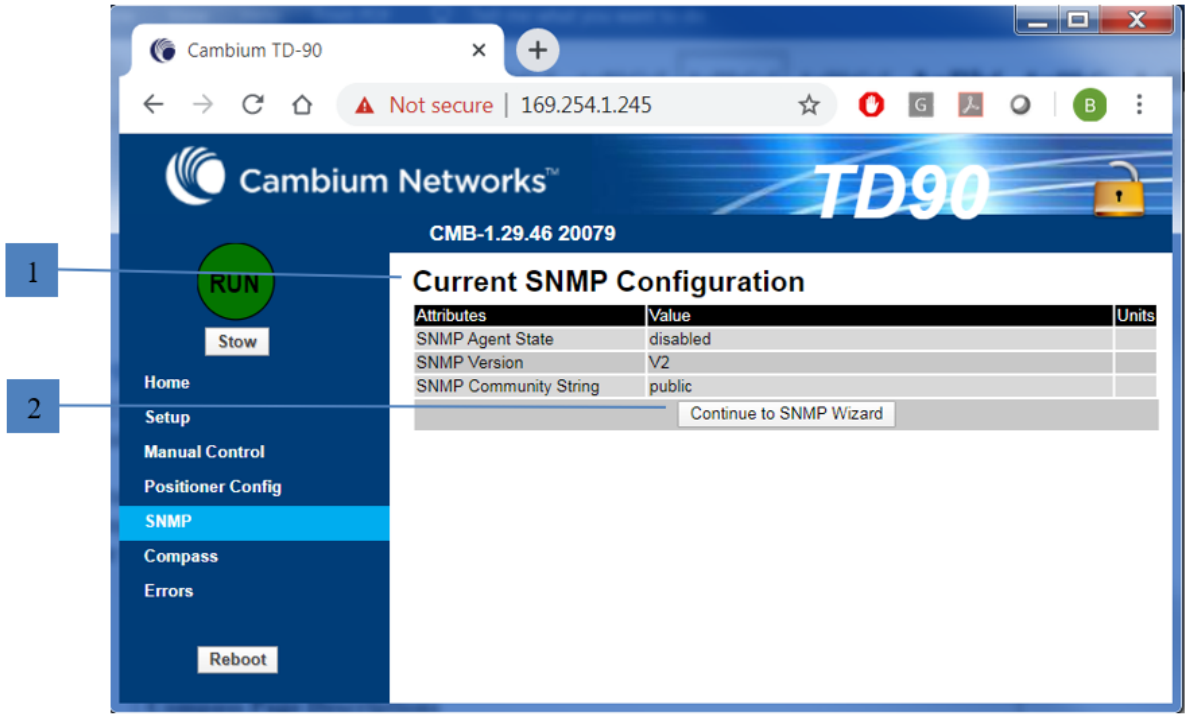

Cambium TD-90
Not secure | 169.254.1.245
Cambium Networks
TD90
CMB-1.29.46 20079
RUN
Stow
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
Positioner Config
Attributes
Azimuth
Elevation
Units
Limits
Ped
Geo
Maximum
30
296.2
30
degrees
Minimum
-30
236.2
-30
degrees
Current
11.8
278.0
degrees
Stow Position
Stow
0
0
degrees
Orientation
Inverted
Unit Name
Unit Name
Cambium TD-90
Software Upload
Choose File
No file chosen
Software Upload
Upload File
Users
cambium
Edit
Delete
Add User
1
2
3
4
5
6

Positioner Config Page Descriptions	
Callout	**Description**
1	The Limits are set to default maximum travel range a TD-90 do (Shown above 3200° Azimuth and 330° Elevation). The user may limit the travel range within this Azimuth or Elevation range
2	The stow position is default to 0 degrees azimuth and 0 degrees elevation. The unit will move to the user entered preset when the “Stow” button is pushed on any of the TD-90 control pages.
3	The orientation of normal operation is elevation over azimuth as shown throughout this manual. If the end user has deployment scenarios where the TD-90 must be mounted upside down (Inverted) then the inverted check box should be checked.
4	Unit Name allows the TD-90 to be given a unique name that will display on the home system summary page under “Positioner name” if left blank the positioner name will remain blank
5	The Software upload allows for upgrades to the software when available. **Note** After software upgrade, SSH will be exposed. The user needs to disable SSH for security consideration.
6	The operator may create multiple users with their own username and password. The unit comes installed with a single user with *Username: cambium* and *Password: cambium*.

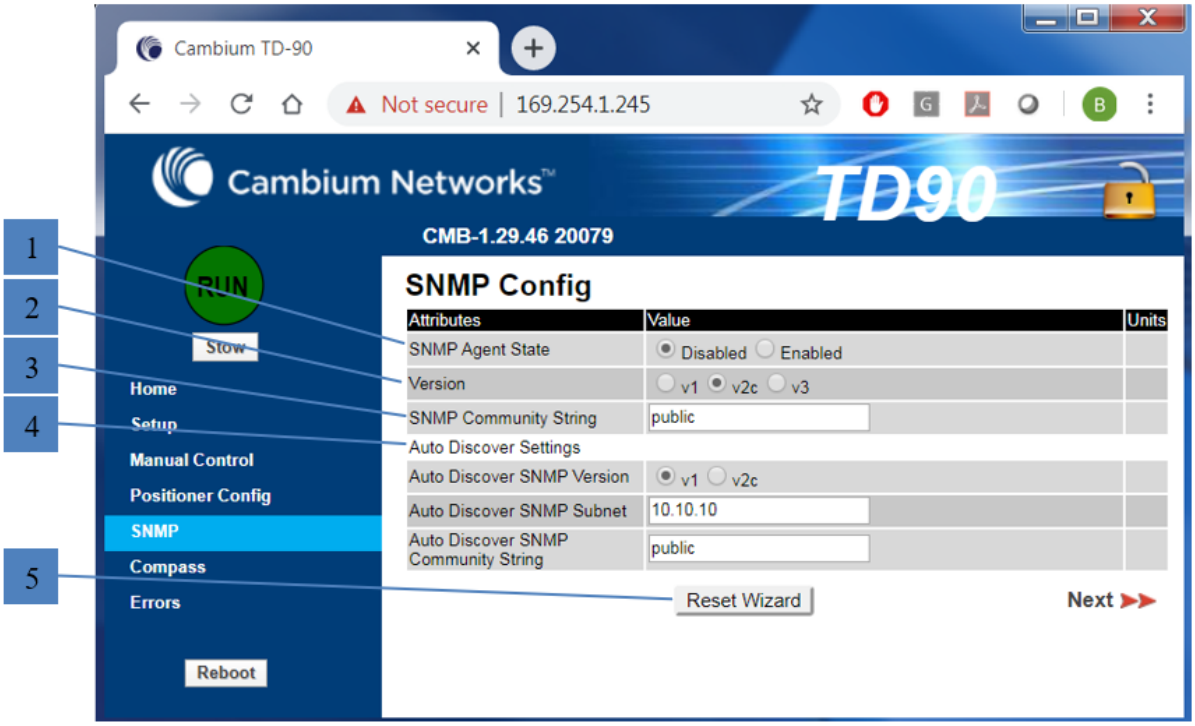
TD-90 SNMP v1 and v2c

The TD-90 comes with an SNMP interface that allows for a remote-control interface. A full MIB is available which allows an operator the ability to remotely command or get status from the positioner. SNMP is setup using a wizard tool that takes you through a 3 step process.

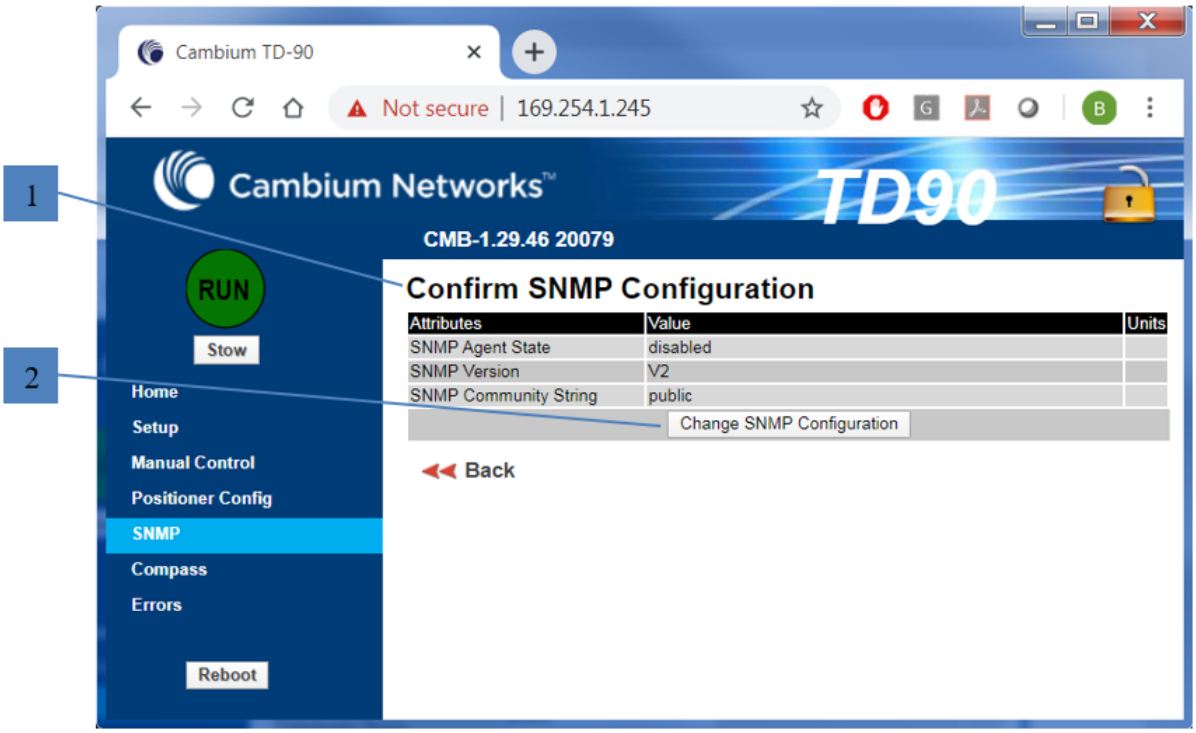
The screen shots and tables below describe each configuration window.


Cambium TD-90
Not secure | 169.254.1.245
Cambium Networks™
TD90
CMB-1.29.46 20079
RUN
Stow
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
Current SNMP Configuration
Attributes
Value
Units
SNMP Agent State
disabled
SNMP Version
V2
SNMP Community String
public
Continue to SNMP Wizard
1
2

Current SNMP Configuration	
Callout	**Description**
1	The default page displayed under the SNMP tab is the Current SNMP configuration settings. Here you will find if the SNMP agent is currently enabled or disabled, the SNMP version and community string.
2	The “Continue to SNMP Wizard” button launches a new page to start the SNMP configuration process.



SNMP Config	
Callout	**Description**
1	SNMP Agent State allows the user to turn on (Enabled) or turn off (Disabled) the SNMP agent.
2	Version allows the user to select what version of SNMP they wish to run. v1 has plaintext community string with 32 bit counters v2c has plaintext community string with support for 64 bit counters, and v3 which adds encryption and authentication to 64 bit counters.
3	SNMP community string allows you to change the name of the string. The community string is similar to a user ID or password and the requesting device must know the community string name. “public” is a commonly used default community string name.
4	The auto discovery settings allow a Cambium Radio and Cambium antenna positioner to establish communications. In most cases these settings should remain unchanged. The auto discovery typically defaults to a 10.10.10.x network where a master radio is 10.10.10.1 and a slave radio is 10.10.10.2 and a master positioner is 10.10.10.10 and a slave positioner is 10.10.10.20. These are the defaults. Should a 10.10.10.x network not be available the operator has the ability to change the address. Changing any default auto discovery settings on a Cambium TD-90 will result in duplicating these changes on the radio.
5	The “Reset Wizard” button will put the settings back to the last stored configuration and return you to the SNMP current configurations page.

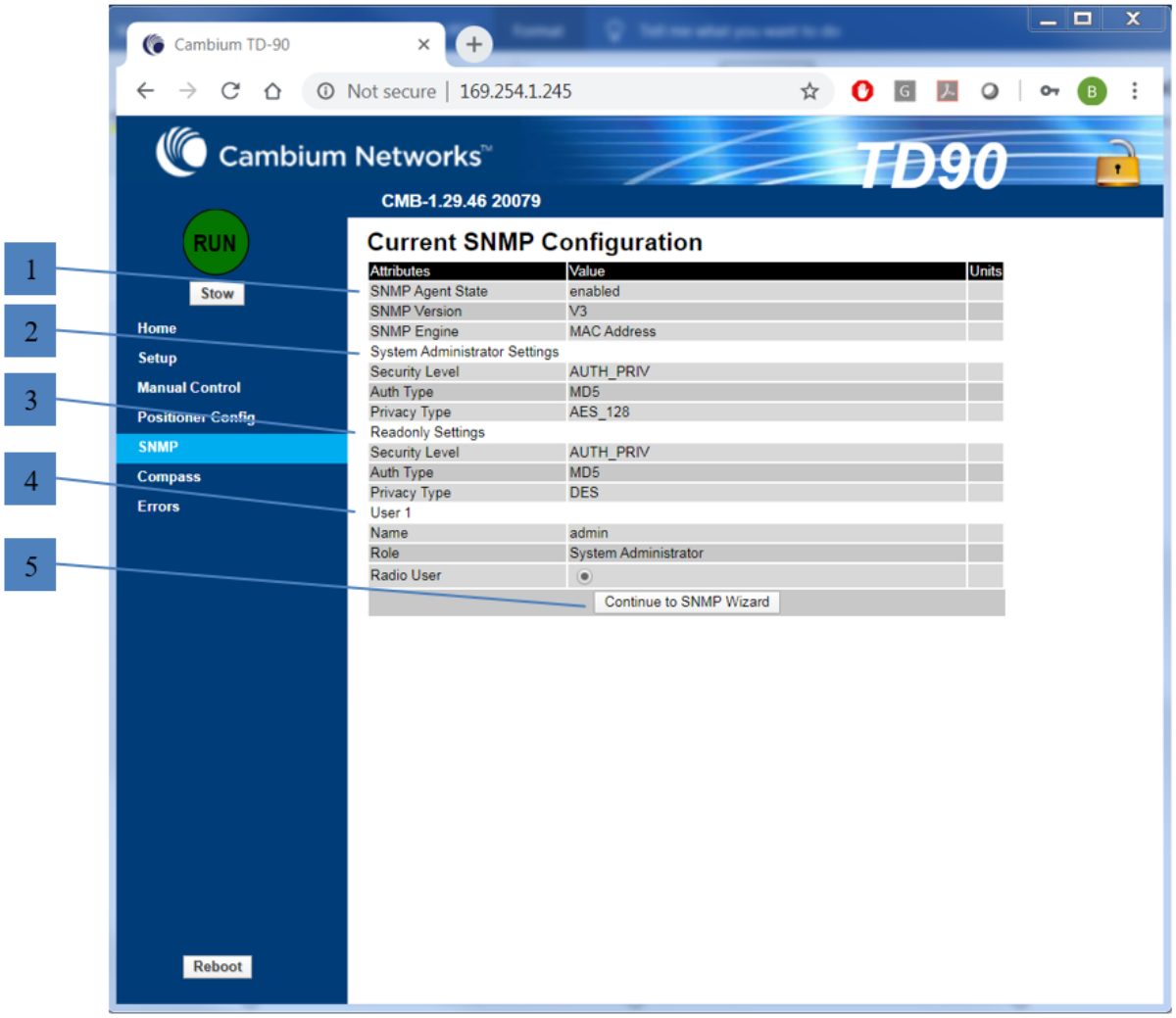


Confirm SNMP Configuration	
Callout	**Description**
1	The Confirm SNMP Configuration shall display the current selected configuration for user review before accepting and changing the SNMP Configuration.
2	The “Change SNMP Configuration” button will save the selections made during the setup wizard.

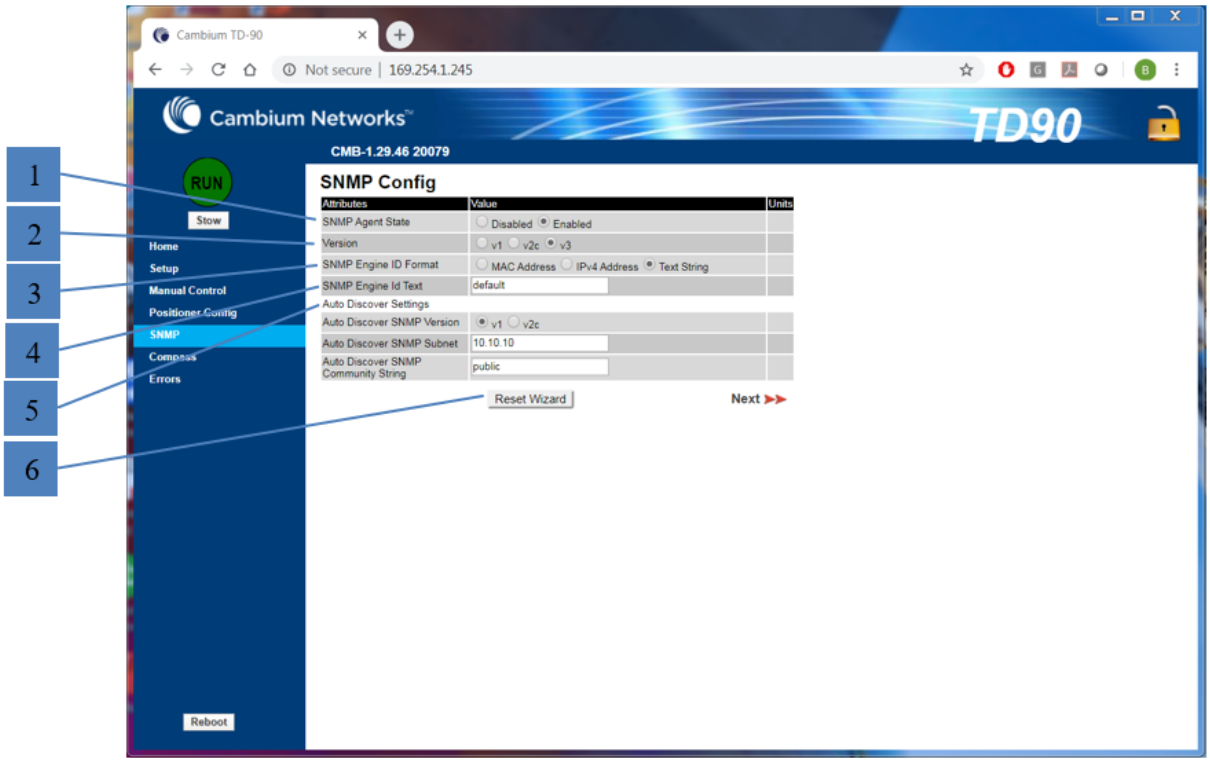
TD-90 SNMP v3

The SNMP v3 wizard adds authentication and encryption. The SNMP v3 wizard adds additional fields to allow the configuration of the authentication and encryption.

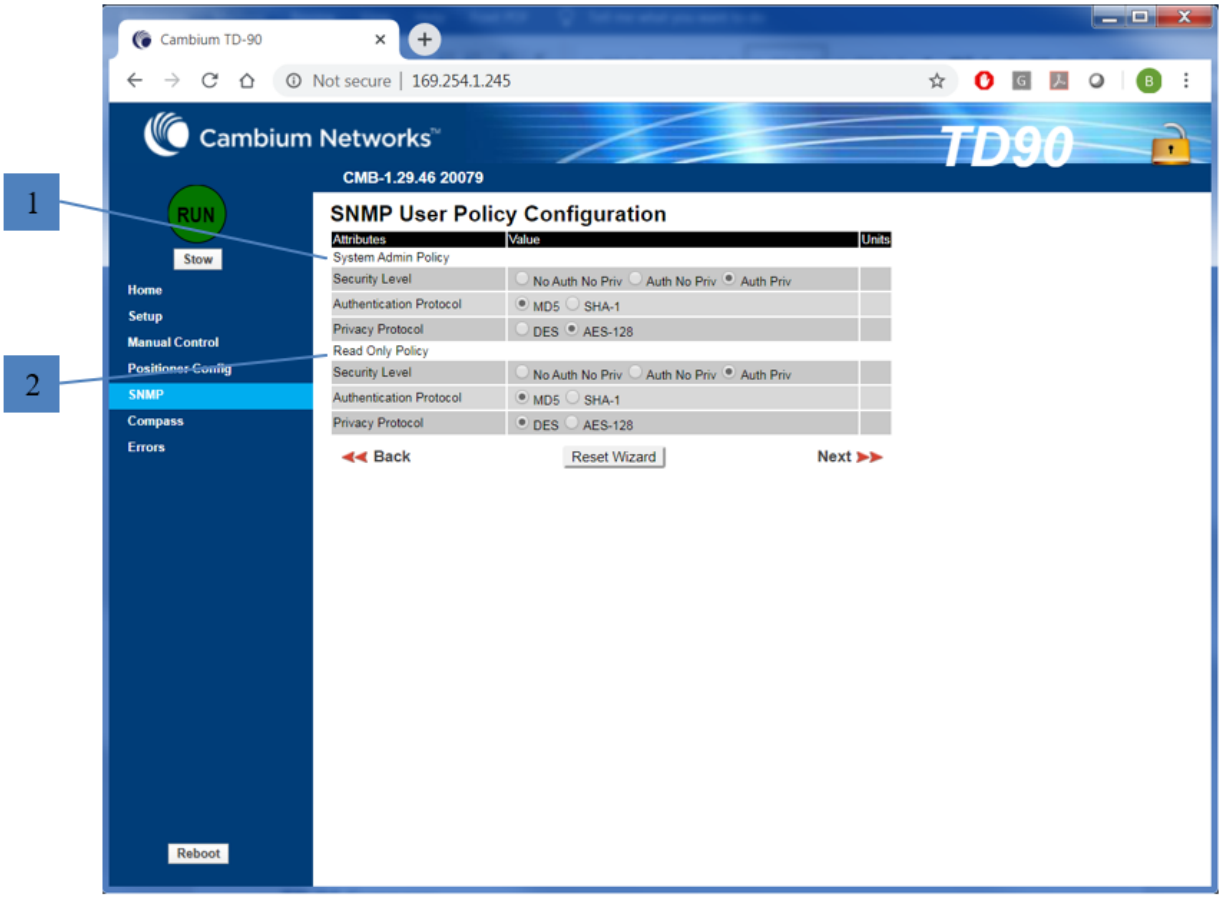
The screen shots and tables below describe each SNMP v3 configuration window.



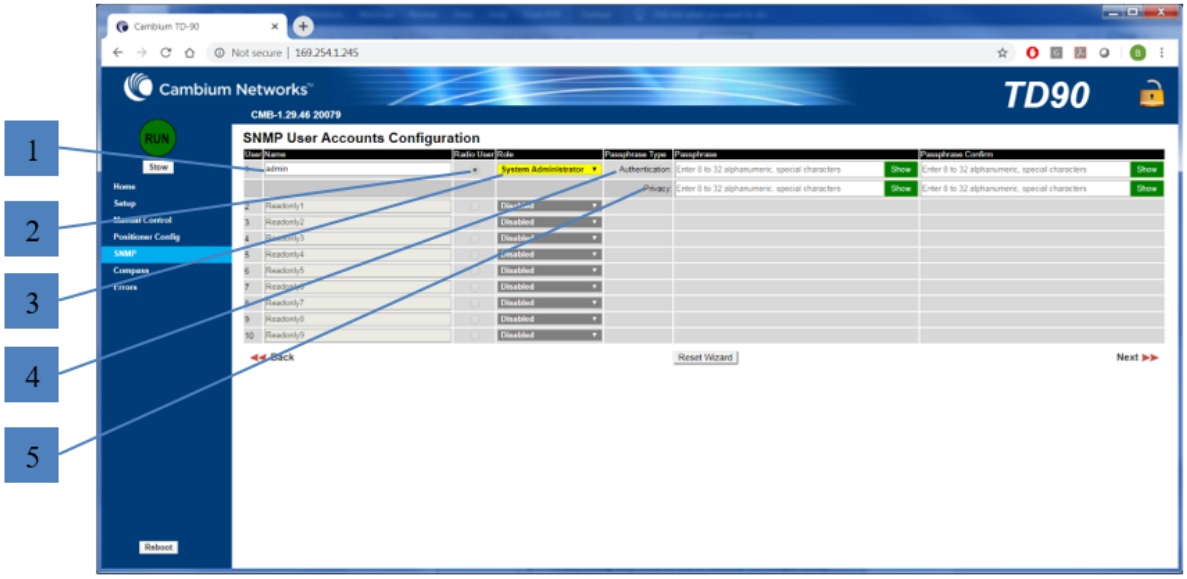
Current SNMP Configuration	
Callout	Description
1	The first three fields list the current status of the SNMP agent. The SNMP Agent State is either turned on “Enabled” or turned off “Disabled”. The SNMP Version shows the user the current version in operation. For this section that covers v3 only the version should always indicate v3. The SNMP engine ID uniquely identifies an SNMP entity in the management domain and may be set to use the devices MAC ID, IPv4 Address, or text string. The example shown here uses MAC Address.
2	The system administrator settings identify the current security level enabled such as No Authentication and No Privacy, Authentication no privacy, or Authentication and Privacy the Authentication Protocol such as MD5 or SHA-1 and the privacy protocol such as DES or AES-128
3	The Read Only Settings displays the Security Level, Authentication Protocol and Privacy Protocol for users with read only access to the SNMP agent.
4	User information will appear for each user registered within the SNMP agent. The User information will display the user name, the roll such as System Admin or Read only, and identify if this user is the radio interface. If the “Radio User” circle is selected it identifies that this user is configured to talk to local Cambium radio that is attached to the TD-90 positioner.
5	The “Continue to SNMP Wizard” button launches a new page to start the SNMP configuration process.


1
2
3
4
5
6
Cambium TD-90
Not secure | 169.254.1.245
Cambium Networks
TD90
CMB-1.29.46 20079
RUN
Stow
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
SNMP Config
Attributes
Value
Units
SNMP Agent State
Disabled
Enabled
Version
v1
v2c
v3
SNMP Engine ID Format
MAC Address
IPv4 Address
Text String
SNMP Engine Id Text
default
Auto Discover Settings
Auto Discover SNMP Version
v1
v2c
Auto Discover SNMP Subnet
10.10.10
Auto Discover SNMP Community String
public
Reset Wizard
Next

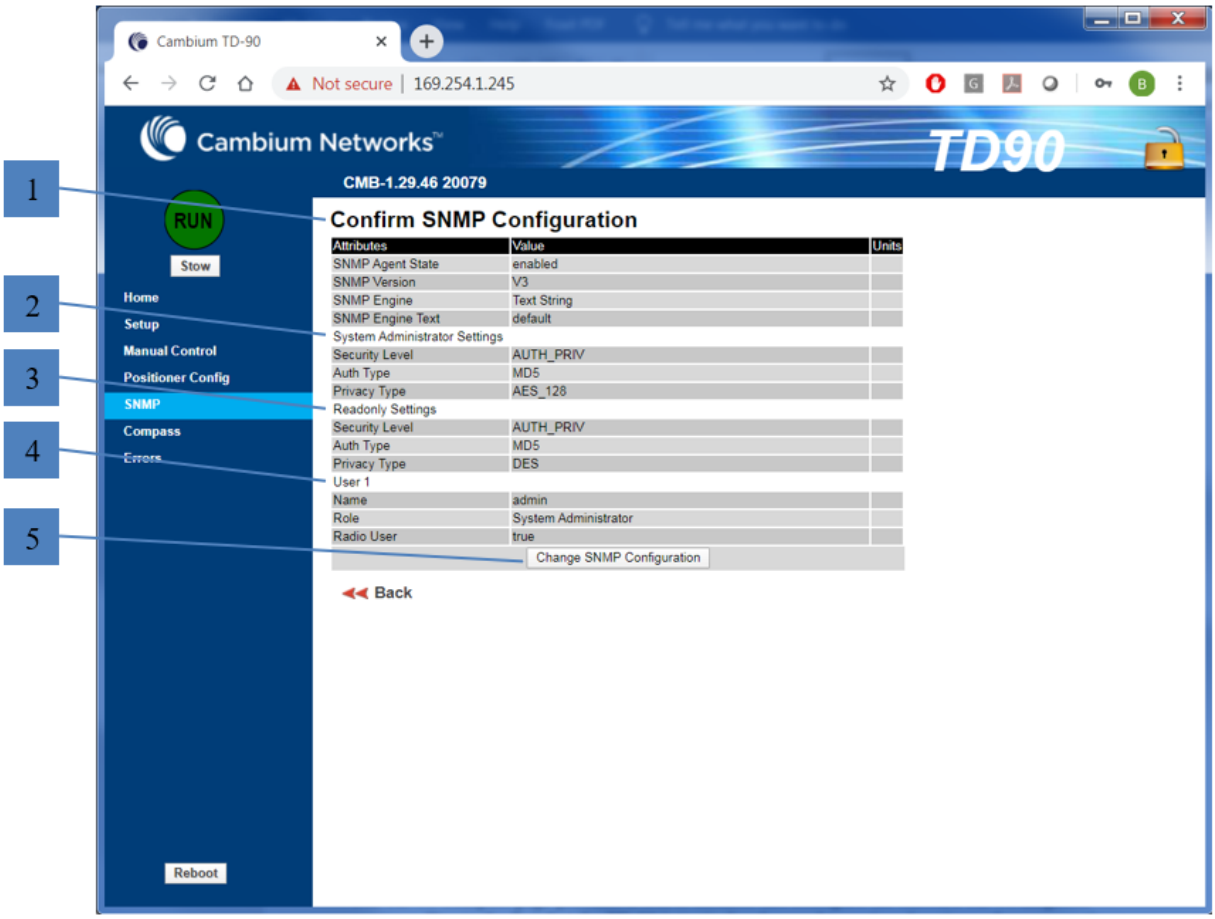
SNMP Config	
Callout	Description
1	The SNMP Agent State allows the user to turn on “Enabled” or turn off “Disabled” the SNMP agent
2	The Version field allows the user to select the version to run. Since this section covers v3 setup the version should be set to v3.
3	SNMP Engine ID Format allows selection between MAC address, IPv4 Address or text string to identify the unique entity.
4	The SNMP Engine Id Text field appears when “text string” is selected as SNMP Engine ID format. This allows the user to enter the specific text string they wish to use to identify the unique entity.
5	The auto discovery settings allow a Cambium Radio and Cambium antenna positioner to establish communications. In most cases these settings should remain unchanged. The auto discovery typically defaults to a 10.10.10.x network where a master radio is 10.10.10.1 and a slave radio is 10.10.10.2 and a master positioner is 10.10.10.10 and a slave positioner is 10.10.10.20. These are the defaults. Should a 10.10.10.x network not be available the operator has the ability to change the address. Changing any default auto discovery settings on a Cambium TD-90 will result in duplicating these changes on the radio.
6	The “Reset Wizard” button will put the settings back to the last stored configuration and return you to the SNMP current configurations page.


Cambium TD-90
Not secure | 169.254.1.245
Cambium Networks
TD90
CMB-1.29.46 20079
RUN
Stow
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
SNMP User Policy Configuration
Attributes
Value
Units
System Admin Policy
Security Level
No Auth No Priv
Auth No Priv
Auth Priv
Authentication Protocol
MD5
SHA-1
Privacy Protocol
DES
AES-128
Read Only Policy
Security Level
No Auth No Priv
Auth No Priv
Auth Priv
Authentication Protocol
MD5
SHA-1
Privacy Protocol
DES
AES-128
Back
Reset Wizard
Next
1
2

SNMP User Policy Configuration	
Callout	**Description**
1	The System Admin Policy provides controls for the user to select the authentication and privacy policies for the Administrator. Select between security levels of No Authentication and No Privacy, Authentication and No privacy, or Authentication and Privacy. Based on your selection the system will also allow you to pick the Hash type to be used for Authentication (MD5 or SHA-1) and the Privacy Protocol (DES or AES-128).
2	The Read Only policy provides controls for the user to select the authentication and privacy policies for read only users. Select between security levels of No Authentication and No Privacy, Authentication and No privacy, or Authentication and Privacy. Based on your selection the system will also allow you to pick the Hash type to be used for Authentication (MD5 or SHA-1) and the Privacy Protocol (DES or AES-128).



SNMP User Policy Configuration	
Callout	**Description**
1	User edited field to enter the name to be used for your user account
2	User selectable field to identify to the positioner which SNMP user is the local Cambium radio
3	Drop-down to select **System Administrator**, **Read Only**, or **Disabled**
4	Authentication Password field. User must enter the Authentication password twice. Enter minimum of 8 and maximum of 32 alphanumeric and or special characters.
5	Privacy Password field. User must enter the Authentication password twice. Enter minimum of 8 and maximum of 32 alphanumeric and or special characters.

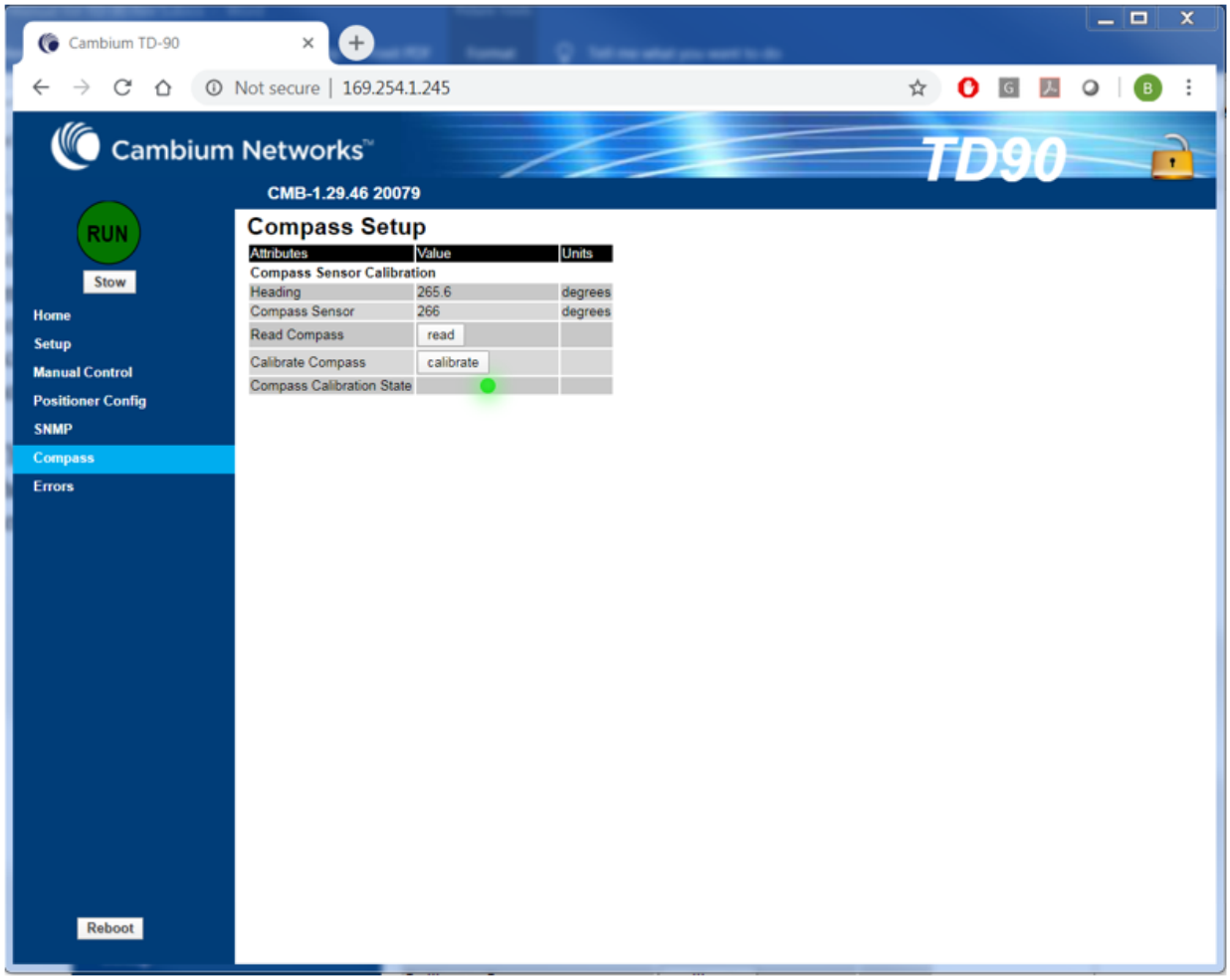


Confirm SNMP Configuration	
Callout	**Description**
1	The Confirm SNMP Configuration shall display the current selected configuration for user review before accepting and changing the SNMP Configuration.
2	System Administrator settings allows review of selections made before accepting changes
3	Read only settings allows review of selections made before accepting changes
4	The user field allows review of users that have been setup during the configuration. Additional user fields will appear for each addition user that is setup during configuration.
5	The “Change SNMP Configuration” button will save the selections made during the setup wizard.

TD-90 Compass

The TD-90 Compass page provides a tool to monitor and configure the onboard TD-90 magnetic compass. Due to the fact that the TD-90 is tactical and moved to various locations where magnetic environments can change, it is necessary to have the ability to monitor and re-calibrate the on-board compass. The compass is only required for mode 1 and 2 operation and is intended to help speed up the acquisition time to establish a radio link. Mode 3 is the default mode and will establish a radio link with no GPS or Compass aid.

The table below describes the various status and controls that are unique to the “Compass” page. All other controls and status that are common to each page are defined in this section under the **Home** page.

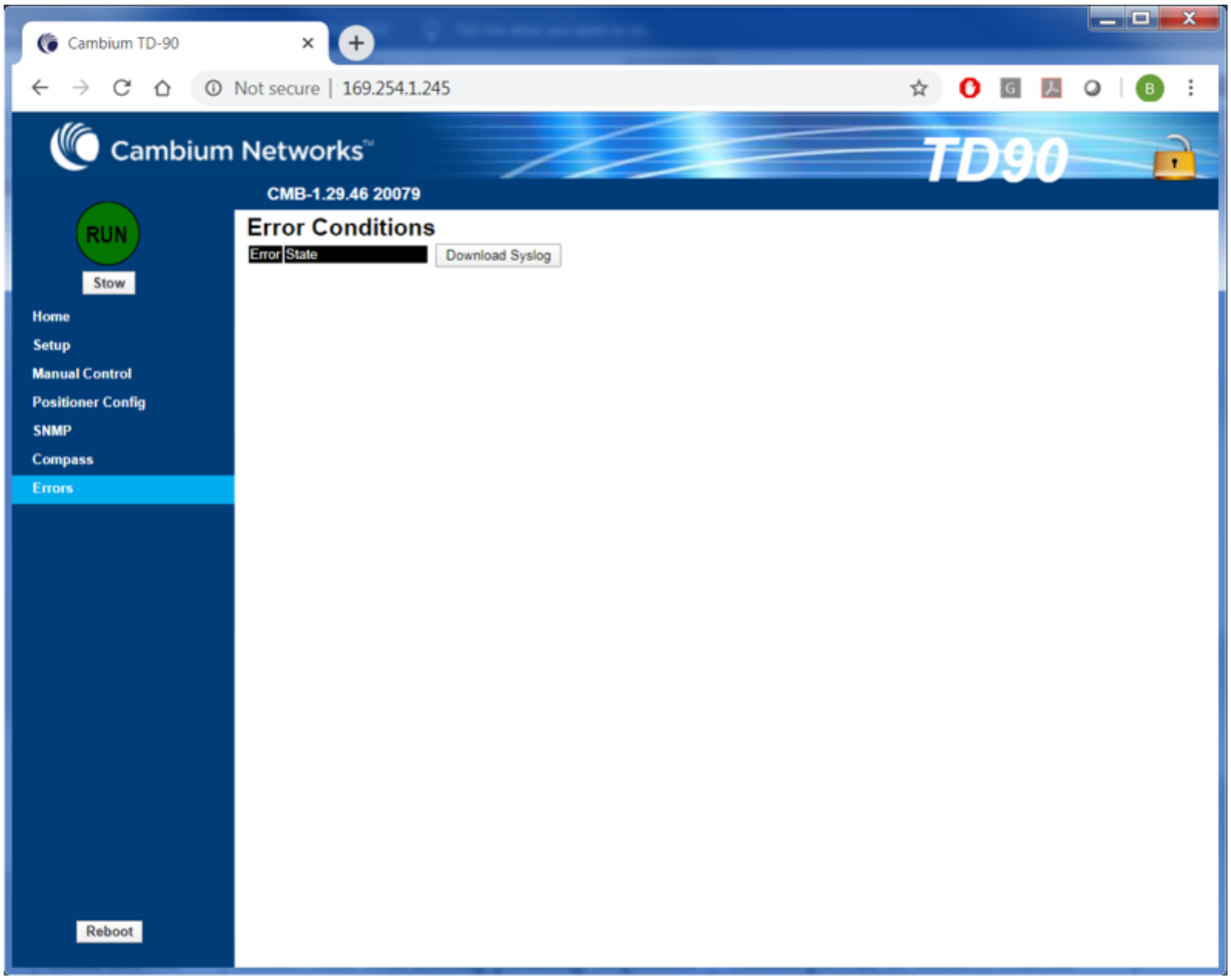

Cambium TD-90
Not secure | 169.254.1.245
Cambium Networks
TD90
CMB-1.29.46 20079
RUN
Stow
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
Compass Setup
Attributes
Value
Units
Compass Sensor Calibration
Heading
265.6
degrees
Compass Sensor
266
degrees
Read Compass
read
Calibrate Compass
calibrate
Compass Calibration State

Compass Page Descriptions	
Attributes	**Description**
Heading	Displays the current heading from the last time the compass was read. Each time the TD-90 is commanded to move it reads the compass to get a reference to current heading
Compass Sensor	Displays the raw output from the compass
Read Compass	Allows the user to take an instant read from the compass sensor. The heading and compass sensor should match after a read and before any additional move is made with a few degrees 3 5°.
Calibrate Compass	Allows the user to re-calibrate the compass. The positioner should be located in its installed location with all attachments made before re-calibrating is performed.
Compass Calibration State	The compass calibration state LED will change between green and yellow states. Green indicates the compass is working within the defined accuracy expected. Yellow suggests the compass is outside the accuracy and suggests a compass calibration.

TD-90 Errors

The TD-90 Errors page provides a window to monitor error conditions along with a button to download the system log which can be forwarded to Cambium and help aid in the debug of a system that is not working properly. An error indicator does not necessary indicate the TD-90 will not establish a link but may explain why a particular link takes longer to acquire or switch acquisition modes.

The table below provides a list of error codes with the explanation of error condition alarms.


Cambium TD-90
Not secure | 169.254.1.245
Cambium Networks
TD90
CMB-1.29.46 20079
RUN
Stow
Home
Setup
Manual Control
Positioner Config
SNMP
Compass
Errors
Reboot
Error Conditions
Error State
Download Syslog

Error	Error Description	Possible Fixes
0x00000001	RADIO_CONNECT_ERR: Connection between TD-90 and local radio	Check IP settings on Radio and TD-90. Is the TD-90 and the Radio on the same network? Is the cable between the Radio and TD-90 in place? Check all Ethernet cabling between TD-90 base and switch or router. Is the Cambium Radio powered on?
0x00000002	SWEEP_TIMEOUT_ERR: TD-90 has been sweeping in azimuth for 12 hours with no link activity.	Suggests there is no other cambium radio on air to form a link. Check setup status of opposite side and cycle power to restart process.
0x00000004	MASTER_SLAVE_SYNC_ERR: Positioner and radio found a link connection but was unable to sync with the distant end radio	Refer to Cambium radio manual and check configuration of radio at each end to insure radios are setup and configured correctly to talk to each other.
0x00000008	LINK_DOWN_SCAN_START_ERR:	
0x00000010	AZ_SCAN_MOVE_FAIL_ERR:	

Error	Error Description	Possible Fixes
0x00000020	AZ_SCAN_MOVE_TIMEOUT ERR: Link is down after TD-90 has concluded an azimuth only scan and returned to the highest reported signal level	Distant end of link has moved or power has been removed from distant end
0x00000040	LINK_DOWN_STEP_START_ERR: Radio link lost during one of the steps in acquisition process	Check power to radios, Check Ethernet cabling between radios and TD-90. Check opposite side of link power and cabling
0x00000080	STEPTRK_MOVE_FAIL_ERR:	
0x00000100	STEPTRK_MOVE_TIMEOUT_ERR: TD-90 is unable to make it to commanded position during step track	Check for obstructions in TD-90 path or software limits.
0x00000200	DATABR_ DOWN_ SCAN_ ERR: TD- 90 stops moving immediately after any link is established during the initial sweep. The Link down at scan start indicates the link is interrupted after the sweep but before the first scan starts.	Indicates marginal link at stop of sweep process. Recoverable error as TD-90 will return to sweep process.
0x00000400	MASTER_WAIT_TIMEOUT_ERR: Master TD-90 has timed-out waiting for a response from the slave TD-90 during a scan or peak sequence. Wait time is 15 minutes before timeout.	Check status of opposite end of link. Possible power removal from opposite end.
0x00000800	SLAVE_WAIT_TIMEOUT_ERR: Slave side error indicating that master did not return after scan function	Check Master side for power failure

Error	Error Description	Possible Fixes
0x00001000	DATABR_DOWN_STEP_ERR: Link goes down during one of the steps in acquisition process	Recoverable error. System will alert of link outage, wait for radio link to recover and
0x00002000	RADIO_DISCONNECT_ERR: Connection between TD-90 and Radio is lost	Check Ethernet cabling between radio and TD-90. Check power on Radio
0x00004000	MODE1_REPOSITION_ERR: Positioner failed to reach desired positioner within 120 seconds	TD-90 azimuth limits have been restricted to less than 3 180° limiting travel to target position or physical obstruction blocking the TD-90 from moving to commanded azimuth.
0x00008000	MODE1_MODE_CTRL_ERR: TD-90 fails to enter mode one	Check GPS. Recoverable error, system will fail over to mode 3
0x00010000	MODE1_SWEEP_TIMEOUT_ERR: TD-90 swept in azimuth for 30 minutes after initial point.	Typical failure is other side of link has not been installed. TD-90 fails back to mode 3 and will start sweep to acquire a link.

Error	Error Description	Possible Fixes
0x00020000	MODE1_DATABR_DROP_ERR: Data bridge drops after it has been established but before the scan and peak process.	Recoverable error. Indicates excessive compass or GPS error. TD-90 will default to Mode 3
0x00040000	MULTIPT_REPOSITION_ERR: Positoiner found link, started scan and failed to regain connection	Check target end radio for power
0x00080000	MULTIPT_MODE_CTRL_ERR: TD-90 fails to enter single ended mode	Check target end radio for power and check radio link configuration
0x00100000	MODE1_2_NO_GPS_ERR: Link is Established and one or both TD-90's fail to pass valid GPS coordinates. Unit will display error but default to Mode 3 and continue to acquire not using Mode 1 or 2	Recoverable error. Check GPS connections on TD-90's at both ends. Verify that GPS has not been disabled in software which will force a mode 3.
0x00200000	LOCATION_EXCHANGE_ERR: TD-90 A and B sides failed to exchange local coordinates within the 20 second time limit	Suggests marginal link during initial sweep process. Recoverable error, TD-90 reverts back to Mode 3.

Error	Error Description	Possible Fixes
0x00400000	TARGET_ CMD_ INTERNAL_ ERR: Internal message error setting target coordinates after sweep in mode 1 or 2	Radio data bridge connection is marginal and was not able to successfully pass data to each side for local coordinates. Recoverable error, TD-90 will auto switch to mode 3 and continue.
0x00800000	SWEEP_MODE_CTRL_ERR: TD-90 unable to perform sweep command.	Check software axis limits for azimuth. Check ability to manually move system for physical obstructions.
0x01000000	MODE2_ REPOSITION_ ERR: Positioner failed to reach desired positioner within 120 seconds	TD-90 azimuth limits have been restricted to less than 3 180° limiting travel to target position or physical obstruction blocking the TD-90 from moving to commanded azimuth.

Error	Error Description	Possible Fixes
0x02000000	MODE2_DATABR_DROP_ERR: TD-90 selects mode 2 and exchanges coordinate locations on both ends. TD-90's both point using on board compass. It is assumed a data bridge will be active after the aid of GPS and compass pointing. If not bridge exists the system will default back to mode 3 to establish link.	Recoverable error. Suggests that GPS or Compass may be compromised. Verify accuracy of GPS coordinates on both ends and compass heading. May require compass calibration on one or both ends.
0x04000000	MODE1_2_CMP_CAL_ERR: Positioner unable to calibrate compass after calibration command.	Possibility of severe magnetic disturbance. Compass cal should also have 360 degrees travel range for calibration. Check azimuth limits and make sure limits are +/- 180 degrees or greater.
0x08000000	CMD_POS_PAST_LIMIT_ERR: Positioner exceeded software limit	Indicates something is wrong with TD-90 position feedback sensor.

System Recovery

In case that the user forget about the login credential or IP address. Use the following steps to recover the unit into factory default mode:

1. Default boot procedure: Power up – (within 10 seconds) –Power down – (within 10 seconds)—Power up. The IP address (169.254.1.145) will be available after this power cycle sequence.
2. Within 60 seconds of the “Default boot”, use web browser to access http://169.254.1.145.
3. The GUI shows “set to factory default” button .
4. Click on the “set to factory default”, you will see a warning saying “this will erase all the configuration of the TD-90”, with “OK” to factory default the unit and “Cancel” not to proceed. If “OK” is pushed, the positioner will perform factory default and reboot. If “Cancel” is pushed, the TD-90 will perform normal reboot.

Contacting Cambium Networks

Product Details	https://www.cambiumnetworks.com/products/wifi/
Quick Start Guide	https://www.cambiumnetworks.com/products/wifi/
User Guide	https://support.cambiumnetworks.com/files/r-series/
Release Notes	https://support.cambiumnetworks.com/files/r-series/
Software Resources	https://support.cambiumnetworks.com/files/r-series/
Knowledge Base (KB) Articles	https://help.cambiumnetworks.com/hc/en-us/sections/206524647-cnPilot-R-series-R201-R201P-
Community	http://community.cambiumnetworks.com/t5/cnPilot-R-Series-Home-Small/bd-p/cnPilot
Support	https://www.cambiumnetworks.com/support/
Warranty	https://www.cambiumnetworks.com/support/warranty/
Repair Queries	https://support.cambiumnetworks.com
Feedback	For feedback, e-mail to support@cambiumnetworks.com/
Address	Cambium Networks Limited, Unit B2, Linhay Business Park, Eastern Road Ashburton, United Kingdom, TQ13 7UP.