

## 1 Overview

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The Ciholas Ultra-Wideband (CUWB) Manager is the primary software tool for managing, configuring, and operating CUWBNetworks. It provides a web-based User Interface (UI) that can be accessed from the user's Local Area Network (LAN), allowing administrators to manage multiple CUWB Configurations and run CUWBNetworks simultaneously.

The CUWB Manager operates a single-page web application that stores all CUWB configurations and controls the execution of each CUWBNetwork. Through this interface, users can configure anchor settings, start or stop CUWBNetwork operation, and monitor system status in real time.

The CUWB Manager provides an Application Program Interface (API) that exposes the same functions available in the web interface. Developers can use the API to build custom tools or automate tasks such as adding or removing tags and adjusting beacon rates. Full API documentation is available in the [CUWB Manager API](#).

This CUWB Manager Manual applies only to v5.1 of the CUWB Manager. The v5.1 CUWB Manager Version and Manual is compatible with Series 300 devices and is not compatible with older databases or legacy Ciholas hardware. Documentation for legacy systems is available in our [legacy area](#).

## 1.1 CUWB RTLS Operation Background

This section outlines the roles and responsibilities of Tags and Anchors within the CUWB Real-Time Location System (RTLS). For a higher-level overview of the CUWB RTLS architecture, refer to the [System Architecture](#) section.

### 1.1.1 Anchors

Anchors serve as static reference points used by the location algorithm to determine the position of Tags. Anchors listen for Tag beacons, record the reception time, and if available, collect sensor data. All received data is transmitted to the CUWB Manager for use in the location algorithm and for display within the web interface.

In addition to serving as reference points, Anchors participate in Global Network Time (GNT) calculations. All devices in the CUWB Configuration must understand GNT in order to transmit and receive during their scheduled times. Multiple anchors participating in GNT allow the time to be distributed across large Anchor Arrays.

Anchors can be configured for one of three roles:

Role	Description
<b>Seeder</b>	Transmits UWB packets to participate in Global Time Synchronization.
<b>Initial Seeder</b>	Functions as a Seeder and also starts the configuration.
<b>Quiet Anchor</b>	Does not transmit. Global Time is modeled from UWB beacons received from other Anchors.

Each CUWB Configuration must have at least one Initial Seeder. This device initiates transmissions within the Anchor Array and provides the initial time model for the system. Ideally, the Initial Seeder is centrally located with strong RF connectivity to a large number of nearby Anchors. The choice of Initial Seeder can influence how quickly the Anchor Array achieves full GNT synchronization.

If multiple devices are configured as Initial Seeder, one will be selected at random to initialize the CUWBNet. If the selected device is unavailable (e.g., network disconnected or powered off), another Initial Seeder will be selected automatically.

Once the CUWBNet starts, Anchors near the Initial Seeder begin receiving UWB packets and attempt to 'lock' onto GNT. When a Seeder achieves full lock, it contributes to the GNT model, allowing synchronization to expand across the Array.

Quiet Anchors listen for transmissions from Seeders and Initial Seeders and attempt to 'lock' onto GNT. Once a Quiet Anchor has locked onto GNT, the Anchor can participate in position calculations but does not contribute to GNT modeling, and cannot be used to expand CUWBNet beyond the existing synchronization.

### 1.1.2 Tags

Tags are mobile devices tracked by the CUWBNet. Each Tag transmits UWB beacons that are received by Anchors. The Anchors forward reception timestamps to the CUWB Manager, where the location algorithm determines each Tag's position.

Tags can be configured to transmit beacons at slower rates to conserve battery life or at faster rates to track dynamic objects.

## 2 Installation

The CUWB Manager can be installed in Ubuntu either online, via a Personal Package Archive (PPA) or offline, using pre-downloaded Debian packages.

### 2.1 Host PC Requirements

- **OS:** Ubuntu 22.04 Jammy or Ubuntu 24.04 Noble
- **CPU:** Intel or AMD 64-bit architecture, 2.5GHz, dual-core or better
- **WAN:** Must be able to reach ppa.cuwb.io via port 443<sup>1</sup>
- **Network:** Two NICs or VLANs — one for the User Network and one for the isolated Anchor Network
- **RAM:** 8 GB or more
- **HD:** 32 GB or more<sup>2</sup>

1. Only required for online installation.

2. Additional space is required for CDP logging. See [CDP Logging](#) for additional requirements.

Requirements increase based upon CUWB System complexity. Larger installations may require additional processing power.

The Anchor Network NIC (or VLAN) must be configured for the link-local IP address range. See the [Networking Guide](#) for detailed instructions.

### 2.2 Online PPA Installation and Setup

Follow these steps to install the CUWB Manager:

1. Follow best practices and review [the install.sh script](#).
2. 

```
bash <(wget -qO- "https://cuwb.io/docs/latest/assets/software-packages/install.sh")
```
3. Paste into an Ubuntu 22.04/24.04 terminal and press Enter.

After installation, the CUWB Manager is accessible on all network interfaces of the host machine at port **5000**.

### 2.3 Offline Installation

The CUWB Manager can be installed on Host PCs that do not have PPA access. For instructions on how to create a transferable DEB package, see [PPA Download](#) for Software Packages.

If using individual Debian packages, CUWB Migrate DEB must be installed prior to CUWB Manager DEB.

Only use CLI to install the CUWB Migrate and CUWB Manager Debian packages.

The latest Debian (DEB) packages can be downloaded from the [Software Packages](#) page for offline installations. Transfer the DEB(s) to a USB drive or other transfer method to the Host PC. After downloading the packages, navigate to the file locations, and type the commands below into a terminal window to install the packages:

```
sudo apt install ./<package_name>.deb
```

Repeat the above step for each Debian package to be installed on the Host PC.

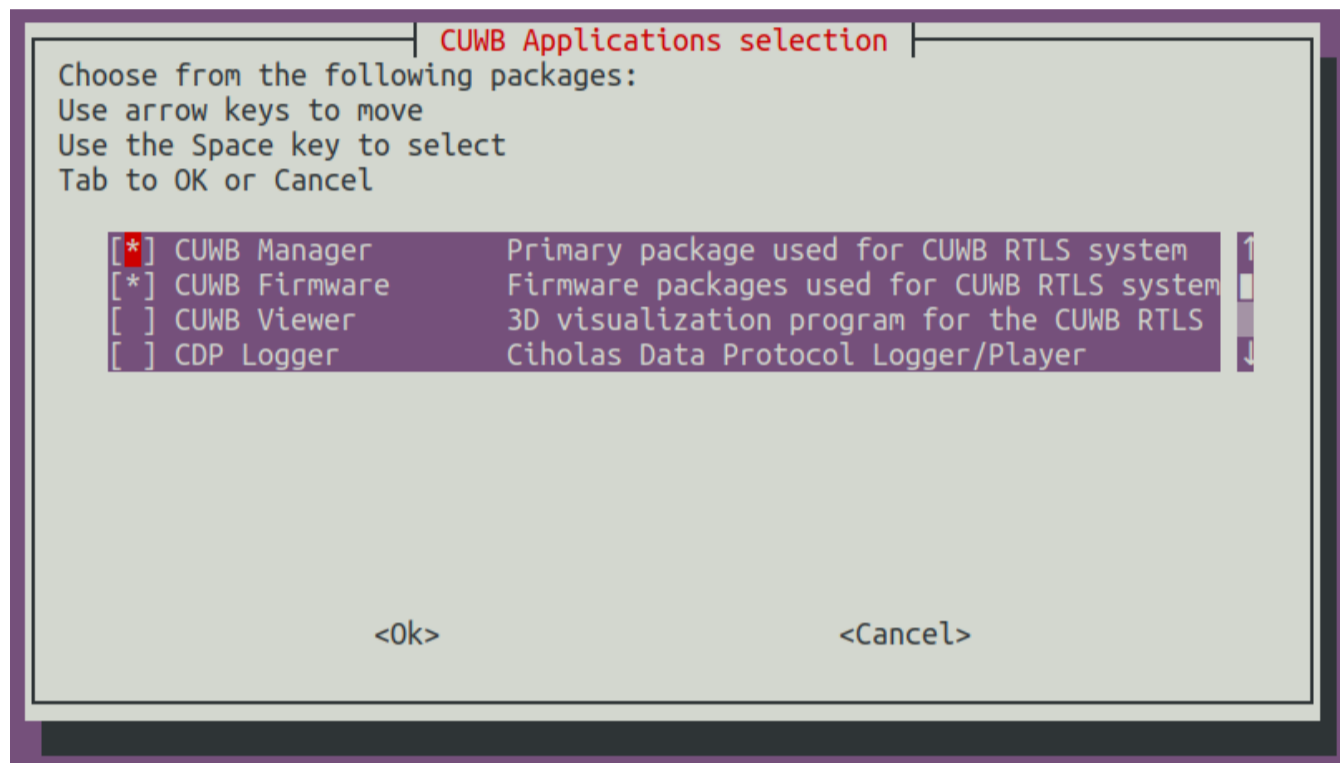
Some additional software, like the **CUWB Viewer** or **CDP Logger**, may have additional Host PC requirements. Review the requirements prior to installation.

## 2.4 CUWB Manager Software Installation

Regardless if installed via the PPA or the offline Debian packages, the CUWB Manager software package launches an installation GUI. Use **Tab** and **Enter** keys to navigate the installation GUI, which walks through several screens, that display the **license agreement**, configure optional **host port settings**, and expand the default **UDP buffer** size.

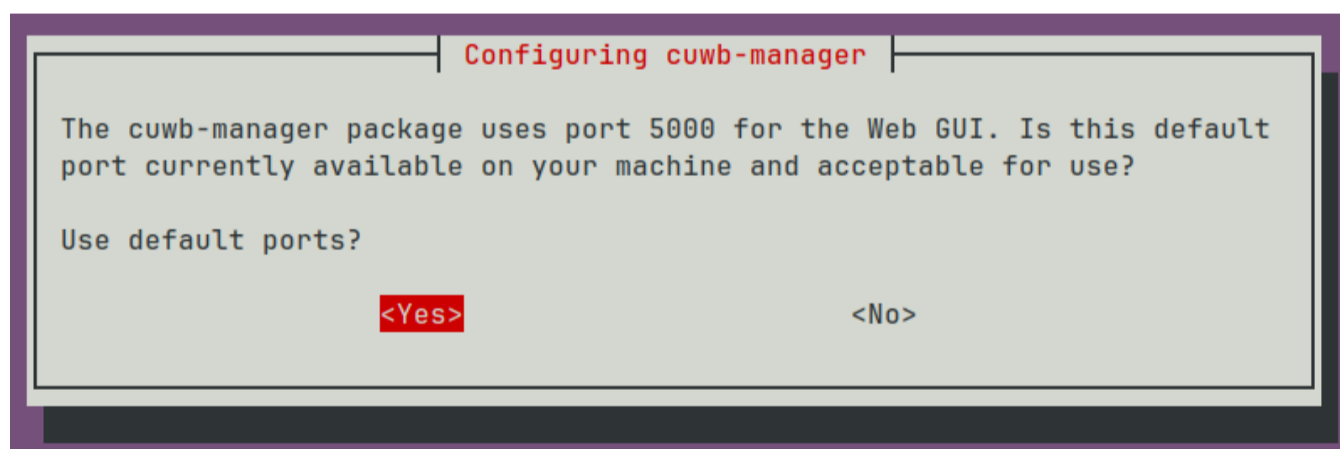
### PPA Only Aggregation Selection

The PPA has a special aggregation that enables users to select which software packages to be installed:



When prompted in 'CUWB Applications Selection,' ensure that **CUWB Manager** and **CUWB Firmware** are selected for installation.

### (Optional) Changing CUWB Manager local host port



When the installation script is first run, there will be a prompt for changing the local host port. Selecting **No** will display another prompt window where the new port can be entered.

If a different port is selected during installation, replace all the documentation references to **:5000** with the new port.

The local host port can only be modified when installing the CUWB Manager for the first time or by uninstalling the CUWB Manager package and reinstalling the package.



## 2.4.1 (Optional) Expanding UDP Buffers

While this setting is optional, it is strongly recommended to increase the UDP buffer size for the linux kernel.

```
Configuring cuwb-manager

The linux kernel comes with woefully small receive buffer limits. CUWB
Manager cannot set it's receive buffer limits above the kernels
configured maximum. It is recommended to set the system maximum to 100
MB (104857600) or greater. Your current maximum is only 208KB (212992).

Additional information can be found in the APD002 - Linux UDP Buffers
Application Note on CUWB.io: https://CUWB.io/docs/latest/apd002/

Increase the system maximum UDP receive buffer size to 100MB?

<Yes> <No>
```

If the UDP buffer size is not increased during installation, it can be increased at any point. See [APD002](#) for instructions.

## 3 Getting Started

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This section guides the user through initial access to the CUWB Manager Web Interface and provides guidance on initial settings.

This Getting Started Guide uses the CUWB Manager in Basic View, which can be changed at any time. See [Basic and Expert Settings View](#) for additional information.

### 3.1 Preparation

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#### 3.1.1 Hardware Setup

Users new to the CUWB System should begin by setting up a small, manageable CUWB Configuration to become familiar with the tools and process. The [Quick Start Guide](#) provides step-by-step instructions for creating and running a small CUWBNet. For more detailed information, see the [Installation Guide](#) and [Networking Guide](#).

To achieve the best performance, carefully select locations for Anchors. Each Anchor should have clear visibility to other Anchors and to the field of interest for tracking. For best practices, see the [Component Placement Guide](#).

Survey data collected during hardware installation will be needed later for the CUWB Configuration setup.

Tags are shipped out in a ship mode which internally disconnects the battery. Some Tag variants support user replaceable batteries which need to be installed before Tag use. Ciholas recommends plugging Tags into chargers, or installing batteries, while the rest of the CUWB Manager is being configured.

If Tags are not plugged in while setup is occurring, they may need to be woken up prior to use. Shake devices prior to use to enable a faster CUWBNet join. Otherwise, Tags may take up to 640 seconds to join the CUWBNet.

#### 3.1.2 Software Setup

If not already installed on the Host PC, follow the [Installation](#) instructions to install the CUWB Manager software.

Ensure that the Anchor Network NIC (or VLAN) is configured for link-local IP address range. See [Networking Guide](#) for instructions on configuring NIC(s).

If installing via separate Debian packages, make sure CUWB Migrate, CUWB Manager, and any CUWB Firmware for Anchors or Tags is installed.

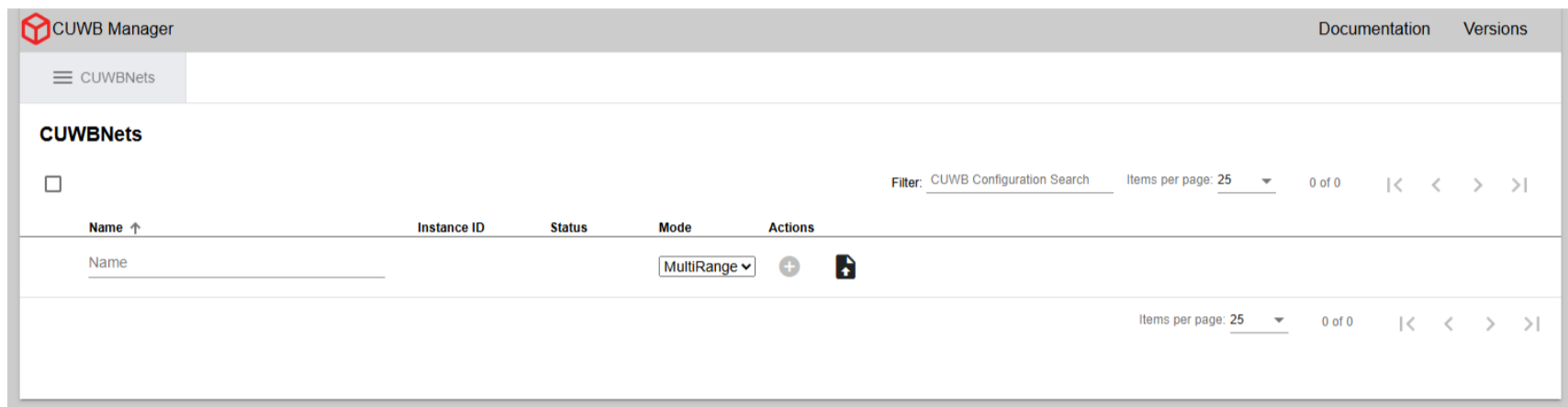
## 3.2 Access the CUWB Manager Web Interface

On the Host PC where the CUWB Manager package was installed, open a web browser and navigate to:

```
http://localhost:5000
```

For systems without a desktop environment, a browser can be opened on another computer with access to the User Network using the IP address of the installation computer instead of `localhost`.

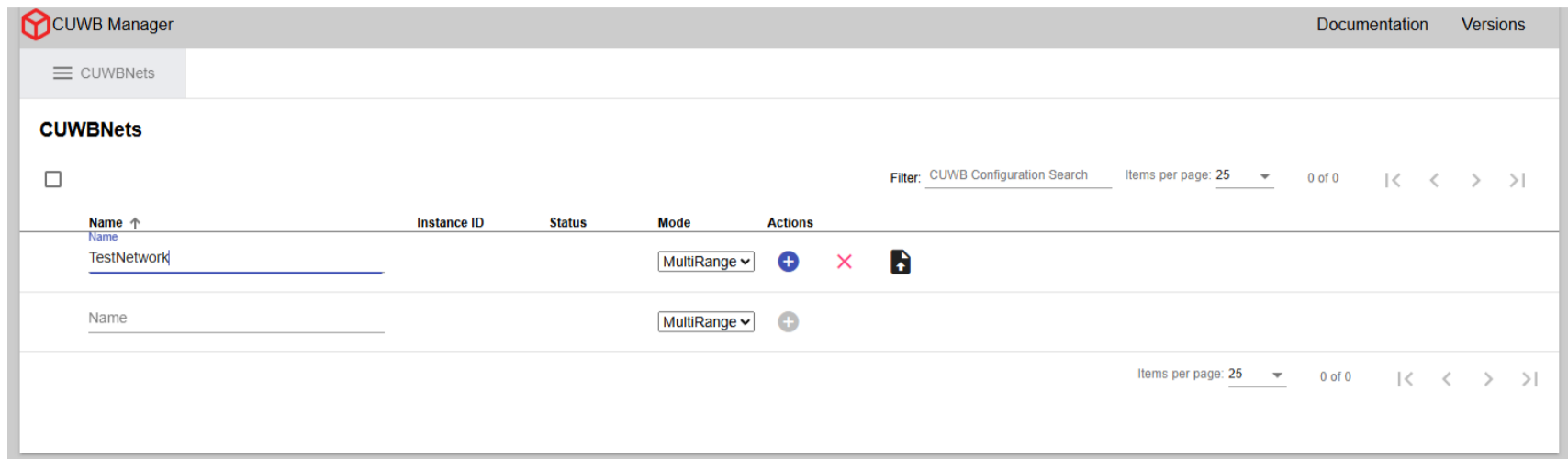
This will present the user with the main configuration page for CUWB Configurations. The CUWB Manager Web Interface is where users create one or more CUWB Configurations. Each CUWB Configuration defines the parameters used by an associated CUWBNet instance. The distinction helps organize settings for different networks and simplifies setup.



The configuration page is also available on port `5000` of each network interface. See [Interface Example](#) for viewing available Host PC interfaces.

## 3.3 Creating CUWB Configurations

Once in the CUWB Manager, open the **CUWB Nets** tab. This section is where all configurations are created and managed.

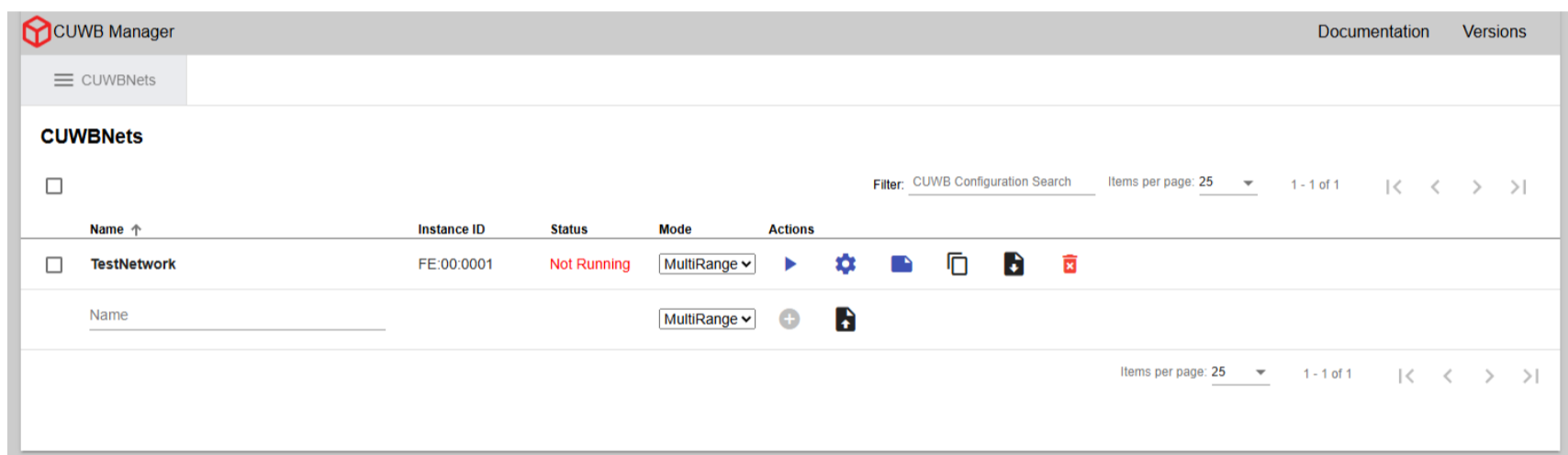


To create a CUWB Configuration:

1. Enter a name for the CUWB Configuration (e.g., TestNetwork)
2. Click the “+” icon under the Actions column.

The name of the CUWBNet cannot contain spaces or special characters, and is limited to a length of 100 characters.

3. After creating the configuration, select the gear icon under Actions. This opens the **Configuration -> Device** tab.



### 3.3.1 Adding Anchors

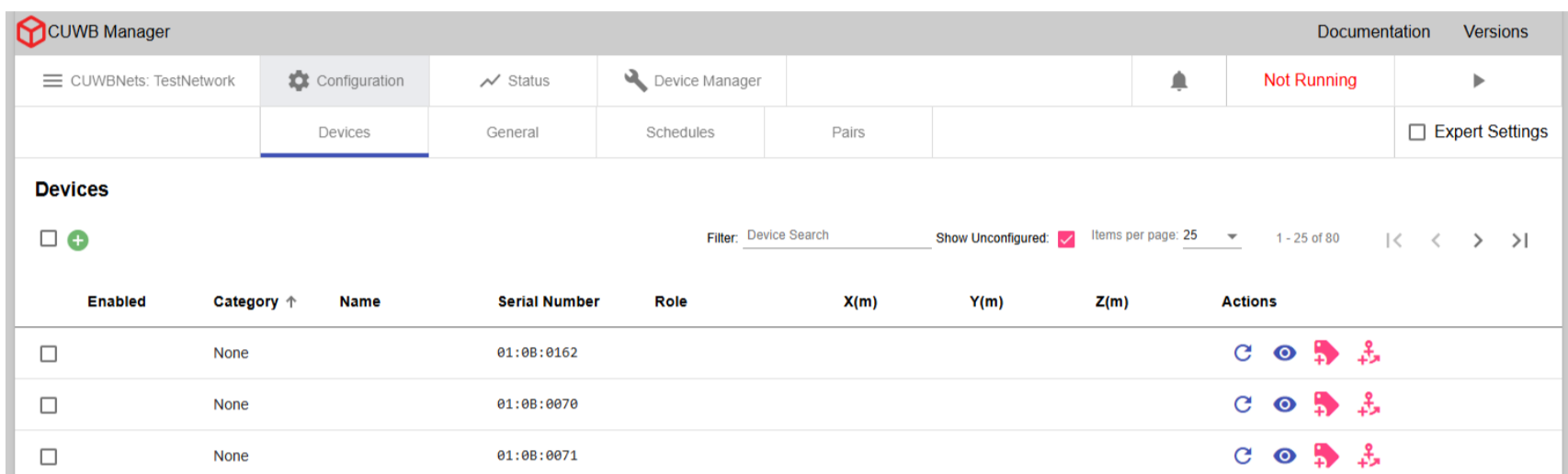
If Anchors are powered on and operational, the serial numbers will automatically populate in the **Configuration -> Devices** tab.

To add an Anchor:

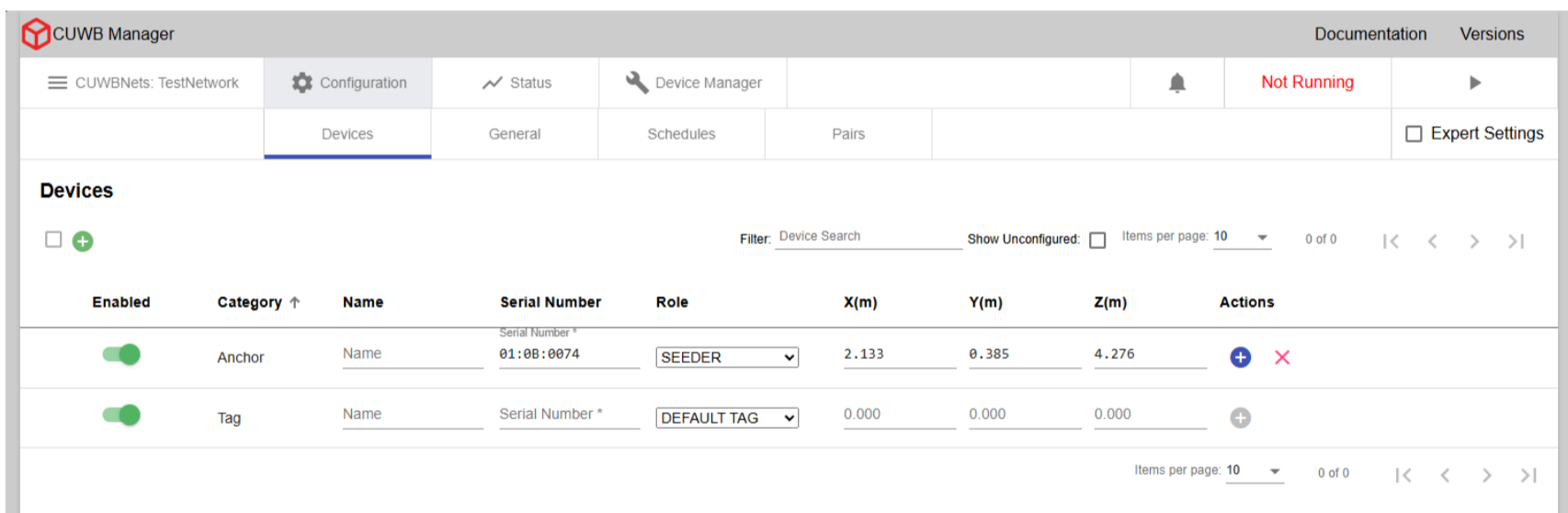
1. Click the Anchor icon under Actions.
2. Enter an optional name, select a role, and provide X, Y, and Z coordinates.

Anchors can be set to **Quiet Anchor**, **Seeder**, or **Initial Seeder** as roles. Most configurations will use the **Seeder** role for the majority of Anchors. If using MultiTime, one of the Anchors should be designated as the **Initial Seeder**. See **Anchor Roles** for details on each role.

3. Click the “+” icon to add the Anchor to the configuration.
4. Repeat for each Anchor in the configuration.



If the Anchors are powered off or did not auto-populate, they can be added manually by entering the same information (serial number, optional name, role, XYZ coordinates) in the fields at the bottom of the page.



X, Y, and Z coordinates must be entered in meters. This is the survey data for anchor locations from the hardware installation.

## 3.3.2 Adding Tags

To add a Tag:

1. Enter its Serial Number
2. Select the Role from the dropdown menu (use DEFAULT TAG if unknown)
3. Enter an optional name

The X, Y, and Z fields are available, but are not used by the system while the device is configured as a Tag.

Roles are beacon rate definitions that can be assigned to Tags. Tags support only one Role at a time, but Roles are configurable dynamically. Optional settings, like LED Brightness, can also be configured per Role. Additional information on Roles is available under [Tag Roles](#).

Custom Roles can be added to the CUWB Configuration prior to adding Tags. Custom Tag Roles will appear in the Role assignment dropdown. See [Adding a new Tag Role](#) section.

Enabled	Category ↑	Name	Serial Number	Role	X(m)	Y(m)	Z(m)	Actions
<input checked="" type="checkbox"/>	Anchor	Name	Serial Number * 01:0B:0074	SEEDER	2.133	0.385	4.276	+ ×
<input checked="" type="checkbox"/>	Tag	Name Bob1234	Serial Number * 0112000d	DEFAULT TAG	0.000	0.000	0.000	+ ×
<input checked="" type="checkbox"/>	Tag	Name	Serial Number *	DEFAULT TAG	0.000	0.000	0.000	+

In MultiRange, Anchors and Tags can be added to a CUWB Configuration at any point, even while the CUWBNet is active. In MultiTime, Tags can be added to a CUWB Configuration at any point, even while the CUWBNet is active. Anchors can be disabled while the CUWBNet is running. The CUWBNet must be stopped in order to add or re-enable Anchors.

Any edits to a device entry will need to be saved using the save icon for the entry row. The save icon will appear when an edit has been made.

### 3.3.3 Configuring Network Settings

The Network Interface Card (NIC) connected to the Anchor Array must be configured for link-local connections. See [Networking Guide](#) for instructions on configuring NIC(s) if they are not configured.

After Anchors and Tags are added to the configuration, navigate to the **General** tab to adjust the network settings. Under Ethernet settings, three data streams are populated by default:

- The **Configuration Stream** is used for device discovery, CUWB Applications and devices periodically announce their presence on this stream. This stream will default to IP address: 239.255.76.67 and Port: 7671. The interface will match the Anchor Stream. This stream should not be modified.
- The **Anchor Stream** is information sent from the Anchor Array devices to the CUWB Engine.
- The **User Stream** is the output data for User Applications to track position, configuration, status, and sensor information.

Each stream consists of three components:

- **IP** - The destination address for the stream
- **Port** - The destination UDP port for the stream

And one of the following:

- **Listening Interface** - The interface for listening to the Configuration or Anchor stream
- **Sending Interface** - The interface for emitting the User stream

The Anchor Stream Interface dropdown menu, highlighted in the red box must match the **inet address** of the link-local NIC or be set to **Link Local**. This address can be determined by the command line in [Interface Example](#) or by using the [Networking Wizard](#) and then selecting the appropriate address from the dropdown menu.

**Ethernet Settings** [Networking Wizard](#)

Config	IP	Port	Listening Interface
	239.255.76.67	7671	Link Local
Anchor	IP *	Port *	Listening Interface
	239.255.78.67	5309	Link Local
User	IP *	Port *	Sending Interface
	239.255.76.67	7667	Default Gateway

[Refresh Network Interfaces](#) Last retrieved on 05-05-2026, 08:09:15

#### Interface Example

To view all network interfaces for the Host PC, type `ifconfig` in a terminal. In addition to the `lo` (or Local Loopback) interface, other interfaces typically begin with `enp` (wired Ethernet) or `wlp` (Wi-Fi). The IP address appears on the second line after `inet`.

*Example:*

```
enp3s0 Link encap:Ethernet HWaddr b8:60:01:c3:9e:20
inet addr:192.168.100.2 Bcast:192.168.100.255 Mask:255.255.255.0
```

This output would indicate any device on the same network segment could access the CUWB Manager by browsing to <http://192.168.100.2:5000>.

## Networking Wizard Example

### Networking Wizard

Welcome to the Networking Wizard.

This utility will help guide you through configuring your Host PC network settings and your CUWBNet ethernet settings.

Close

Next

The Networking Wizard guides users through the steps required for configuring both the Host PC and the CUWBNet for operation, including identifying available network interfaces and identifying potential problems in the setup.

To run the Networking Wizard, click the button labeled [Networking Wizard](#).

The Networking Wizard does not modify the Host PC's networking settings automatically, it is only a guide. For full operating system level instructions, see the [Networking Guide](#).

### 3.3.4 Common General Settings

Other commonly modified general settings are also available in this tab. See the [CUWB Manager Web Interface](#) for all available options. These settings may not need to be adjusted for each RTLS deployment.

Setting	Description
<b>Operational Mode</b>	The operational mode sets which algorithm determines the Tag's position. The default operational mode is MultiRange.
<b>Bounding Box</b>	The bounding box sets the maximum bounds of the tracking area. When more than one Anchor is present, click <a href="#">Use Anchor Bounds</a> to automatically set the system's bounding box just beyond the plane formed by the Anchors. Alternatively, enter minimum and maximum X, Y, and Z limits (in meters) to define the tracking area.
<b>Ethernet Settings</b>	The Ethernet settings define and configure the IP addresses and ports used by the system.
<b>RF Settings</b>	The RF settings determine which Radio Frequency the RTLS system uses. The default selection is Channel 5 PRF64 Preamble Code 11.
<b>Device Updates</b>	This setting will enable or disable automatic firmware updates. Ciholas recommends disabling updates to prevent unintended updates.
<b>Smoothing Factor</b>	The Smoothing Factor allows users to globally apply smoothing to the RTLS position output to reduce jitter. The CUWB Configuration uses a simple smoothing algorithm by default.

## 3.3.5 Common Schedule Settings

After general settings are adjusted, navigate to the [Configuration -> Schedules](#) tab. The CUWB Manager generates an air-time schedule for every Tag and Seeder listed in the CUWB Configuration. This gives devices a known time slot in which they can perform different RF actions according to the UWB operational mode. For a more detailed analysis of the underlying schedule for the operational modes, see [Timing and Schedule](#).

The screenshot shows the CUWB Manager interface with the 'Schedules' tab selected. The 'Tag Roles' section contains a table with the following data:

Name	Beacon Rate (Hz)	Tag Count	LED Brightness	Actions
UNCONFIGURED	DISABLED	0	(Device's Setting)	[X]
DEFAULT TAG	10 Hz	0	(Device's Setting)	[X]
0.1Hz	0.1 Hz	0	(Device's Setting)	[X]
1Hz	1 Hz	0	(Device's Setting)	[X]
10Hz	10 Hz	0	(Device's Setting)	[X]
50Hz	50 Hz	0	(Device's Setting)	[X]
100Hz	100 Hz	30	(Device's Setting)	[X]
20Hz	20 Hz	1	(Device's Setting)	[X]
Name *	10 Hz	Count *	(Device's Setting)	[+]

The 'Anchor Roles' section shows the following configuration:

Seeder Count: 0 | Seeder Rate: 10 Hz | LED Brightness: (Device's Setting)

- **Tag Roles** - Users can define and name custom Tag Roles, each defined by its beacon rate. The beacon rate sets how frequently the time slot is in the schedule.
- **Seeder Rate** - The Seeder rate cannot be adjusted in MultiRange Mode. In MultiTime Mode, the Seeder rate can be adjusted via the dropdown menu. Ciholas generally recommends using a 10Hz rate for most applications.

### Preconfigured Tag Roles

Two Tag Roles are preconfigured for every CUWB Configuration: Unconfigured and Default. These preconfigured Roles can only have their counts modified.

- **Unconfigured** - Tag Role assigned to devices that are not configured to participate in the CUWBNet but may still appear nearby.
- **Default** - Tag Role used by Tags unless another role is selected.

### Adding a New Tag Role:

To add a new role:

1. Enter a name for the role.
2. Select the beacon rate from the dropdown menu.
3. Enter the maximum number of Tags expected to use this role if using MultiTime.
4. Optionally enable or disable LEDs.
5. Click the "+" icon to add the Role.

When using a custom role for Tags, be sure to assign each Tag to that Role in [Configuration -> Devices](#) tab.

## Adjusting LEDs for Anchors or Tags

Under LED Brightness, devices can be set to different LED modes: **On**, **Off**, and **Device's Settings**. **Device's Settings** will have devices follow their firmware programmed LED behaviors. These are outlined in each device datasheet.

Turning off LEDs may lead to confusion if a device is functioning. It is recommended to leave LEDs in either **Device's Settings** or **On** during system setup.

## 3.4 Running the CUWBNet

After entering devices and customizing settings for the application, start the CUWB Configuration by clicking the Play button:

- In the upper right-hand corner in most tab views
- On the CUWBNet page
- On the Status tab

When the CUWBNet starts, Anchors will start their synchronization process (if using MultiTime) and start to build out the CUWBNet through UWB communications. If using MultiRange, devices will begin to range to each other. On the **Status -> Devices** tab, device connectivity and synchronization status is displayed.

Serial Number	Role	Connectivity	Synchronization ↑
01:0B:006F	Seeding Anchor	✓ UWB+Eth	⚠ Tx
01:0B:006C	Seeding Anchor	⚠ Eth	!
01:0B:006D	Seeding Anchor	⚠ Eth	!

The status uses red exclamation points for errors, yellow triangles for warnings, and green checks for good status. For additional details, see [Status Indicators](#).

MultiRange will not display the synchronization status; and connectivity indication is limited to Ethernet only.

If Tags were not powered during setup, they may need to be awakened prior to use. Shaking a device before use speeds up the join process; otherwise, Tags may take up to 640 seconds to join the CUWBNet.

Additional diagnostics and system status information is available in the **Log** tab. For more information on common Log messages, see [Common Log Messages](#).

## 3.5 Next Steps

Once the CUWBNet is active and devices are online, users can start tracking objects of interest. The CUWB Manager also provides advanced tools to customize and optimize tracking performance. See the [CUWB Manager Reference Manual](#) for advanced features of the CUWB Manager and CUWB Devices.

Additional CUWB RTLS tools:

- [CUWB Manager API](#) - Automate control of system functions
- [CDP Logging](#) - Enable CDP data collection for analysis
- [CUWB Viewer](#) - Visualize and model the tracking environment in 3D

## 4 Web Interface Walkthrough

The CUWB Manager Web Interface is the GUI through which users can set up one or more CUWB Configurations. Each CUWB Configuration controls the various settings that need to be used by an associated CUWBNet instance. This section describes the different tabs and configuration options within the CUWB Manager Web Interface in detail.

The terms “CUWB Configuration” and “CUWBNet Instance” are closely related. A CUWB Configuration is the set of parameters for a particular CUWBNet, while a CUWBNet Instance refers to the active, running system.

### 4.1 General Controls

#### 4.1.1 Bell Icon

In the upper right-hand corner in most tab views, a bell icon that displays a count of unread notifications. If this count exceeds 9, the bell icon will display “9+” instead of the full count. For more information see the [notifications section](#).



#### 4.1.2 CUWBNet Control

In the upper right-hand corner of most tabs, the stop / play button allows control of the CUWBNet. There are three modes for a CUWBNet: Running, Shutting down, and Stopped.

- **Running** - The CUWBNet is enabled and active. The CUWBNet is running with the settings provided by the associated CUWB Configuration. Certain settings cannot be adjusted in this state.
- **Shutting down** - The CUWBNet is shutting down its processes. This may take a few seconds. Settings that are unable to be set while the CUWBNet is running are not allowed to be adjusted while the CUWBNet is shutting down.
- **Stopped** - The CUWBNet is not running. All settings in the associated CUWB Configuration can be adjusted.

Shutting Down a CUWBNet involves ensuring all active devices within the CUWBNet return to a nominal state. The process of sending wireless UWB commands to all devices directing them to leave the CUWBNet can take several seconds.

#### 4.1.3 Basic and Expert Settings View

The Configuration tabs can be set to basic and expert views. The basic mode provides a reduced set of common features that cover the majority of users. Expert mode can be enabled via the expert mode checkbox.

Basic view is recommended unless more complex settings are needed.

#### 4.1.4 List Control

The CUWB Manager displays CUWBNet, devices, and notifications in list format, supporting the following controls:

- **Filter & Search** - Narrow displayed items by name or parameter.
- **Sorting** - Click column headers to sort in ascending or descending order.
- **Items per Page** - Item display counts can be selected from the drop down menu.
- **Page Control** - Includes: Fast forward to beginning of list, Previous Page, Next Page, and Fast forward to end of list

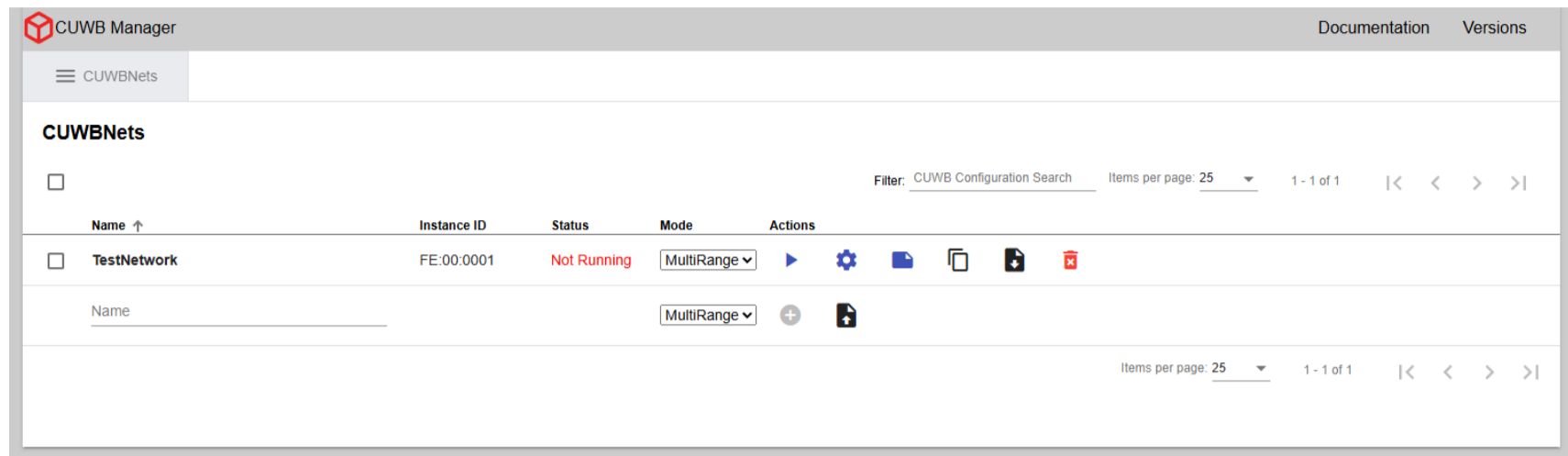
## 4.1.5 Other links

Along the top of the Web Interface are links to the CUWB.IO Documentation site and a Version Page which displays the currently available versions of the CUWB Software Package from the PPA.

The PPA version table may be invalid if the Host PC is not connected to the external internet.

## 4.2 CUWB Configuration

The landing page of the CUWB Manager Web Interface is a listing of all available CUWB Configurations.



### 4.2.1 Name

This is the name of a particular CUWB Configuration and the name of the associated CUWBNet instance. Spaces and other special characters are not allowed in the name field. The field is restricted to 100 characters.

Valid Naming Examples: "Warehouse\_Test" or "Floor\_2\_Building\_5"

Invalid Naming Examples: "Warehouse Test" or "Floor 2 Building 5"

### 4.2.2 Instance ID

The instance ID is a unique identifier starting with FE:xx:xxxx, that represents a CUWB Configuration and CUWBNet instance.

When using more than one CUWBNet, the instance ID can be used to filter CDP packets.

See [CUWBNet Instance ID](#) for setting a custom ID.

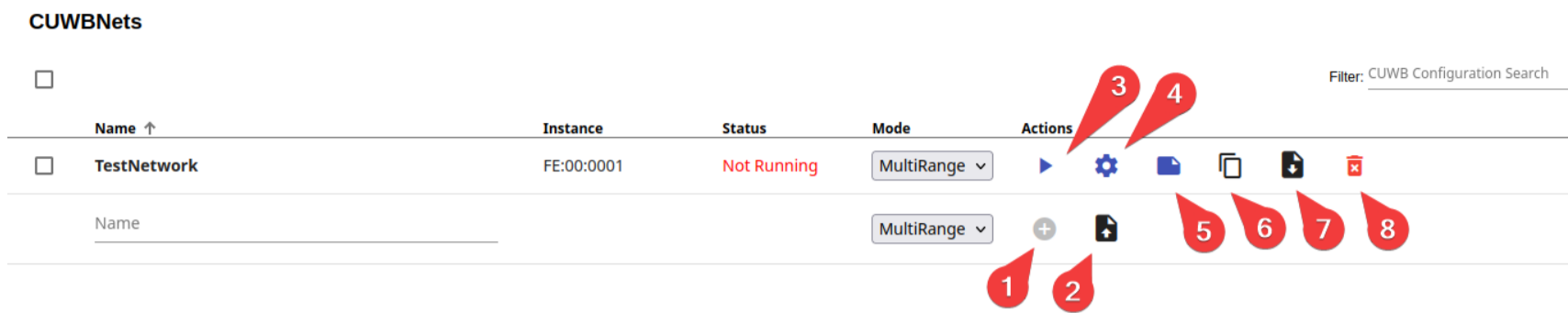
### 4.2.3 Status

This column indicates the CUWBNet status: stopped, shutting down, or running. See [CUWBNet Control](#) for additional detail.

### 4.2.4 Mode

Indicates the mode, MultiTime™ or MultiRange™, for the given CUWB Configuration. The dropdown selector in this column can be used to change the mode for the CUWB Configuration.

## 4.2.5 Actions



The Actions column provides controls for each individual CUWBNet. Available actions are as follows:

### When first adding a new CUWB Configuration:

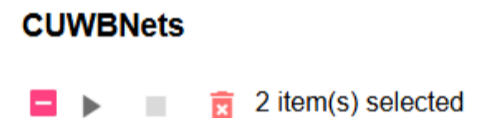
1. **Plus Icon** - Add a new CUWB Configuration
2. **Upload Icon** - Upload a CUWB Configuration file to a new CUWB Configuration instance

### After a CUWB Configuration is Added:

3. **Play / Stop Button** - Start or stop the CUWBNet
4. **Gear Icon** - Shortcut to Device Configuration tab
5. **Page Icon** - Shortcut to the Summary tab
6. **Copy Icon** - Duplicate the CUWB Configuration to a new CUWB Configuration
7. **Download Icon** - Download a copy of the CUWB Configuration
8. **Trashcan Icon** - Delete the CUWB Configuration

## Group Actions

Group actions, such as play/stop and delete, can be performed on multiple selected CUWB Nets using the checkboxes. The group actions and a number of items selected will appear at the top of the list.



## 4.3 Configuration - Devices

The [Configuration -> Devices](#) tab provides the interface for adding devices to the CUWB configuration. Here, users can input device serial numbers and configure necessary parameters needed by the system for each device.

Enabled	Category	Name ↑	Serial Number	Role	X(m)	Y(m)	Z(m)	Actions
<input type="checkbox"/>	Tag	Item 2	01:12:0068	10Hz	0.000	0.000	0.000	🔄 👁️ 🗑️
<input type="checkbox"/>	Tag	TagMask	01:12:XXXX	100Hz	0.000	0.000	0.000	🗑️
<input type="checkbox"/>	Anchor	Name	01:08:0077	SEEDER	2.137	-0.299	4.358	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:006D	SEEDER	-4.567	-3.955	4.365	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:006E	SEEDER	-0.305	-3.968	4.366	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:006F	SEEDER	3.964	-3.957	4.360	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:0070	SEEDER	8.233	-3.958	4.360	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:0071	SEEDER	8.228	3.351	4.357	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:0072	SEEDER	3.966	3.352	4.357	🔄 👁️ 🗑️
<input type="checkbox"/>	Anchor	Name	01:08:0073	INITIAL SEEDER	-0.306	3.356	4.361	🔄 👁️ 🗑️
<input type="checkbox"/>	Tag	Name	Serial Number *	DEFAULT TAG	0.000	0.000	0.000	+

### 4.3.1 Enabled

Toggle devices on or off in the configuration.

In MultiRange mode, Anchors and Tags can be enabled within the CUWB Configuration, regardless of whether the CUWBNet is running. In MultiTime mode, Tags can be enabled at any time; however Anchors can only be enabled when the CUWBNet is stopped. All devices can be disabled while the CUWBNet is running.

### 4.3.2 Category and Role

Devices can be configured as either an Anchor or a Tag. Anchors are static devices placed in a region of interest that act as reference points. Tags are mobile devices that are trackable in the region of interest.

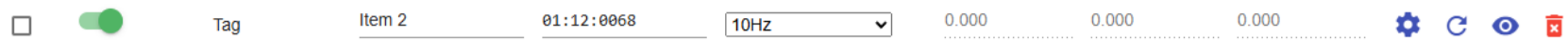
When entering a new device, the device type is determined based on the device's role. A role of Seeder, Initial Seeder, or Quiet Anchor will result in the device being recognized as an Anchor. When configuring an Anchor, the following pieces of information are required: serial number, role, and survey location. All fields must be provided by the user before the Anchor can be added to the CUWB Configuration. See [Anchors](#) for an in-depth view of the different Anchor roles.

The Initial Seeder role is only available when using MultiTime operational mode.

A role other than the ones mentioned above will result in the device being a Tag in the configuration. When configuring a Tag, the only pieces of information that are required are the serial number and role. If using [Default Tag](#), a Tag uses a role which beacons at 10Hz.

To set a custom Tag Role, see [Tag Roles](#).

## 4.3.3 Serial Number and Name



The serial number is the 8 digit number listed on the device, e.g., 01:12:0068, 01:23:4567.

The name is a customizable name for a particular device. The custom names configured here can be seen in the [CUWB Viewer](#), accessed by [API request](#), or from CDP data item [0x013f](#).

### Wildcards for Tags

A **Wildcard** is a special character used in the serial number field to match an unknown digit in the serial number. Wildcards can be used to assign roles to groups of devices. A capital X can replace any character in the Tag serial number. It will wildcard that particular number.

Anchors cannot use wildcards.

Wildcards are prioritized to the most specific wildcard. Using the exact serial number is prioritized over any wildcards that the device would match.

01:12:0123 would match the 01:12:XXXX wildcard instead of 01:XX:XXXX, if both wildcards are present in the device list.

Wildcards will cause the **Status -> Devices** tab to display a yellow exclamation mark in the role column instead of the role name. This is due to devices potentially having different roles configured.

## 4.3.4 X, Y, and Z

These columns provide the survey location for Anchors. The survey must be entered in meters and can be specified up to three decimal places. The system supports using a period, or full stop, as the standard decimal separator.

Commas are not supported in entering X, Y, and Z location data.

Although the X, Y, and Z fields can be entered for a Tag, these values are not used by the system while the device is configured as a Tag.

## 4.3.5 Actions

Enabled	Category	Name	MAC	Dropdown	Value 1	Value 2	Value 3	Actions
<input type="checkbox"/>	Anchor	Name	01:0B:0076	SEEDER	-2.743	0.305	4.276	Reset, Brightness, Trash
<input type="checkbox"/>	Anchor	Name	01:0B:006C	SEEDER	-8.839	-3.353	4.276	Reset, Brightness, Trash
<input type="checkbox"/>	Tag	Name	Serial Number *	DEFAULT TAG	0.000	0.000	0.000	Plus, Reset, Brightness, Trash

### When first adding a new Device:

1. **Plus Icon** - Add a new device to the CUWB configuration after device information is provided

### After adding a Device:

2. **Reset Icon** - Open a menu to send a hard or soft reset command to a device on a running CUWBNet instance. A soft reset will reset the device’s CUWBNet state without rebooting. A hard reset will reboot the device.
3. **Brightness Icon** - Trigger **LED identification sequence**: solid, flashing, or serial number flash.
4. **Trash Icon** - Delete a device from the configuration

### While editing a Device entry:

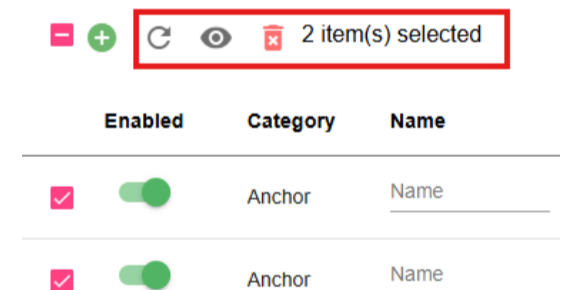
- **Undo Button** - Undo the last edit
- **Save Icon** - Save the edit(s)

### Expert Mode enables the following:

- **Gear Icon** - Add a device setting key to a specific device. See [Appendix A](#) for additional details on available settings.

## Group Actions

The Reset, Brightness, and trash actions can be used as a group action if more than one device is selected by checkbox. These controls appear at the top of the device list, highlighted in the red box. A count of devices selected will also be present. The Plus and Gear actions are not available as group actions.



## 4.3.6 LED Identification

The CUWB Manager has the ability to modify device colors via the Brightness Icon. This feature is useful for identifying devices, particularly Anchors when surveying. Available options are solid color, flashing color, or serial number flash.

### Solid Color

The following options are available to set devices to a solid color:

Color Options	Duration Options
Red, Green, Blue, Magenta, Yellow, or White	30 seconds, 5 minutes, or 30 minutes

## Flashing Color

The LEDs for devices can be set to a flashing pattern of 750 ms ON and 750 ms OFF. This is to help differentiate the pattern from other standard LED behaviors. See [LED Pattern Section](#) for the typical Role led patterns.

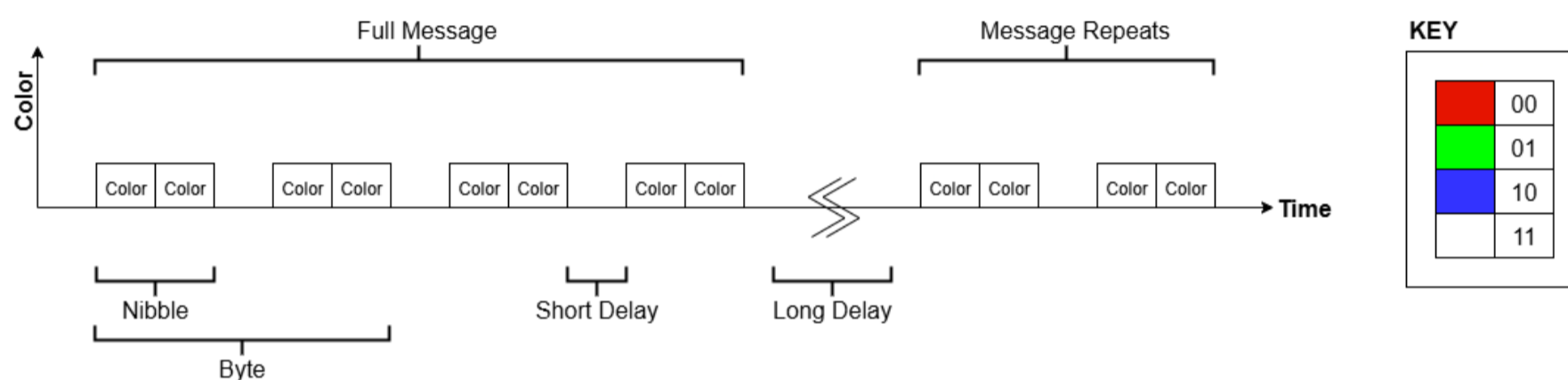
The following options are available to set devices to a flashing color:

Color Options	Duration Options
Red, Green, Blue, Magenta, Yellow, or White	30 seconds, 5 minutes, or 30 minutes

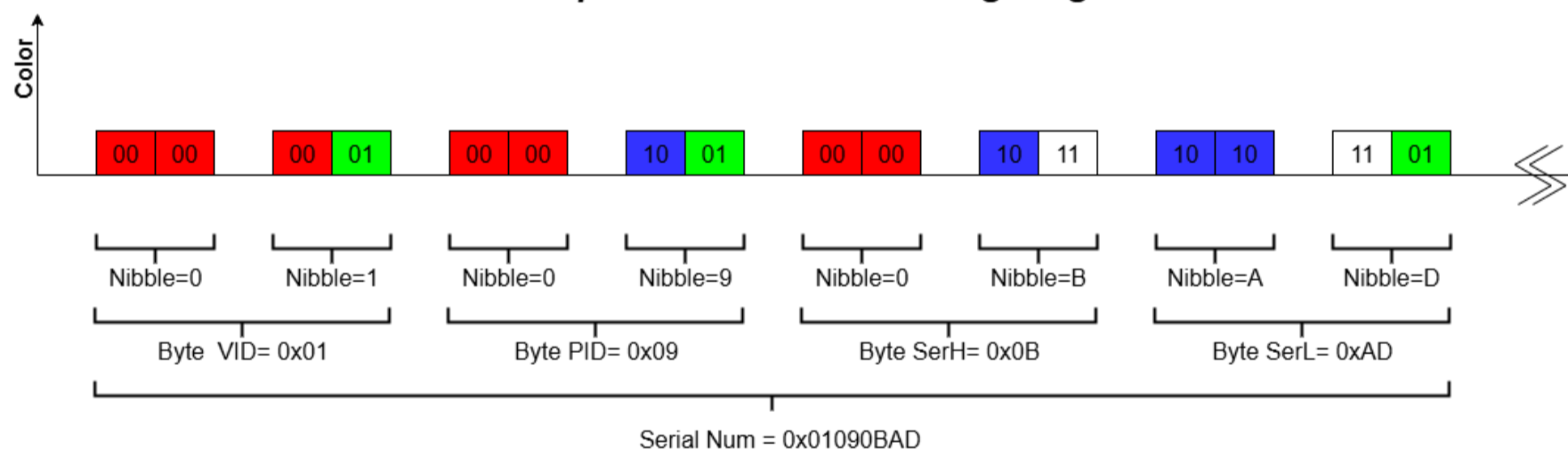
## Serial Number Flash

Serial number flash is a pattern of colors that encode the device's serial number. This can be used to clarify Anchor serial numbers during installation.

**Serial Flash Timing Diagram and Decoding**



**Example Serial Number Timing Diagram**



The serial number of the device is 4 bytes long and color coded via 8 nibbles. There is a short delay between 2 nibbles and a long delay between the full 4 bytes of serial number.

## Color Cheat Sheet

Nibble Colors	Bit Value	Hex Value
Red Red	0000	0
Red Green	0001	1
Red Blue	0010	2
Red White	0011	3
Green Red	0100	4
Green Green	0101	5
Green Blue	0110	6
Green White	0111	7
Blue Red	1000	8
Blue Green	1001	9
Blue Blue	1010	A
Blue White	1011	B
White Red	1100	C
White Green	1101	D
White Blue	1110	E
White White	1111	F

## 4.3.7 Additional Tab Actions and Icons

### Calculator Icon

When using MultiTime mode, the calculator icon pop-ups a calculator which can be used to determine the maximum number of Tags based on a supported Tag Role in the CUWBNet or CUWB Configuration.

### Plus Icon

The Plus Icon will highlight and jump to the new device entry line. This can be useful when adding large quantities of devices.

### Show Unconfigured

Display serial numbers of available devices that are not currently configured in the CUWBNet.

# 4.4 Configuration - General

CUWB Manager
Documentation Versions

CUWB Nets: TestNetwork
Configuration
Status
Device Manager
Not Running

Devices
General
Schedules
Pairs
Expert Settings

**CUWBNet Instance ID**

FE:4C:387F

**Position Settings**

Smoothing Factor:

Smoothing Factor Mode:

- Simple smoothing is strictly a basic averaging of the data over the last number of positions determined by the smoothing factor.
- Weighted smoothing does an average over the last number of positions determined by the smoothing factor, weighting each position based on its quality.

**Bounding Box**

	Min *	Max *
X (meters):	-20.0	20.0
Y (meters):	-20.0	20.0
Z (meters):	0.0	3.0

Min/Max Padding \*   
Value in meters.

**Device Updates**

Automatic Firmware Updates:

Wireless Updating Anchor:

**RF Settings**

Channel

**Operational Mode**

Mode:

**LED Settings**

LED Pattern

- Device (default) mode will display the battery/power state of the device plus connectivity.
- Role mode will utilize the color to display the devices current role. See [here](#) for more details.

**Ethernet Settings** Networking Wizard

<b>Config</b>	IP <input type="text" value="239.255.76.67"/>	Port <input type="text" value="7671"/>	Listening Interface <input type="text" value="Link Local"/>	<input type="button" value="↻"/>
<b>Anchor</b>	IP * <input type="text" value="239.255.76.66"/>	Port * <input type="text" value="7672"/>	Listening Interface <input type="text" value="Link Local"/>	<input type="button" value="↻"/>
<b>User</b>	IP * <input type="text" value="239.255.76.66"/>	Port * <input type="text" value="7673"/>	Sending Interface <input type="text" value="169.254.0.0/16"/>	<input type="button" value="↻"/>

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## 4.4.1 CUWBNet Instance ID

The Instance ID will auto-populate with a unique ID in the Ciholas Serial number format, e.g., FE:XX:XXXX. This ID is configurable, but must start with "FE". The Instance ID appears in CDP output data and can be used to filter data by CUWBNet instance.

No CUWBNet can have the same instance ID as another CUWBNet within the same LAN.

## 4.4.2 Position Settings

Position settings control the globally applied smoothing mode and smoothing factor.

- **Simple** - is a moving average of the position data over the last number of positions as determined by the smoothing factor.
- **Weighted** - is an average of the last number of positions determined by the smoothing factor, weighing each position based on its quality.

## 4.4.3 Bounding Box

The bounding box values globally limit the area the location algorithm uses for calculating the position of Tag beacons. The algorithm will not allow Tags to travel beyond the configured values. These values should be configured to reasonably cover the area of interest for the Tags.

Anchors installed in a planar geometry, i.e., mounted to the ceiling, present an issue to the location engine. Such geometries can result in Tags 'sticking' to the plane of the Anchors. The bounding box should **not** include the plane of the Anchors in these cases. Alternatively, users can install Anchors with diversity in all dimensions preventing Tags from sticking to planar geometries.

When more than one Anchor is configured with X, Y, and Z survey position, the "Use Anchor Bounds" option can be used to set the bounding box to just beyond the X, Y, and Z limits of the Anchor positions. An optional minimum/maximum padding can also be added.

Troubleshooting details can be found under [Planar Anchors](#).

## 4.4.4 Device Updates

Automatic firmware updates can be enabled or disabled. When enabled, wired devices configured as Tags or Anchors will get updated over their wired connection. For wireless devices, users can use the default setting of **Auto** or if using MultiTime, select an individual Anchor to be the **Wireless Updating Anchor**. Wireless devices configured as Tags will be updated over the air when within range of the **Wireless Updating Anchor**. **Auto** allows the CUWB Engine to select the best Anchor for wireless updates instead of using a predefined Anchor.

If an Anchor happens to be using a Tag role, the Anchor will still update over the wire and not wirelessly.

See [Tag Bootloading](#) and [Anchor Bootloading](#) for additional details and instructions.

## 4.4.5 RF Settings

Drop downs provide configurable RF settings.

Devices are region locked. Observe all local and regional regulatory restrictions for use.

The following combinations are generally available; note that not all settings are available in all regions:

Channel	PRF	Description
5	64	Default channel for use in FCC, CE, ISED regions
9	64	Default channel for use in the MIC region; also available for use in FCC, CE, and ISED regions

Always verify regulatory region requirements and restrictions prior to use.

The Tags can only join CUWBNetS that are configured to use the same RF Settings. Tags do not support all channel combinations by default. Some RF settings combinations can only be enabled on Tags by using **Persistent Properties** via the **Device Manager**.

Additional details on RF parameters, such as center frequency and bandwidth are provided in the respective device datasheets.

### RF Settings in Expert Mode

**RF Settings**

Channel	Prf	Preamble Code
5	64	11

Expert mode enables a user to configure the PRF and Preamble Code:

Channel	PRF	Preamble Code	Description
5	16	3 or 4	Alternative channel for use in FCC, CE, ISED regions
5	64	9, 10 , 11 or 12	Default channel for use in FCC, CE, ISED regions
9	16	3 or 4	Alternative channel for use in FCC, CE, ISED, and MIC regions
9	64	9, 10, 11 or 12	Default channel for use in the MIC region; also available for use in FCC, CE, and ISED regions

Always verify regulatory region requirements and restrictions prior to use.

## 4.4.6 Power Settings [Expert Only]

### Power Settings

Tx Power Reduction:

LNA:

Power Settings are only available to expert users. The **TX Power Reduction** field reduces the devices' transmission power between 0 and 25.5 dB. Use **0** for no reduction in transmission power.

The Low Noise Amplifier (LNA) mode is modified via the dropdown menu to **Device's Settings**, **Enabled**, or **Disabled**. Use **device's settings** for default LNA behavior.

- **Device's Settings** - All devices will enable the LNA unless configured otherwise through persistent properties.
- **Enabled** - All LNAs will be enabled for packet receptions.
- **Disabled** - All LNAs will be disabled for packet receptions.

See **RF Power Control Settings** for additional feature details.

Unless otherwise specified by device persistent properties, the **Device's Setting** default to RX LNA **Enabled**.

## 4.4.7 Operational Mode

The CUWB System can operate in two fundamentally different operational modes: *MultiRange™*, and *MultiTime™*. Each mode provides users with low-latency location data output and can be used for large scale deployments. MultiRange utilizes ranging beacons between each Tag and multiple Anchors to produce location data, while MultiTime utilizes timing beacons between each Tag and the Anchor array.

The default CUWBNet setting is MultiRange. MultiRange is more tolerant to survey error and generally easier to set up for small installations. Users are encouraged to experiment with both modes to determine what is right for their application.

Additional detail regarding MultiTime vs MultiRange modes and when to use them can be found in **CUWB Operational Modes**.

The CUWB Manager software tabs adjust dynamically based on the available settings for the selected operational mode.

## 4.4.8 LED Pattern

Use this dropdown to globally control the LED Pattern behavior for devices in the CUWB Configuration. LEDs can be configured for Device mode or Role mode.

### Device Mode

When configured in Device mode the LEDs are controlled by the device firmware. LED state definitions for Device mode can be found in the respective product datasheets. Each device will have varying LED state definitions.

### Role Mode

Setting the CUWB Manager LED mode to Role mode will enable the devices to flash their individual roles within the CUWB Configuration. Role mode is useful, particularly during system setup and testing, to identify device roles and configuration from the tracking area. The table below shows the colors used in this mode.

Color	ON Time	OFF Time	Role
Blue	100 ms	1900 ms	TAG
Green	100 ms	1900 ms	QUIET ANCHOR
Magenta	100 ms	1900 ms	SEEDERS & INITIAL SEEDERS
White	100 ms	1900 ms	UNCONFIGURED

## 4.4.9 Ethernet Settings

**Ethernet Settings**

Networking Wizard

<b>Config</b>	IP 239.255.76.67	Port 7671	Listening Interface Link Local
<b>Anchor</b>	IP * 239.255.78.67	Port * 5309	Listening Interface Link Local
<b>User</b>	IP * 239.255.76.67	Port * 7667	Sending Interface Default Gateway

Refresh Network Interfaces

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The CUWB Manager requires three communication streams to be defined for a CUWBNet to operate. The definition of these streams are as follows:

- **Configuration Stream** - This stream is used for device discovery. CUWB Applications and devices periodically announce their presence on this stream. This stream will default to IP address: 239.255.76.67 and Port: 7671. The interface will match the Anchor Stream. This stream should not be modified.
- **Anchor Stream** - Information sent from the Anchor Array devices to the CUWB Engine.
- **User Stream** - Output data for User Applications to track position, configuration, status, and sensor information.

Each stream consists of three components:

- **IP** - The destination address for the stream
- **Port** - The destination UDP port for the stream

And one of the following:

- **Listening Interface** - The interface for listening to the Configuration or Anchor stream
- **Sending Interface** - The interface for emitting the User stream

The dropdown selection for Listening and Sending Interfaces are populated with the addresses of the Network Interfaces on the Host PC. The Listening Interface may also be set to **Link Local** to automatically match to a link-local addressed interface and the Sending Interface may be set to **Default Gateway** to automatically match to the default interface on the Host PC.

In Expert Mode, the dropdown selection can be manually overridden by typing in the interface.

## Refreshing Network Interfaces

The **Refresh Network Interfaces** button will update the options listed in the dropdown menu under **Listening Interfaces** and **Sending Interfaces**. This should be used after making a change to the Host PC's networking configuration in the operating system.

## CDP Streams Defaults

The default settings for the CDP streams are recommended for users who are unfamiliar with networking concepts. If a stream is changed from the default settings, the reset button will be enabled. Pressing this button will return the IP, port, and Network Interface settings to the default for that stream.

## Networking Wizard

To run a CUWBNet, the Host PC must have a network interface configured for link-local addressing connected to the Anchor chain. This interface must match what is configured for the CUWBNet's Ethernet Settings.

The Networking Wizard guides users through the steps required for configuring both the Host PC and the CUWBNet for operation, including identifying available network interfaces and identifying potential problems in the setup.

To run the Networking Wizard, click the button labeled **Networking Wizard**.

The Networking Wizard is disabled while the associated CUWBNet is running.

## Optional Ethernet Settings [Expert Only]

### Optional Ethernet Settings

- Command, Debug, and Data To Device CDP streams are allowed a single entry each
- The Duplicate CDP streams are for duplicating Config/Anchor/User data and allowed multiple entries
- Required fields listed as **BOLD**

Name	Dest IP	Dest Port	Interface	TTL	Actions
<input type="text"/>	<b>IP</b>	<b>Port</b>	<b>Interface</b>	<b>TTL</b>	<b>+</b>

In Expert mode, additional Ethernet streams are available. They include:

- **Command Stream** - Sends commands that are destined for Tags from the CUWB Engine to Anchors. If a manual entry is not created, a default will be created at IP Address: 239.255.63.82 and Port: 7672. The interface will match the Anchor Stream. The user should not send any data on this stream.
- **Debug Stream** - Used by Anchors to publish debug CDP data for Ciholas debugging purposes. If a manual entry is not created, a default will be created at IP Address: 239.255.11.11 and Port: 1111. The interface will match the Anchor Stream. The user should not send any data on this stream.
- **Data to Device Stream** - Accepts CDP commands from external applications bound for CUWB Tags or Anchors.
- **Duplicate streams** - for Config, Anchor, and User Streams. The CUWB Engine will duplicate all traffic it receives or sends on these streams to their duplicate streams. This is primarily intended to provide more flexibility when logging or doing post analysis on these streams.

Expert mode also enables the ability to set Port and TTL values for the Config, Anchor, and User streams.

## 4.4.10 System Settings [Expert Only]

### System Settings

Key	Value	Actions
Key	Value	+

These optional expert settings allow users to enable features, adjust feature thresholds, and adjust other system settings. The UI provides a short list of available options when the **key** text box is selected. See **System Setting Keys** in the Settings Key Appendix for available settings options.

Some system keys duplicate functionality of the CUWB Manager Web Interface. Updating a setting in one location will update the same setting elsewhere. If a setting dropdown is blank, it may be due to a system key setting selecting a value not available normally in the dropdown menu.

## 4.5 Configuration - Schedules

This page is for configuring different roles and role parameters that impact the CUWB Configuration schedule.

In MultiTime mode, the CUWB Manager generates an air-time schedule for every Tag and Seeder listed in the CUWB Configuration. The schedule defines a dedicated timeslot in which to beacon or listen. Under **Status -> Schedule**, a visual representation of the CUWB Configuration's schedule is provided for running CUWB Nets. For additional information, check out the [CUWB Operational Modes Application Note](#).

Name	Beacon Rate (Hz)	Tag Count	LED Brightness	Actions
UNCONFIGURED	DISABLED	0	(Device's Setting)	[X]
DEFAULT TAG	10 Hz	0	(Device's Setting)	[X]
0.1Hz	0.1 Hz	0	(Device's Setting)	[X]
1Hz	1 Hz	0	(Device's Setting)	[X]
10Hz	10 Hz	0	(Device's Setting)	[X]
50Hz	50 Hz	0	(Device's Setting)	[X]
100Hz	100 Hz	30	(Device's Setting)	[X]
20Hz	20 Hz	1	(Device's Setting)	[X]
Name *	10 Hz	Count *	(Device's Setting)	[+]

**Anchor Roles**  
 Seeder Count: 0 | Seeder Rate: 10 Hz | LED Brightness: (Device's Setting)

In MultiRange mode, devices transmit at arbitrary times using an Aloha protocol. There is no fixed schedule in this mode. The role parameters define the relative beacon rates.

Name	Beacon Rate (Hz)	LED Brightness	Actions
UNCONFIGURED	DISABLED	(Device's Setting)	[X]
DEFAULT TAG	10 Hz	(Device's Setting)	[X]
0.1Hz	0.1 Hz	(Device's Setting)	[X]
1Hz	1 Hz	(Device's Setting)	[X]
10Hz	10 Hz	(Device's Setting)	[X]
50Hz	50 Hz	(Device's Setting)	[X]
100Hz	100 Hz	(Device's Setting)	[X]
20Hz	20 Hz	(Device's Setting)	[X]
Name *	10 Hz	(Device's Setting)	[+]

**Anchor Roles**  
 LED Brightness: (Device's Setting)

## 4.5.1 Tag Roles

Roles consist of beacon rate definitions and other settings that can be assigned to Tags as a group. Roles can be created in the [Configuration -> Schedules](#) tab.

A user might, for example, desire to have a slow beacon rate role for a Tag that is used to track objects that rarely move and have a fast rate for other objects that move quickly through the environment.

Once a role is created, it will be available for use on the [Configuration -> Devices](#) tab under the role dropdown menu.

### Name

A custom name for a Tag role must be added. Names should be descriptive enough to separate them from other roles. Two Tag roles are always available: UNCONFIGURED and DEFAULT TAG.

- **Unconfigured** - Tag Role assigned to devices that are not configured to participate in the CUWBNet but may still appear nearby.
- **Default** - Tag Role used by Tags unless another role is selected

If a Configuration is set up with unconfigured Tag slots, Anchors may initially join the associated CUWBNet as an unconfigured Tag. This will cause the Anchor to use the unconfigured Tag LED settings.

### Beacon Rate

The beacon rate should be set to the desired rate for the given role.

- For basic users, the beacon rate is selectable from a drop down menu.
- For expert users, the beacon rate can either be entered in Hz or ticks when in MultiTime mode. In MultiRange mode, the beacon rate can only be entered in Hz.

A tick is an arbitrary unit used for scheduling by the CUWB system. There are exactly 97500 ticks every second. Ticks are provided as an option due to rounding errors when entering beacon rates in Hz.

### Tag Count

MultiTime adds an additional column called Tag Count. The Tag Count is the maximum number of Tags that can participate in the CUWBNet simultaneously for the given role. Users should set the count to a value equal to, or larger than, the number of Tags they expect to participate in the role at any given time.

Tags can not participate in a MultiTime CUWBNet if their assigned role does not have a Tag count set. If the Tag count is too low for the number of Tags using that role, then Tags will only participate on a first come first served basis.

## LED Brightness

LED Brightness can be set to **Device's Settings**, **On**, or **Off**. Roles will default to **Device's Settings** when first created.

- **Device's Settings** - Tags follow firmware-based LED behaviors while participating in a CUWBNet. See respective product datasheets for additional information.
- **Off** - Tags do not display LED behaviors while participating in a CUWBNet. This effectively turns all LEDs off and could lead to confusion depending on the user's application.
- **On** - Tags display LED behaviors which follow the CUWB Configuration global setting while participating in a CUWBNet.

Use the LED **Off** settings to achieve lower power, longer battery life, on the Tags.

## User Data [Expert Only]

User data options are only available in expert mode.

The following fields become available per role:

- **User Data Rate** - Rate in Hz (or ticks) of expected user data delivery
- **User Data Size** - Size of user data in bytes
- **Payload Overhead Size** - Padding for user data payload in bytes, typically 5 bytes

For additional details on configuring User Data, see **User Data** in the CUWB Manager Reference Guide.

## Actions

The following actions are available:

- **Trashcan Icon** - Deletes a role from the configuration.
- **Undo Button** - Visible when editing a role; reverts the most recent change.
- **Save Icon** - Saves the current edits made to the role.

Expert Mode enables the additional action:

- **Gear Icon** - Adds a role settings key to the selected role. Multiple keys can be added as needed. A small numerical indicator is displayed on the icon, showing the total number of settings currently applied to that role.

## 4.5.2 Anchor Roles

Anchor roles are only available when using MultiTime. All Anchors are scheduled to transmit at the same seeder rate, which can be selected from the drop down menu. Available rates are 10Hz, 20 Hz, and 40 Hz.

Selecting a rate faster than 10Hz will help the Anchor Array synchronize time more quickly, but it will do so at the cost of locates per second. In nearly all situations, 10Hz is adequate.

If using expert mode, the seeder rate can be specified by typing in a rate in either Hz or ticks.

## Seeder Count

Seeder Count is the number of time slots to allocate for the Initial Seeder and Seeder Roles in a MultiTime schedule. The default value is **0**, which will configure the CUWB Configuration to use the total number of devices configured with the Initial Seeder or Seeder Role when the CUWBNet starts.

If users plan to add more devices to either the Initial Seeder or Seeder Role dynamically after the CUWBNet has started, this count can be used to allocate extra time slots for those devices.

If an Anchor is configured dynamically while the Seeder Count is higher than the number of Anchors configured with the Seeder Role, it will join the CUWBNet as a Seeder. If an Anchor is configured dynamically while the Seeder Count is equal to the number of Anchors configured with the Seeder Role, it will not participate in the CUWBNet.

## LED Brightness

LED Brightness can be set to **Device's Settings** , **On** , or **Off** . Roles will default to **Device's Settings** when first created.

- **Device's Settings** - Anchors follow the firmware-defined LED behaviors while participating in a CUWBNet. See respective product datasheets for additional information.
- **Off** - Anchors will not display LED behaviors while participating in a CUWBNet. This setting effectively turns off all LEDs, which may cause confusion in some applications.
- **On** - Anchors will display LED behaviors which follow the CUWB Configuration global setting while participating in a CUWBNet.

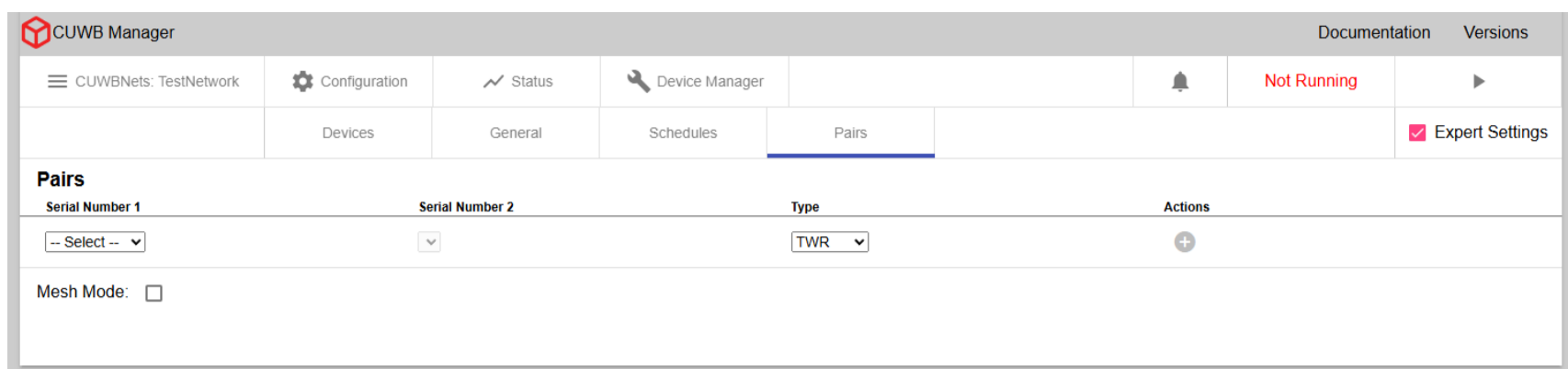
Use the LED **Off** setting to prevent anchor LED patterns and illumination from interfering with environmental aesthetics.

## Anchor Actions

Expert Mode enables the additional action:

- **Gear Icon** - Adds a role settings key to all Anchor roles. Multiple keys can be added as needed. A small numerical indicator is displayed on the icon to show the total number of settings currently applied to the role.

## 4.6 Configuration - Pairs



### 4.6.1 Distance Measurement from Two-Way Ranging (TWR)

In the **Pairs** tab under Configuration, users can configure distance measurements from individual pairs in the Anchor Array. Once configured, Distance data is reported over the User Stream in **DistanceV2** CDP Packets and is calculated using TWR timing data from packets already transmitted by the Anchors. This setting does not increase UWB airtime usage and is available in both MultiRange and MultiTime modes.

Distance from TWR data can be configured using the dropdown menus, and can be configured between individual Anchors or one Anchor and all other Anchors in the Anchor Array.

MultiRange additionally supports TWR from Tag to Anchor, but MultiTime only supports TWR between Anchors.

Below are some suggested reasons a user might want to enable TWR Distance measurements:

- *Survey Checking:* Distances between Anchors, measured using UWB transmissions, can be compared to nominal survey distances to find errors in survey.
- *Identification of LoS Issues:* Distances measured between Anchors that lack LoS will be larger than their nominal surveyed distances. In general the CUWB Engine will ignore timing data between these pairs, but it may be useful to add them as blacklist pairs to improve overall time synchronization.
- *Pure Distance Applications:* Users may want distance measurements Anchors-to-Anchor or Tag-to-Tag for unique applications that rely solely on ranging data and don't require time synchronization.

### 4.6.2 Blacklist Ranging Pair [Expert Only]

Only available while using MultiTime mode, this allows expert users to have the CUWB Engine ignore data between certain Anchor pairs. This can help resolve time synchronization issues caused by environmental issues or poor line-of-sight.

### 4.6.3 Mesh TWR Mode [Expert Only]

Only available while using expert settings, this mode allows users to configure distance measurement for all devices on the CUWBNet. For MultiTime, this is all Anchors. For MultiRange, this would be all devices (Tag to Anchor and Anchor to Anchor).

Enabling TWR Mesh Mode causes significant additional Ethernet traffic on the User Stream in large Anchor Arrays.

## 4.7 Status - Notifications

In the CUWB Manager, under **Status -> Notifications**, users can view any notifications that are generated while using the CUWB Manager. These include messages about changes being made to the CUWB Configuration via the **API Backend** and high priority messages from the CUWBNet.

Notifications are not preserved for display across Host PC reboots. The notification data is archived in the text logs.

### 4.7.1 Notification Table

Notifications displayed in this table include a timestamp of when the notification was generated, a classification, the message, and a button to mark the notification read or unread. Unread notifications will appear with a white background and read notifications will appear with a grey background.

All information level notifications will be marked as read, while warning and error level will be marked as unread.

### Notification Classification

Tue Apr 28 2026 09:00:40 GMT-0500		sample-cuwbnet started.
Tue Apr 28 2026 09:00:39 GMT-0500		WARNING: Role half_phasing has a tag count (1) that is less than the number of
Tue Apr 28 2026 09:00:30 GMT-0500		The port value 5882 matches the command stream port, which is not allowed.

Each notification is marked with a classification level: green circles for information, yellow triangles for warnings, and red circles for warnings.

## 4.7.2 Notification Detail Panel

Clicking on a notification will open a panel at the bottom of the page. This panel contains the full message of the notification, the classification icon, timestamp and an additional button to mark read/unread.

## 4.7.3 Additional Notification Tab Controls

In addition to the **normal list controls**, the **Notifications** tab also offers the following controls:

- **Show Read Messages Checkbox:** When this is disabled, the display will only show notifications which have not been read.
- **Mark All as Read Button:** This button marks all currently received notifications as read.

The table of notifications is sortable by timestamp, classification, or message content. By default, it is sorted by timestamp with the most recent notification appearing at the top of the list.

## 4.8 Status - Log

The screenshot shows the CUWB Manager interface with the 'Log' tab selected. The log messages are as follows:

```

2026-May-05 07:34:08.839163 Opening CUMB Configuration /var/lib/cuwb/network/cuwbnets/TestNetwork.cuwb...
2026-May-05 07:34:08.839984 static_server_id: 4266408063
2026-May-05 07:34:08.840006 position_smoothing: 20
2026-May-05 07:34:08.840019 vm_rejection_threshold: 0.2
2026-May-05 07:34:08.841144 Particle Transmitter: 01:08:0073
2026-May-05 07:34:08.845640 Initializing the host...
2026-May-05 07:34:08.845733 CUWBNet Instance ID: FE:4C:387F
2026-May-05 07:34:08.857602 Wired Device 01:08:0074 = R- B-1.0.0-train17 F-6.3.0-cuwb5.1.0
2026-May-05 07:34:08.943222 Wired Device 01:08:0084 = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:08.959036 Wired Device 01:08:0083 = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:08.981454 Wired Device 01:08:0075 = R- B-1.0.0-train17 F-6.3.0-cuwb5.1.0
2026-May-05 07:34:09.046348 Wired Device 01:08:0076 = R- B-1.0.0-train17 F-6.3.0-cuwb5.1.0
2026-May-05 07:34:09.138728 Wired Device 01:08:0077 = R- B-1.0.0-train17 F-6.3.0-cuwb5.1.0
2026-May-05 07:34:09.162795 Wired Device 01:08:0081 = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:09.250973 Wired Device 01:08:007A = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:09.279484 Wired Device 01:08:007C = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:09.303853 Wired Device 01:08:007E = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:09.426174 Wired Device 01:08:006E = R- B-1.0.0-train17 F-6.3.0-cuwb5.1.0
2026-May-05 07:34:09.428410 Wired Device 01:08:007B = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:09.440510 Wired Device 01:08:007F = R- B-1.1.0 F-6.2.0-train24
2026-May-05 07:34:09.448108 Wired Device 01:08:006D = R- B-1.0.0-train17 F-6.3.0-cuwb5.1.0
2026-May-05 07:34:09.463916 Wired Device 01:08:0080 = R- B-1.1.0 F-6.2.0-train24
  
```

In the **Log** tab, users can view information about the CUWBNet from the **CUWB Engine** at a more in-depth level than the **Notifications** page. Whenever any significant change occurs in the CUWBNet state, such as a new device joining the CUWBNet or timing out, a message will be printed to this log. This information can be invaluable when debugging setup issues. See **Logging** for a list of common log messages.

The data in the **Log** tab will reset if the CUWBNet is stopped and the user leaves the tab. Additionally, there is a limit to how many log messages can be displayed in the log tab at once. By default, 1000 log messages can be displayed. This amount can be modified with the **Max Log Messages** quantity at the top of the tab.

The Log tab's data will reset if the CUWBNet is stopped and the user leaves the tab.

The Log tab is configured to auto-scroll as new messages are posted by default. Use the **auto-scroll** checkbox to enable or disable auto-scrolling.

### 4.8.1 Downloading Logs from the CUWB Manager

The **Download** button opens a dialog window to allow users to select a log file to download, sorted by timestamp. Each entry is timestamped with a last modified time and date. Up to 31 log files may be present for a single CUWBNet. A new log file is generated every 24 hours.

File Name	Timestamp	Actions
TestNetwork.log	Tue May 5 07:36:14 2026	

Close

## 4.8.2 Downloading Logs directly from the Host PC

Logs are located on the Host PC at `/var/log/cuwb/network`.

The following logs are available:

- `cuwb-manager.log` - Logs UI-related errors and issues.
- `cuwb-websocket.log` - Logs errors and issues occurring between the backend and CUWB Engine.
- `<name_of_CUWBNet>.log` - Logs errors and issues specific to the selected CUWBNet. This info is displayed in the Log tab of the CUWB Manager.



## 4.9 Status - Devices

In the CUWB Manager, under **Status -> Devices**, users can view various details about the currently running CUWBNet. This section displays information for each device, including the current connectivity status, synchronization status, firmware version, battery information and IP address, if applicable.

### 4.9.1 Status Indicators

Serial Number	Role	Connectivity	Synchronization ↑
01:0B:006F	Seeding Anchor	UWB+Eth	Tx
01:0B:006C	Seeding Anchor	Eth	
01:0B:006D	Seeding Anchor	Eth	

The status uses red exclamation points for errors, yellow triangles for warnings, and green checks for good status.

### 4.9.2 Connectivity Status

In MultiTime mode, the connectivity status indicates whether each device has an active wired Ethernet connection, a wireless UWB connection, or both.

In MultiRange mode, the connectivity status will only indicate if an Anchor has an Ethernet connection. Tags will display a UWB connection.

## 4.9.3 Synchronization Status

This status is only reported when using MultiTime. Synchronization status indicates whether an Anchor is Transmit (Tx) synchronized, Receive (Rx) synchronized, or both. Transmit synchronization is necessary to spread synchronization to other devices. Receive synchronization is required for contributing to Tag position calculations.

Quiet Anchors will only have Rx synchronization.

## 4.9.4 Other Status

- **IP Address:** If a device is connected via Ethernet, the IP address will be displayed.
- **Firmware Version:** Displays the firmware version number of each device in the CUWBNet.
- **Battery Percentage:** Displays the current battery percentage reported by the device. If this percentage is below 20%, a warning icon will appear next to the entry.

When a device is selected, a panel at the bottom of the page will display additional detailed information for the device:

01:0B:0084	Seeding Anchor	✓ UWB+Etll ✓ Tx+Rx	169.254.9.1	6.2.0-train24
01:0B:0085	Seeding Anchor	✓ UWB+Etll ✓ Tx+Rx	169.254.11.1	6.2.0-train24
01:12:0007	100Hz	✓ UWB	55	6.3.0-cuwb5.1.0

**01:12:0007** [Clear Cached Data](#)

**Connectivity Status:** ✓  
 UWB  
Specifies if the device has UWB connectivity to the rest of the CUWB configuration.  
 Time last heard from: May 5, 2026, 07:44:51 AM  
 Last known position: -5.464, -4.331, 0.915  
 Last known battery %: 55  
 Has External Power: No  
 Charging: No

**Role:**  
 Expected:  
 Active: 100Hz  
The role that this device is currently using.

[Clear Global Cache](#)

Items per page: 25 | 1 - 25 of 33 | < >

## 4.9.5 Device Status Caching

This tab also utilizes caching to display the last known status from the devices. This status data includes: battery, charging and external power flags, firmware version, IP address, and a timestamp of when the device was last heard from. The cached data will persist between page refreshes, CUWBNet restart, and Host PC reboots.

When a CUWBNet is started, the data from the cache is loaded onto the **Status -> Devices** tab. For devices actively participating in the CUWBNet, the cached data is updated on a real-time basis.

Any data for a device that is not in the CUWB Configuration will create an unconfigured device entry in the table. If the device is not being heard from, the last heard timestamp will be displayed next to the connectivity. Clearing the cached data will remove the entry.

### Clearing Cached Data

The cached data can be cleared for all devices by clicking the **Clear Cache** button at the top of the page.

To clear the cache for a selected device, click on the device and select the **Clear Cached Data** option in the detailed information panel.

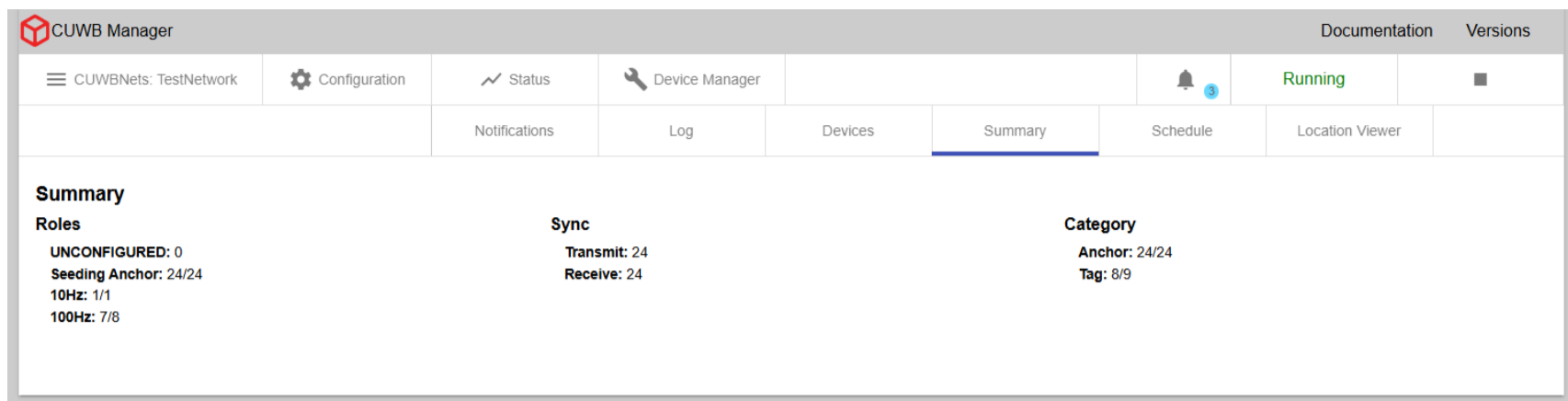
## 4.9.6 Additional Device Tab Controls

In addition to the **normal list controls**, the **Device** tab also offers the following controls:

- **Show Unconfigured** - Toggle displaying Tags with the **UNCONFIGURED** Role.
- **Clear Cache** - This button will clear the cached data for all devices.



## 4.10 Status - Summary



The screenshot shows the CUWB Manager interface with the 'Summary' tab selected. The top navigation bar includes 'CUWB Manager', 'CUWB Nets: TestNetwork', 'Configuration', 'Status', 'Device Manager', 'Notifications', 'Log', 'Devices', 'Summary', 'Schedule', 'Location Viewer', 'Documentation', and 'Versions'. The 'Summary' tab displays the following metrics:

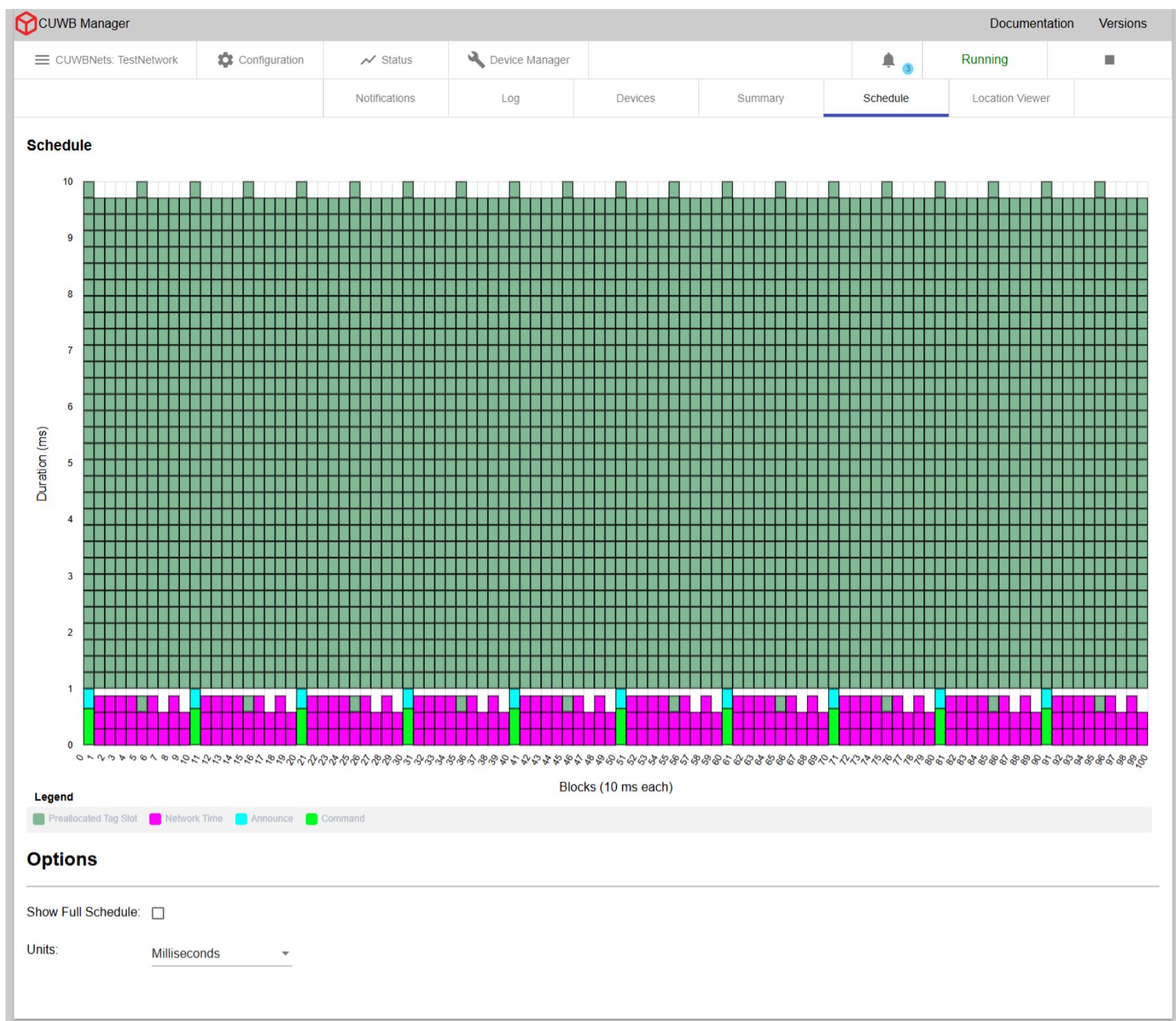
Roles	Sync	Category
UNCONFIGURED: 0	Transmit: 24	Anchor: 24/24
Seeding Anchor: 24/24	Receive: 24	Tag: 8/9
10Hz: 1/1		
100Hz: 7/8		

This tab provides an overview of various CUWBNet metrics:

- **Roles:** Displays device counts for different device roles
- **Sync:** Shows the total number of devices that are Transmit (Tx) and Receive (Rx) synchronized.
- **Category:** Shows devices listed by category: Anchors, Tags, and Unconfigured Devices

For items displayed as a fraction, the numerator is the count of devices currently online and the denominator is the total of devices defined in the configuration.

## 4.11 Status - Schedule



The schedule tab is only for use with MultiTime mode. The tab is hidden in MultiRange mode.

The schedule tab displays the schedule that the system has created for the devices in a chart format with each cell giving information on what it represents. This chart is a representation of the UWB events that occur over time. The chart shows all the UWB activity that occurs over the course of one second. In this chart, time starts in the bottom-left corner and progresses up the column. After reaching the top of the column, time continues from the bottom of the column immediately to the right. The height of each column (and the total number of columns) is determined by the rate of the fastest scheduled event. For example, on a default MultiTime CUWBNet, all events will run at 10 Hz, so each column will be 100 ms long, and there will be 10 columns.

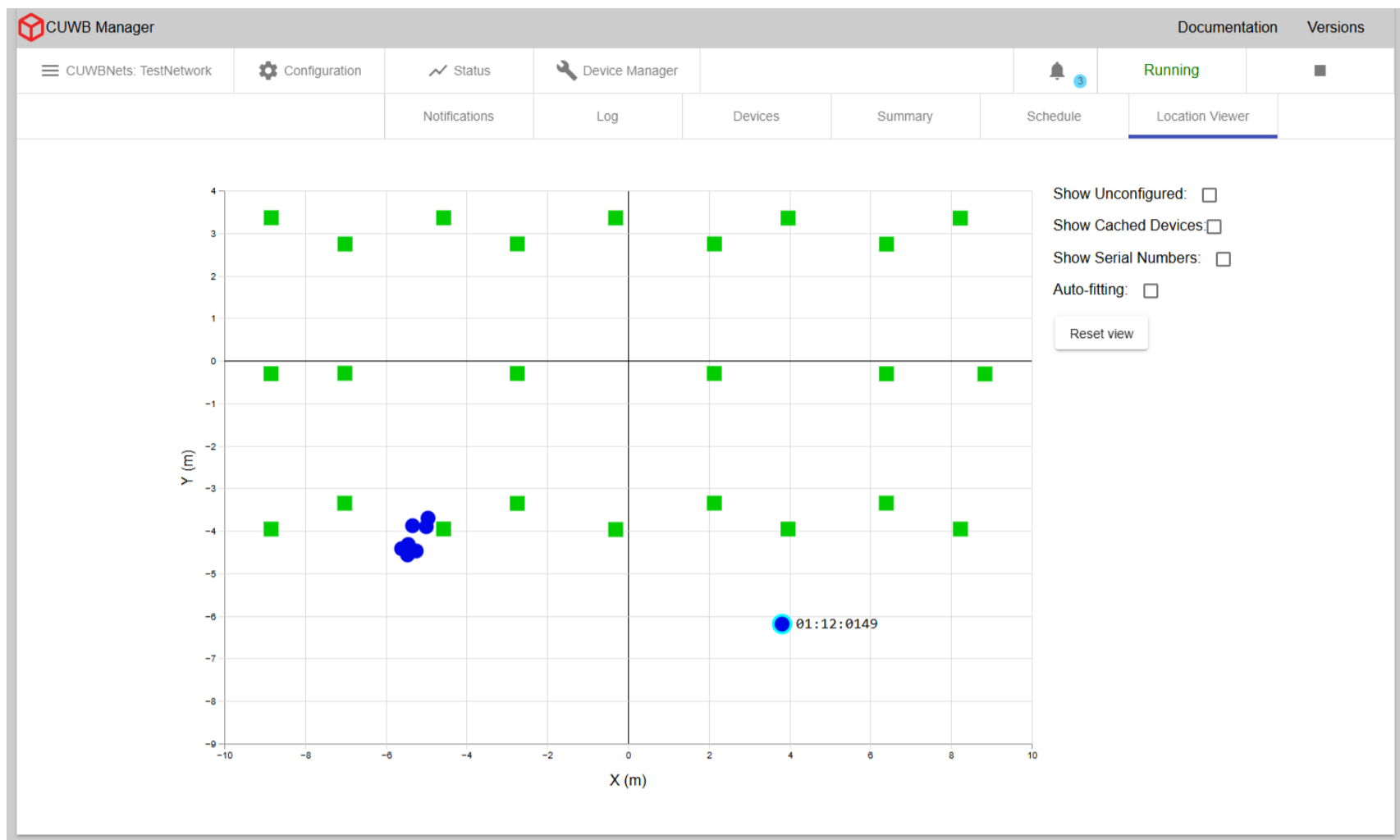
Each cell in the chart represents a single UWB transmission. Highlighting any single cell will highlight all the cells representing repeated events where that transmission is repeated in a one second window.

There are multiple types of UWB packets that are used in transmissions in the CUWB system; these different types are represented with different colors in the schedule chart. For example, the Command Window - where commands are sent to have new devices join the CUWBNet - is displayed in neon green.

### 4.11.1 Options

- **Show Full Schedule** - select this checkbox to expand the schedule view from displaying only the occupied time slice to showing the entire schedule.
- **Units** - Select the schedule to be displayed in milliseconds or ticks

## 4.12 Status - Location Viewer



The Location Viewer is a 2D map showing the current locations and status of network devices with a slow refresh rate. For a faster refresh rate and 3D modeling, see our standalone [CUWB Viewer](#). Anchors are represented as squares and Tags are represented as circles. The table below shows how device connectivity and synchronization status is represented by color.

Color	Description
Gray	For Anchors, after 15 seconds, and Tags, after 5 seconds, if new data has not been received for the time period.
Orange	For Anchors that are only partially connected and synchronized to the Anchor Array.
Green	For Anchors that are fully connected and synchronized to the Anchor Array.
Blue	For Tags that are constantly receiving new data.

Anchors in MultiRange will appear in the viewer as an orange color, instead of green.

Inactive Tags will be removed from the plot after 5 seconds, and will reappear once new data is received.

### 2D Viewer Controls:

- **Pan** - Click and drag to pan around the plot
- **Zoom** - Scroll with the mousewheel to zoom in and out
- **Device Selection** - Click on a device to select it, highlighting it and revealing its serial number. To deselect a device, select another device or click on any empty space in the plot.

## 4.12.1 Options

- **Show Serial Numbers** - Toggle serial number display
- **Auto-fitting** - Fit all devices on the viewable plot, resizing dimensions as needed. Auto-fitting will stop when the box is unchecked or the user pans / zooms around on the plot.
- **Reset View** - Undo panning or zooming done by the user. This setting does not affect auto-fitting.
- **Show Unconfigured** - Toggle displaying Tags with the **UNCONFIGURED** Role.

## 4.13 Device Manager

The screenshot shows the CUWB Manager interface. At the top, there is a navigation bar with 'CUWB Manager', 'CUWB Nets: TestNetwork', 'Configuration', 'Status', and 'Device Manager'. The 'Device Manager' tab is active. Below the navigation bar, there is a 'Device Manager' section with an 'Action' dropdown set to 'Soft Reset' and an 'Apply' button. A table of devices is displayed with columns for 'Selected', 'Name', 'Serial Number', 'Connectivity', 'Response', and 'Timestamp'. The table shows 10 devices, with the 3rd device (Serial Number 01:0B:006E) selected and highlighted. Below the table, a detailed panel for the selected device shows its Name, Serial Number, Connectivity, Response, and Timestamp.

Selected	Name	Serial Number ↑	Connectivity	Response	Timestamp
<input checked="" type="checkbox"/>		01:0B:006C	UWB+Eth	Successfully reset device 01:0B:006C.	Tue May 05 2026 07:52:40 GMT-0500
<input type="checkbox"/>		01:0B:006D	UWB+Eth		
<input checked="" type="checkbox"/>		01:0B:006E	UWB+Eth	Successfully reset device 01:0B:006E.	Tue May 05 2026 07:52:40 GMT-0500
<input type="checkbox"/>		01:0B:006F	UWB+Eth		
<input type="checkbox"/>		01:0B:0070	UWB+Eth		
<input type="checkbox"/>		01:0B:0071	UWB+Eth		
<input type="checkbox"/>		01:0B:0072	UWB+Eth		
<input type="checkbox"/>		01:0B:0073	UWB+Eth		
<input type="checkbox"/>		01:0B:0074	UWB+Eth		
<input type="checkbox"/>		01:0B:0075	UWB+Eth		

**Name:**  
**Serial Number:** 01:0B:006E  
**Connectivity:** UWB+Eth  
**Response:** Successfully reset device 01:0B:006E.  
**Timestamp:** Tue May 05 2026 07:52:40 GMT-0500

The Device Manager tab allows users to issue commands to devices individually or as a group using the checkboxes. Command options include resets, enabling ship mode, setting and getting persistent properties, and getting device attributes.

The device list displays a unit's name, serial number, connectivity, recent response, and the timestamp of the recent response. Selecting a device row will open a detailed panel of the same information with additional space for longer response messages.

The CUWBNet must be running in order to make full use of the Device Manager.

Upon pressing the Apply button, the Device manager sends commands once. Like any RF signal, UWB transmissions are susceptible to interference, so over-the-air command delivery is not guaranteed.

Some commands, like `get property list`, `get property` and `get device attributes`, can transfer a large amount of data over-the-air. Users should limit the amount of Tags utilizing these commands to avoid transmission failures due to lack of airtime.

Users should utilize a maximum ratio of 10 Tags to 1 Anchor to allow enough processing time for data transfer.

## CUWB USB Driver and Device Manager

The Device Manager can be used in conjunction with the **CUWB USB Driver** allowing commands to be sent to devices that support a USB connection.

Using the CUWB USB Driver, with the Device Manager, requires a CUWBNet to be running to set Persistent Properties or retrieve Device Attributes.

### 4.13.1 Resets

Devices can be sent a reset command through the UI.

A soft reset will reset the device's CUWBNet state without rebooting. A hard reset will reboot the device.

To reset a device:

1. Select **Soft Reset** or **Hard Reset**
2. Using the checkboxes, select one or more devices to be reset
3. Hit **Apply**

If the command is successful, the selected devices will reset and their respective response columns will display the following message:

Successfully reset device 12:34:5678

### 4.13.2 Ship Mode

Ship mode is a special mode for rechargeable, battery powered-devices that disconnects the battery internally to allow safe shipment. Once in ship mode the devices are not operational until they exit ship mode, which typically occurs by plugging the device into power. Devices that are in ship mode will not search for or operate within CUWBNet. See device datasheets for support and specific ship mode information.

To return a device to ship mode:

1. Select the **ship mode** action
2. Using the checkboxes, select one or more devices to be placed into ship mode
3. Hit **Apply**

If the command is successful, the selected devices' response will display the following message and the devices will enter ship mode:

Successfully readied device 12:34:5678 for ship mode

If using the CUWB USB driver to send ship mode commands, the device will enter ship mode once removed from USB power.

## 4.13.3 Device Attributes

Device attributes are the attributes of a device that are not modifiable. These include the following:

- MAC Address for Anchors
- Maximum Beacon Rate for Tags
- RF Jurisdiction
- Enclosure Color
- Device Creation Timestamp
- Stock-keeping unit (SKU)

### Get Device Attributes

The `get device attributes` command provides a list of all the device attributes and their values. The list output is a semicolon-separated message.

1. Select the `get device attributes` action
2. Using the checkboxes, select one or more devices to retrieve attributes
3. Hit `Apply`

If the command is successful, the selected devices' response will display the following message:

```
Device 12:34:5678 has attributes: MAC address: 00:01:02:03:04:05; maximum beacon rate: N/A;  
jurisdiction: FCC; color: black; device creation timestamp: Tue Mar 24 2026 16:09:42 GMT-0600; SKU:  
AN302-K1;
```

## 4.13.4 Persistent Properties [Expert Only]

Persistent Properties are device properties that will persist after a device reboots. Persistent Properties are for expert users only; the default settings will work for most users.

### Known Properties vs Custom Properties

Persistent Properties use a hex-based ID number. For a listing of currently supported properties, see [Appendix A](#) in the CUWB Manager Feature Reference.

Invalid Custom Persistent Properties may cause devices to malfunction.

Custom Persistent Properties can be manually entered through the device manager by selecting the custom property option from the dropdown menu using hexadecimal. Values for custom Persistent Properties should be a hexadecimal string in little Endian format.

Defined Properties may have more detailed UI messages. See [Persistent Property Appendix](#) for additional details on expected messages.

### Get Property List

The `get persistent property list` command provides a list of all the Persistent Property IDs that a device possesses. This list output is a comma separated message.

1. Select `get persistent property list` action
2. Using the checkboxes, select one or more devices
3. Hit `Apply`

If the command is successful, the devices' respective responses will display the following message:

```
Device 12:34:5678 has properties: 0x40a0,0x40a1,0x4086,0x4085
```

### Get Property

The `get persistent property` command retrieves the value of the provided Persistent Property ID.

1. Select `get persistent property` action
2. Select the Persistent Property from the dropdown menu
3. Using the checkboxes, select one or more devices
4. Hit `Apply`

If the command is successful, the devices' respective responses will display the following message:

```
Device 12:34:5678 has the following Search Parameters: Channel 9, PRF 16, Preamble Code 4.
```

## Set Property

The **set persistent property** command sets a value for a Persistent Property ID.

1. Select **set persistent property** action
2. Using the checkboxes, select one or more devices
3. Select the Persistent Property from the dropdown menu
4. Select the property value from the dropdown menu or provide the property value in hex
5. Hit **Apply**
6. Select the **Hard Reset** action
7. Using the checkboxes, reselect the same devices from step 2
8. Hit **Apply**

If the command is successful, the devices' respective responses will display the following message:

```
Set property 0x0064 for device 12:34:5678
```

## Clear Property

The **clear persistent property** command will remove the value that is set for a Persistent Property ID. This will revert the setting to firmware controlled defaults.

1. Select **clear persistent property** action
2. Using the checkboxes, select one or more devices
3. Select the Persistent Property from the dropdown menu
4. Hit **Apply**
5. Select the **Hard Reset** action
6. Using the checkboxes, reselect the same devices from step 2
7. Hit **Apply**

If the command is successful, the devices' respective responses will display the following message:

```
Successfully cleared property 0x0064 for device 12:34:5678
```

## Property Command Failure

If one of the above commands fails, the following message will be displayed:

```
Persistent Property request for device 12:34:5678 failed.
```

## 5 Revision

---

Version	Date	Change Description
5.1.0	2026-05-01	Adding new section for notifications; updating log and device manager sections;
5.0.1	2025-11-14	Updating Host PC Requirements; Streamlining Common General Settings; Adding colon requirement for Device Manager;
5.0.0	2025-10-31	Initial Release

## 6 APPENDIX A : Settings Keys

### 6.1 Device Settings Keys

This section describes the different optional device settings keys that can be added to a CUWB Configuration on a per device basis. These are added per device under **Configuration -> Devices** via the gear icon. These settings are for expert users only.

These are also called interface settings in the API documentation.

#### 6.1.1 Ina\_mode

This device setting key specifies whether a device, while participating in a CUWBNet, will use its Low Noise Amplifier (LNA).

If this device setting is present, it will override the system and role setting of **Ina\_mode**.

Device Key Definition	Value	Description
Ina_mode	enabled	The device will use their LNA
Ina_mode	disabled	The device will not use their LNA
Ina_mode	device_setting	The LNA is enabled by default unless configured otherwise through persistent properties
Ina_mode	invalid	Default - Uses either <b>system</b> or <b>role</b> wide Ina_mode instead of device based

#### 6.1.2 position\_delivery\_probabilities

This device settings key specifies a comma-separated list of integer percentages that determine which position windows a particular anchor participates in transmitting position delivery packets.

Device Key Definition	Value	Description
position_delivery_probabilities	x	Comma-separated list of probabilities
position_delivery_probabilities	0	Default - Position Delivery Disabled

#### 6.1.3 rx\_antenna\_delay\_offset

This device settings key is a signed integer that specifies the adjustment to the device's local antenna delay for any packets received by the device. This setting key should only be used with custom hardware.

For use with custom hardware only. Do not modify without express Ciholas guidance.

Device Key Definition	Value	Description
rx_antenna_delay_offset	0	Default - Do not modify

## 6.1.4 tx\_antenna\_delay\_offset

This device settings key is a signed integer that specifies the adjustment to the device's local antenna delay for any packets transmitted by the device. This setting key should only be used with custom hardware.

For use with custom hardware only. Do not modify without express Ciholas guidance.

Device Key Definition	Value	Description
tx_antenna_delay_offset	0	Default - Do not modify

## 6.1.5 tx\_power\_reduction

This device settings key specifies for a device, while they are participating in a CUWBNet, the adjustments to their transmission power.

If this device setting is present, it will override the system and role setting of `tx_power_reduction`.

Device Key Definition	Value	Description
tx_power_reduction	x	Value to subtract from transmission power in tenths of decibels, up to 25.5 dB
tx_power_reduction	0	Do not reduce transmit power
tx_power_reduction	-1	Default - Use <code>system</code> or <code>role</code> wide tx_power_reduction instead of device based

## 6.2 Role Settings Keys

This section describes the different optional role settings keys that can be added to a CUWB Configuration. These are added per device role under **Configuration -> Schedules**. These settings are for expert users only.

Some of these role keys duplicate functionality of the CUWB Manager Web Interface. Updating a setting in one location will update the same setting elsewhere. If a setting dropdown is blank, it may be due to a role key setting selecting a value not normally available in the dropdown menu.

If the value for the role settings key is not provided, the setting will be set to the default value.

### 6.2.1 command\_window\_divisor

This role settings key specifies how many command subgroups each role should have.

Role Key Definition	Value	Description
command_window_divisor	x	Number of Command Subgroups per Role
command_window_divisor	10	Default - Number of Command Subgroups per Role

### 6.2.2 emit\_network\_time\_period

This role settings key specifies the rate that a Tag will emit CDP Network Time packets **0x0149** over **CSP**.

Role Key Definition	Value	Description
emit_network_time_period	x	Time in microseconds
emit_network_time_period	0	Default - Device will not emit Network Time packets over CSP

### 6.2.3 Ina\_mode

This role setting key specifies how the LNA will be configured for devices following this role and participating in a CUWBNet.

If this role setting is present, it will override the system setting of **Ina\_mode**.

Role Key Definition	Value	Description
Ina_mode	enabled	The device will use their LNA
Ina_mode	disabled	The device will not use their LNA
Ina_mode	device_setting	The LNA is enabled by default unless configured otherwise through persistent properties
Ina_mode	invalid	Default - Uses either <b>system</b> wide Ina_mode instead of device based

## 6.2.4 max\_role\_velocity

This role settings key specifies a limit used for sanity checking incoming data by the CUWB Engine. The maximum role velocity is given in meters per second and affects any tag in a given role.

The max\_role\_velocity should be set to 2-3x the maximum speed of tags used in the role for MultiRange and 5x the maximum speed in MultiTime. Lower values will result in less noise in output position measurement, but will also result in rejected input data and can negatively impact CUWB Engine operation if set too low.

If this role setting is present, then it overrides the System Setting of `max_tag_velocity`.

Role Key Definition	Value	Description
max_role_velocity	x	Maximum velocity in meters per second
max_role_velocity	0	Default - Uses system wide max velocity instead of role based velocity

## 6.2.5 mr\_num\_anchors

This role settings key specifies the number of Anchors that should be used in the MultiRange selection algorithm for the role. The value for this setting can be lowered to save battery power on Tags by reducing UWB transmissions. Changing this value can impact the overall quality of the output location. This role key is ignored when using MultiTime.

This role settings key overrides the system settings key `mr_num_anchors`.

Role Key Definition	Value	Description
mr_num_anchors	x	Anchor Quantity used in MultiRange algorithm
mr_num_anchors	8	Default - Anchor Quantity used in MultiRange algorithm

## 6.2.6 no\_network\_timeout

This role settings key specifies the amount of time, in seconds, before a Tag falls off the network if it has not heard any MultiRange UWB Packets. This role key is ignored when using MultiTime.

Role Key Definition	Value	Description
no_network_timeout	x	Time in seconds
no_network_timeout	0	Default - device_timeout will be used instead of this value

## 6.2.7 position\_delivery\_divisor

This role settings key enables or disables position delivery for a role.

Role Key Definition	Value	Description
position_delivery_divisor	1	Position Delivery for the role is enabled
position_delivery_divisor	0	Default - position delivery for the role is disabled

## 6.2.8 position\_delivery\_smoothing

This role settings key sets the amount of smoothing for position calculations that are delivered via position delivery for a given role.

Role Key Definition	Value	Description
position_delivery_smoothing	x	Amount of smoothing for calculations
position_delivery_smoothing	0	Default - No smoothing applied

## 6.2.9 tx\_power\_reduction

This role settings key specifies the adjustment to the transmission power of devices following this role and participating in a CUWBNet.

If this role setting is present, it will override the system setting of `tx_power_reduction`.

Role Key Definition	Value	Description
tx_power_reduction	x	Value to subtract from transmission power in tenths of decibels, up to 25.5 dB
tx_power_reduction	0	Do not reduce transmit power
tx_power_reduction	-1	Default - Use <b>system</b> wide tx_power_reduction instead of device based

## 6.2.10 wake\_on\_shake\_threshold

This role settings key sets the minimum accelerometer value needed to trigger a “shake” event for the Wake-on-Shake Leave behavior. This is a positive integer value of milligravities.

Role Key Definition	Value	Description
wake_on_shake_threshold	x	Threshold of movement in mg
wake_on_shake_threshold	125	Recommended Value - Threshold of movement in mg
wake_on_shake_threshold	0	Default - Wake on Shake is disabled

## 6.2.11 wake\_on\_shake\_timeout

This role settings key sets the time for a device to leave a CUWBNet if it has not experienced a “shake” event. Only positive values are valid.

Role Key Definition	Value	Description
wake_on_shake_timeout	x	Stationary timeout in seconds
wake_on_shake_timeout	30	Recommended Value - Stationary timeout in seconds
wake_on_shake_timeout	0	Default - Wake on Shake is disabled

## 6.3 System Settings Keys

This section describes the different optional system settings keys that can be added to a CUWB Configuration. These settings are for expert users only.

Some of these system keys duplicate functionality of the CUWB Manager Web Interface. Updating a setting in one location will update the same setting elsewhere. If a setting dropdown is blank, it may be due to a system key setting selecting a value not available normally in the dropdown menu.

If the value for the system settings key is not provided, the setting will be set to the default value.

### 6.3.1 anchor\_announce\_timeout

This system key specifies the time an anchor will wait to send an Anchor Announce packet for MultiRange mode.

System Key Definition	Value	Description
anchor_announce_timeout	x	Time in milliseconds
anchor_announce_timeout	25	Default - time in milliseconds

### 6.3.2 anchor\_health\_report\_period

This system key specifies the period, in seconds, at which the CUWB Engine should emit anchor health data items.

System Key Definition	Value	Description
anchor_health_report_period	x	Period of x seconds which the CUWB Engine emits anchor health data items
anchor_health_report_period	0	Default - Anchor health packets are disabled and not emitted

### 6.3.3 announce\_window\_period

This system key specifies the rate in ticks for the announce window for MultiTime mode. If set to 0, then the announce window will be scheduled at the same rate as the Seeder Rate.

The `announce_window_period` must be an even multiple of the Seeder Rate in ticks.

System Key Definition	Value	Description
announce_window_period	x	Announce window rate in ticks
announce_window_period	0	Default

### 6.3.4 cdp\_aggregation\_network\_period

This system key specifies the CDP aggregation rate for anchors. The CDP aggregation rate is how long anchors hold onto CDP data before sending. CDP aggregation collects CDP data items at the anchors and combines the items into a larger UDP packet. This can help reduce Ethernet traffic load for switches.

System Key Definition	Value	Description
cdp_aggregation_network_period	x	Time in ticks
cdp_aggregation_network_period	0	Default - Time in ticks

## 6.3.5 cdp\_aggregation\_mode

This system key enables or disables CDP aggregation for anchors. CDP aggregation collects CDP data items at the anchors and combines the items into a larger UDP packet. This can help reduce Ethernet traffic load for switches.

System Key Definition	Value	Description
cdp_aggregation_mode	disabled	CDP aggregation is disabled.
cdp_aggregation_mode	enabled	Default - CDP aggregation is enabled.

## 6.3.6 cdp\_logging\_enabled

This system key specifies if text log messages from the CUWB Engine will be emitted over CDP.

System Key Definition	Value	Description
cdp_logging_enabled	true	CUWB Engine log messages will be emitted over CDP
cdp_logging_enabled	false	Default - CUWB Engine log messages will not be emitted over CDP

## 6.3.7 command\_window\_period

This system key specifies the rate in ticks for the command window for MultiTime mode. If provided a value of 0, then the command window will be scheduled for the same rate as the Seeder Rate.

System Key Definition	Value	Description
command_window_period	x	Command window rate in ticks
command_window_period	0	Default

## 6.3.8 device\_timeout

This system key specifies the CUWB Engine global device timeout in seconds. The global device timeout is the number of seconds the CUWB Engine can go without hearing data from a device before it recognizes the device as timed out and starts sending it reset commands. If a device doesn't have a specific lease or CUWBNet timeout configured, then it will use the device timeout on the device-side as well.

System Key Definition	Value	Description
device_timeout	x	Global device timeout in seconds
device_timeout	30	Default

## 6.3.9 device\_update\_mode

This system key specifies how the CUWB Engine will update devices. The CUWB Engine will automatically look in /usr/lib/cuwb/device-images/ for images to use for updating devices.

This setting is also available in the CUWB Manager Web Interface under [Configuration -> General](#) tab. The Dropdown "Enabled" is the equivalent of the "auto" setting as a system key.

System Key Definition	Value	Description
device_update_mode	auto	Enables bootloading both over-the-air and over-the-wire
device_update_mode	wired	Enables bootloading only over-the-wire
device_update_mode	wireless	Enables bootloading only over-the-air
device_update_mode	disabled	Default - No bootloading will occur

## 6.3.10 ignore\_network\_duration

This system key specifies the duration, in seconds, that unconfigured devices will ignore the CUWBNet when all unconfigured Tag slots are full.

System Key Definition	Value	Description
ignore_network_duration	x	Duration, in seconds, to ignore the CUWBNet
ignore_network_duration	30	Default - Duration, in seconds, to ignore the CUWBNet

## 6.3.11 led\_mode

This system key specifies whether the LED for a device, while participating in a CUWBNet, is controlled by the device or by the role.

This setting can also be set in the [Configuration -> General](#) tab of the CUWB Manager via the LED Pattern dropdown menu.

System Key Definition	Value	Description
led_mode	device	Device controls the LED based on device status behavior
led_mode	role	Default - CUWB Configuration controls the LED based on role behaviors

Additional information about device-based LED behaviors can be found in the device datasheets.

## 6.3.12 Ina\_mode

This system settings key specifies, for all devices, if the devices use their LNA while they are participating in a CUWBNet.

This setting can also be set in the [Configuration -> General](#) tab of the CUWB Manager via the [Power Settings](#).

System Key Definition	Value	Description
Ina_mode	enabled	The device will use their LNA
Ina_mode	disabled	The device will not use their LNA
Ina_mode	device_setting	The LNA is enabled by default unless configured otherwise through persistent properties

## 6.3.13 log\_playback\_mode

This system key allows the CUWBNet to receive CDP data played back from the Host PC's internal stream as if the data is coming from actual devices.

System Key Definition	Value	Description
log_playback_mode	disabled	Default - Log playback is disabled.
log_playback_mode	full_playback	Log playback is enabled.

## 6.3.14 low\_anchor\_count\_tracking

Enabling low Anchor count tracking allows the CUWB Engine to compute position output data when not enough Anchor data is received for good tracking. When enabled, the CUWB Engine uses a different, low-accuracy, algorithm to compute output positions any time fewer than four Anchors report beacon receptions.

System Key Definition	Value	Description
low_anchor_count_tracking	enabled	Allows the CUWB Engine to use an additional imprecise tracking algorithm
low_anchor_count_tracking	disabled	Disables the imprecise tracking algorithm

By default, this setting is enabled in MultiTime and disabled in MultiRange.

## 6.3.15 max\_position\_calculation\_delay

This system key specifies the delay between reception of initial [Ping V5 CDP packet](#) and calculation of position associated with that Ping V5 packet along with ping data received from all anchors. This setting intentionally adds delay to allow for variable latency in a user's Ethernet LAN or when using CDP aggregation.

System Key Definition	Value	Description
max_position_calculation_delay	x	Time in milliseconds
max_position_calculation_delay	5	Default - Time in milliseconds. This delay is added to the CDP aggregation period.

## 6.3.16 max\_tag\_velocity

This max Tag velocity key specifies a limit used for sanity checking incoming data by the CUWB Engine. The max\_tag\_velocity is given in meters per second and affects all Tags in the system.

The max\_tag\_velocity should be set to the 2-3x the maximum speed expected for Tags in the CUWBNet. Lower values will result in less noise in output position measurement, but will also result in rejected input data and can negatively impact CUWB Engine operation if set too low.

This settings key can be overridden by `max_role_velocity`.

System Key Definition	Value	Description
max_tag_velocity	x	Maximum velocity in meters per second
max_tag_velocity	20	Default when in MultiRange mode
max_tag_velocity	250	Default when in MultiTime mode

## 6.3.17 max\_user\_data\_payload\_size

This system key specifies the maximum size of any extraneous commands that can be passed through the CUWBNet to devices over UWB. The max\_user\_data\_payload\_size is in bytes.

If a command larger than this max size is sent to the CUWBNet, it will be thrown away and a warning message will be printed in the text log for the CUWBNet.

System Key Definition	Value	Description
max_user_data_payload_size	x	Payload size in bytes. Must be less than 350 bytes
max_user_data_payload_size	0	Default size. No User Data sent with commands.

## 6.3.18 mr\_num\_anchors

This system key specifies the number of Anchors that a Tag will range to at any given time in MultiRange mode. The value for this setting can be lowered to save battery power on Tags by reducing UWB transmissions. Changing this value can impact the overall quality of the output location.

This system settings key can be overridden by the role settings key `mr_num_anchors`.

System Key Definition	Value	Description
mr_num_anchors	x	Anchor Quantity used by Tags in MultiRange algorithm
mr_num_anchors	8	Default - Anchor Quantity used by Tags in MultiRange algorithm

## 6.3.19 position\_delivery\_max\_positions

This system key specifies the maximum number of Tags that can receive positions from position delivery.

System Key Definition	Value	Description
position_delivery_max_positions	x	Maximum quantity of Tags receiving Position Delivery
position_delivery_max_positions	0	Default - Position Delivery is disabled

## 6.3.20 position\_delivery\_max\_subwindow\_positions

This system key specifies the maximum number of positions to be delivered during a position delivery transmission.

System Key Definition	Value	Description
position_delivery_max_subwindow_positions	x	Maximum number of Positions in Position Delivery Transmission
position_delivery_max_subwindow_positions	10	Default - Maximum number of positions in Position Delivery Transmission

## 6.3.21 position\_delivery\_period

This system key specifies the rate of position reports from the Anchors.

System Key Definition	Value	Description
position_delivery_period	x	Rate of Position Reports from Anchors in Hz
position_delivery_period	0	Default - Position Delivery is Disabled

## 6.3.22 position\_delivery\_windows

This system key specifies the number of position windows that exist for position delivery.

System Key Definition	Value	Description
position_delivery_windows	x	Number of Position Windows for Position Delivery scheduling
position_delivery_windows	0	Default - Position Delivery is disabled

## 6.3.23 position\_smoothing

This system key specifies the global amount of smoothing to be done on position calculations.

This setting can also be set in the **Configuration -> General** tab of the CUWB Manager via the Smoothing Factor.

System Key Definition	Value	Description
position_smoothing	x	Amount of smoothing for position calculations
position_smoothing	0	Default - No smoothing applied on position calculations

## 6.3.24 position\_smoothing\_mode

This system key specifies the global type of smoothing algorithm used by the CUWB Engine when non-zero position smoothing is applied.

This setting can also be set in the [Configuration -> General](#) tab of the CUWB Manager via the Smoothing Factor.

Kalman Filtering is only available when using the system setting key.

System Key Definition	Value	Description
position_smoothing_mode	weighted_average	Uses a weighted average algorithm
position_smoothing_mode	simple_kalman_filter	Uses a simple kalman filter algorithm
position_smoothing_mode	simple_average	Default - Uses a simple average algorithm

## 6.3.25 transmit\_anchor\_status

This system key configures the CUWB Engine to emit Anchor status data items along with the Tag's position CDP item.

Anchor status data items specify which Anchors were used, what their qualities were, and what sanity checks they failed, if any.

- If set to **"false"** or **"none"**, then Anchor status data items will not be emitted.
- If set to **"true"** or **"position"**, then the data items will be emitted and will provide the status for position data.

System Key Definition	Value	Description
transmit_anchor_status	position	Adds Anchor status data items to the Tag's position cdp data item
transmit_anchor_status	true	Adds Anchor status data items to the Tag's position cdp data item
transmit_anchor_status	false	Does not add Anchor status data items to the Tag's position cdp data item
transmit_anchor_status	none	Default - Does not add Anchor status data items to the Tag's position cdp data item

## 6.3.26 twr\_mesh\_mode

This system key is used to enable TWR mesh mode.

This setting can also be set in the [Configuration -> Pairs](#) tab of the CUWB Manager while in expert mode.

System Key Definition	Value	Description
twr_mesh_mode	true	Enables TWR mesh mode
twr_mesh_mode	false	Default - Disables TWR mesh mode

## 6.3.27 tx\_power\_reduction

This system settings key specifies, for all devices, the adjustment to their transmission power while they are participating in a CUWBNet.

This setting can also be set in the [Configuration -> General](#) tab of the CUWB Manager via the [Power Settings](#).

System Key Definition	Value	Description
tx_power_reduction	x	Value to subtract from transmission power in tenths of decibels, up to 25.5 dB
tx_power_reduction	0	Do not reduce transmit power

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# 7 APPENDIX B : License Terms and Conditions

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## 1 General Terms and Conditions of Purchase/Service

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These General Terms of Purchase/Service are a legal Agreement between you and Ciholas, Inc. (“Ciholas”), and govern your use of all Ciholas services and products, which include, but are not limited to, [CUWB.io](https://CUWB.io), [Ciholas.com](https://Ciholas.com), and all Ciholas Products, Software, and Hardware. If you are accessing and/or using any of the Ciholas services and products on behalf of your employer or as an agent of a third party, your employer or third party is bound to these terms.

Please read these General Terms carefully. Your use of these services and products indicates that you have read, understand, and agree to be bound by the terms herein. Any attempt to set up, use, or install these products constitutes your assent to all the terms of this Agreement. If you disagree with this or any of our other policies, please do not install or use our services and products, and see our return policies for instructions regarding our 60-day Money-Back Guarantee. Written approval is not a prerequisite to the validity and enforceability of this Agreement. Ciholas reserves the right to amend and/or update these terms from time to time. Such modifications to this Agreement will be posted to the website and bundled with software revisions.

This Agreement constitutes the entire and exclusive Agreement between Licensor and Licensee regarding Ciholas services and products, unless modified and agreed to in writing by both parties. We may terminate or suspend access to our services and products at any time, without prior notice or liability, for any reason whatsoever, and without limitation if you breach the General Terms. All provisions of the General Terms shall survive termination, including, without limitation, ownership provisions, warranty disclaimers, indemnity, and limitations of liability. If any provision of this Agreement is deemed invalid or unenforceable, the remaining provisions shall remain in full force and effect.

Any customized services and products will be governed under a separate Customization Agreement.

## 2 Definitions

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For purposes of this Agreement, the following terms shall have the following meanings, unless the context clearly requires otherwise:

“Agreement” means this General Terms of Purchase/Service Agreement and Technology License, any exhibits or appendices attached hereto, and any documents incorporated by reference.

“Buyer” means a person or entity that purchases or contracts to purchase products, services, or property from Ciholas.

“Ciholas” means Ciholas, Inc. including any entity controlled by Ciholas, Inc.

“End-User” means the person or entity that receives and uses Ciholas services and/or products.

“Firmware” means a code segment compiled into binary machine code that is embedded inside a device.

“Hardware” means the physical components of the Ciholas UWB Systems, such as anchors, tags, and supporting equipment.

“Indemnitee” includes, but is not limited to, all End-Users, Buyers, and/or Licensees.

“License Configuration” means a particular configuration or setting provided with Ciholas services and/or products for the purposes of meeting regulatory requirements, or ensuring performance to specification.

“Licensee” means any individual or entity who purchases or uses Ciholas services and/or products covered by this Agreement.

“Licensor” means Ciholas, Inc. including any entity controlled by Ciholas, Inc.

“Our” means Ciholas, Inc. including any entity controlled by Ciholas, Inc.

“Personal Identifiable Information (PII)” means any identifying information unique to you that is made available to Ciholas when you browse our sites, create accounts on our sites, purchase and use our services and products, and/or contact us through our support phone number /email.

“Products” means any goods and/or services provided by Ciholas that are covered under this Agreement.

“Services” means services ancillary to the support and operation of Ciholas Products, Software, Firmware, or Hardware.

“Software” means programs or sets of instructions, including associated source code, object code, documentation, and data, which enable End-Users to perform specific operations or series of operations.

“Technology License” means the License granted to the Licensee for the use of Ciholas services and products through this Agreement.

“We” means Ciholas, Inc. including any entity controlled by Ciholas, Inc.

“You” means the person or entity entering into this Agreement with Ciholas.

## 3 Technology License

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Subject to the terms and conditions of this Agreement, Ciholas grants to you, the Licensee, a limited, non-exclusive, license to use CUWB Software and CUWB Hardware containing Ciholas' Intellectual Property and patent-protected technologies. Ciholas remains the owner of all titles, rights, and interests in the CUWB Software, CUWB Hardware, and other Ciholas products.

Unless expressly stated otherwise, all Software constitutes original code and is subject to the License. Any use of the Software must be in compliance with the License. You acknowledge that the Software and the underlying ideas or concepts of the services and/or products are valuable intellectual property, and you agree not to, except as expressly authorized and only to the extent applicable by statutory law, attempt (or permit others to attempt) to decipher, decompile, disassemble, modify, or otherwise reverse engineer, or attempt to reconstruct or discover any original code, underlying ideas, algorithms, interoperability of the services, products, and Software by any means. Ciholas services, products, and Software are meant to be used in conjunction with one another and any attempt to circumvent this is a violation of this License.

It is a violation of this Agreement to alter any of the Ciholas products to change their designated capability with the intent, or resulting effect, of circumventing the license configuration. Any unauthorized modification violates the terms of service and may make the products illegal in certain jurisdictions (see Government, Regulation, Jurisdiction, and Export Control below).

You must never use Ciholas services and products in any way where the failure of said services and products could cause possible harm, injury, or death to you or others.

The Licensor may amend the License at any time and will post such modifications on our website. Changes are effective upon posting. The Licensee's continued use of the Software after such posting constitutes acceptance.

## 4 Support

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Under this Agreement, Ciholas is under no obligation to provide support for any product or service (such as, but not limited to, technical support, maintenance, upgrades, modifications, or new releases) unless otherwise specified by an additional Agreement.

## 5 Indemnification

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Notwithstanding any other Agreements with Ciholas, the user shall indemnify, defend, and hold harmless the Licensor, its employees, successors, and heirs against any claim, liability, cost, damage, deficiency, loss, expense, or obligation of any kind or nature (including, without limitation, reasonable attorney's fees and other costs and expenses of litigation) incurred by or imposed upon the indemnitees, or any one of them, in connection with any claims, suits, actions, demands, or judgments (including, but not limited to, actions in the form of tort, warranty, or strict liability) arising from the use of Ciholas software and products.

## 6 Force Majeure

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Ciholas shall not be liable or responsible to you for any failure or delay in fulfilling or performing any term of this Agreement, when and to the extent that, such failure or delay is caused by or results from acts beyond Ciholas' reasonable control, including, but not limited to, acts of nature, natural disasters, war, terrorism, labor disputes, supply chain disruptions, power outages, or governmental restrictions.

## 7 Government Regulation, Jurisdiction, and Export Control

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Ciholas products are subject to governmental regulations and laws that may vary by state and country. By purchasing Ciholas products, you agree you will not ship, transfer, or export said products in any manner prohibited by law. You also warrant and agree that you are not located in, under the control of, or a national or resident of any of the countries defined by the Office of Foreign Assets Control, which include, but may not be limited to, Cuba, Iran, North Korea, and Syria. In addition to embargoes, other countries and/or regions may face restrictions under various U.S. export control regulations or be the target of sanctions governed by the Export Administration Act of 1979 (EAA), as amended, any successor legislation, the Export Administration Regulations (EAR), and the International Traffic in Arms

Regulations (ITAR). You will comply in all respects with the export and reexport restrictions applicable to Ciholas products and will otherwise comply with the EAA, EAR, ITAR, and other United States laws and regulations in effect from time to time.

In addition to export regulations, the United States and other countries have laws and regulations governing the use of radio frequency (RF) devices. In the United States, such regulation is under Title III of the Communications Act of 1934, as amended, and regulated by the Federal Communications Commission (FCC). The FCC oversees all non-Federal uses of the radio frequency spectrum, while other regulatory bodies oversee RF devices in other countries' jurisdictions. You agree that you will only use Ciholas products in the jurisdiction for which they were certified and will not exceed the products' operational and use limitations as stated in the product manual. All Ciholas products are labeled as to their specific jurisdictional certification in accordance with the laws of that jurisdiction.

### 7.28 Governing Law

This Agreement will be governed by the laws of the State of Indiana, USA. Parties agree to attempt, in good faith, to resolve and settle any dispute arising out of this Agreement through negotiation between officially authorized representatives of each party. If the dispute is not resolved through negotiation, any litigation arising from the use of Ciholas services and/or products must be brought and resolved in the State of Indiana, USA.

## 8 60-Day Money-Back Guarantee

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All standard Ciholas products not covered by another agreement have a 60-day Money-Back Guarantee. If for any reason the performance of any product is not acceptable, the product may be returned to Ciholas for a refund. Please note: bulk orders are not eligible for the money-back guarantee and cannot be canceled once the order is processed.

Shipping costs and any taxes and/or duties are not refundable and there is a 20% restocking fee for all returns under this policy. To be eligible for a refund, a customer must include an RMA# (see our return process) and dated proof of purchase with the item for return. The cost of the return shipment, including all taxes and duties, is at the buyer's expense. Any product returned not in resalable condition will not be refunded.

## 9 Limited Warranty

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Ciholas warrants that all Ciholas manufactured products, excluding software, will be free from any defect in materials or workmanship for a period of one year. Warranty begins on the date that an item is shipped from Ciholas to the buyer. The warranty is non-transferable and is extended only to the original buyers of this product when the product is used for the purpose for which it was intended. The one-year warranty covers only defects arising under normal use and does not include malfunctions or failures resulting from misuse, abuse, neglect, alteration, improper installation, acts of nature, tampering, or any repairs attempted by anyone other than Ciholas. During the one-year warranty period, the customer's sole and exclusive remedy will be, at Ciholas' sole discretion, the repair or replacement of the defective product, or refund of the purchase amount of the product. Ciholas reserves the right to substitute functionally equivalent new or serviceable used parts.

To be entitled to the rights provided by the one-year warranty, the customer must do the following:

1. Contact Ciholas Technical Support at [returns@ciholas.com](mailto:returns@ciholas.com) or 1-844-595-TECH (8324).
2. Provide in email/phone call, all model number(s), serial number(s), and proof of purchase for all items affected.
3. If return/exchange is necessary, customer will be given a Returned Material Authorization (RMA) # to include with their return.
4. The customer must then ship the item(s), at their expense (including all duties and taxes), to the address provided in the RMA authorization.
5. Once a product arrives at Ciholas, return shipment of repaired or replaced product(s) or a refund will be sent to the customer. The method of return shipment is at Ciholas' discretion and expense, except for applicable duties and taxes, which are the responsibility of the buyer.

### 9.1 Product Warranty Exclusions

Ciholas does not warrant or guarantee, and is not responsible for the following:

1. Defects, failures, damages, or performance limitations caused in whole or in part by: (A) power failures and surges; fires; floods; acts of nature; excessive temperatures; corrosive environments; accidents; actions by third parties; or

- other events outside of Ciholas' control; or (B) customer abuse; mishandling; misuse; negligence; improper storage, servicing, installation, or operation; or unauthorized attempts to repair or alter equipment in any way.
2. Performance of the equipment when used in combination with equipment not purchased, specified, or approved by Ciholas.
  3. Consumable goods used with, or required by, Ciholas products.
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### 1 CUWB Manager Backend

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Flask

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## 2 CUWB Manager Frontend

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d3

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core-js

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zone.js

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cache-loader

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@angular-devkit/build-optimizer

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webpack

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ng2-file-upload

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socket.io-client

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ngx-tour-md-menu

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### 2.26 bootstrap

bootstrap

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### 2.27 normalize.css

normalize.css

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Pure CSS Material Switch

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## 3 CUWB Manager Installer

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### 3.1 debconf

debconf

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## 4 CUWB Engine

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### 4.1 SQLiteCPP

SQLiteCPP

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## 4.2 SHA-1 in C

SHA-1 in C

By Steve Reid [steve@edmweb.com](mailto:steve@edmweb.com)

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## 4.3 cpp\_redis

cpp\_redis

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## 4.5 Eigen

Eigen

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## 4.6 qt5

qt5

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## 5 CUWB Migrate

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