

RAELink3/RAELink3 Mesh Quick Start Guide

Version 1.0 – February 19, 2016

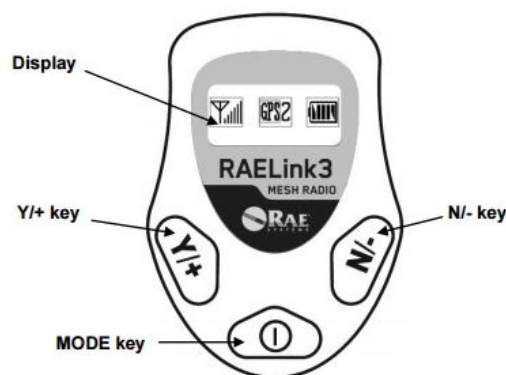


This Quick Start Guide is intended to provide the necessary steps for setting up and using the RAELink3 and RAELink3 Mesh (RAELink3/3 Mesh) transmitters to provide remote real-time data updates to ProRAE Guardian base stations while using EPA air monitoring equipment. The RAELink3/3 Mesh are compact, portable radio-frequency modems that provide long-range wireless communication between remote portable air monitors and a base station/computer for comprehensive monitoring. The RAELink3 communicates wirelessly with air monitors via Bluetooth, while the RAELink3 Mesh communicates via a mesh radio. Both are able to connect up to 64 RAELink3/3 Mesh connected monitors. Prior to using the RAELinks, it is assumed that ProRAE Guardian is already set up. This guide does not include all functions of the RAELink3/3 Mesh, rather it describes the process to initiate and operate a remote system using a ProRAE Guardian base station, RAELink3/3 Mesh transmitters, and EPA air monitoring equipment. Refer to RAE Systems user manual for a complete operational guide on RAELink3/3 Mesh.



1.0 Basic User Information & Set-up

Below is the display for the RAELink3/3 Mesh:



The **MODE** key acts as the on/off and save, the **Y/+** key increases values, and the **N/-** key decreases values and selects “no” to advance to the next function. These keys also control different parameters and make different selections within different menus.

The display shows indicators for the Radio Signal strength, connection to GPS Satellites, and the remaining Battery Life. Below these three indicators is displayed NetID, Remote, Mesh Link, OSTD, ORTR. A description of each of these indicators is provided below:

- Radio Signal – Refers to the signal strength in the network. In the photo below, the signal strength is full, minus one bar.
- GPS Satellites – Shows number of satellites. In the photo below, no satellites are currently connected to the RAELink.

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- Battery Charge – Indicates the battery level via a bar graph. In the photo below, only 3 bars remain indicating the battery is half charged.
- Net ID - Indicates the network ID that the RAELink is set to. The unit below is set to Network ID 235.
- Remote – Possible operating modes include: host, remote, and repeater. The unit below is currently set to Remote.
- Mesh Link – Indicates a Mesh Radio connection.
- OSTD – Indicates how many instruments are connected via Mesh Radio. The unit below has 0 units connected to it via radio.
- ORTR – Indicates how many instruments are connected via cable. The unit below has 0 units connected to it via cable.



1.1 Turning Unit On

To turn on, press and hold the **Mode** button until the display is on. To turn off, press and hold **Mode** for 3 seconds and the display will show "Shutting Down..." After a 5-second countdown, you see "Unit Off." Release your finger, and the screen will go blank. For backlight, pressing any key while the display is on will turn on the backlight. After 15 seconds of inactivity, the backlight turns off.

1.2 Battery and Charging

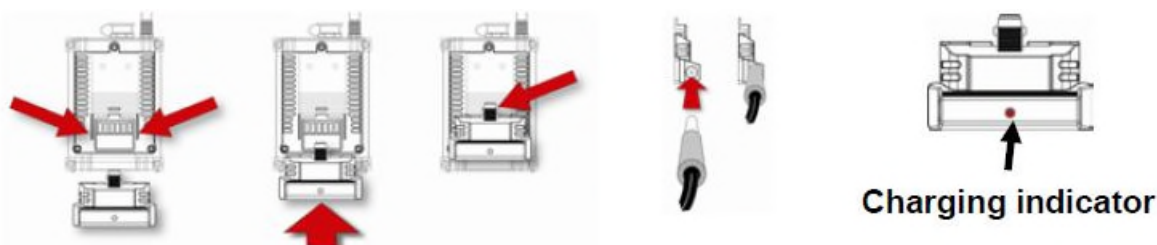
The RAELink3/3 Mesh can use a rechargeable lithium-ion battery or an alkaline battery pack. It can also be operated attached to a charger. To take the rechargeable battery or alkaline battery pack out of the RAELink3/3 Mesh, remove the 3 Phillips head screws from the rear of the unit and lift it out. To replace the AA batteries in the alkaline battery pack, remove the two Phillips-head screws on the inside, remove the cover, and replace the 5 AA batteries (Duracell MN1500 or Energizer E91 only). Make sure that the polarity ("+" and "-") for each battery is correct. Do not mix old and new batteries. Only change batteries in a non-hazardous location.

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Before using the RAELink3/3 Mesh, charge the Li-ion battery by attaching the instrument to the Charging Adapter.



1. Align the Charging Adapter with the back of the RAELink3/3 Mesh (two guides match indents on the back of the Charging Adapter).
2. Slide the Charging Adapter onto the back of the RAELink3/3 Mesh.
3. Make sure the latch clicks into place. (Press the latch when detaching the charger).
4. Plug the power supply connector into the input on the side of the Charging Adapter.
5. Plug the power supply into a wall outlet.

The LED Charging Indicator in the Charging Adapter should glow red to indicate it is charging, and glow green when the battery is fully charged.

2.0 Initial Network Setup

For initial network setup, the RAELink3/3 Mesh units will need to be set as a *host*, *remote*, or *repeater* as described below in Section 2.1. There can only be one host in the network. Physically connect the host to the computer with ProRAE Guardian as described in the ProRAE Guardian Quick Start Guide. The function of the remote and repeater are described in Section 2.1.

All RAELink3/3 Mesh will need to be on the same network for the RAELink3/3 Mesh transmitters to communicate to each other. Set up a RAELink3/3 Mesh network by setting the RAELink Network ID as described below in Section 2.2. After the Network ID is set, the RAELink3/3 Mesh has the ability to communicate with other units set to the same Network ID. The next step is to set the Unit ID so the RAELink3/3 Mesh can be identified in ProRAE Guardian (Section 2.3 below). The Unit ID will also be used to identify all air monitoring devices linked to the RAELink3/3 Mesh transmitter. Pairing air monitoring equipment to the RAELink3/3 Mesh is described in Sections 3.0 and Section 4.0.

2.1 Set up Operating Mode as Host, Remote, or Repeater

RAELink3/3 Mesh transmitters can be configured to operate as *host*, *remote*, or *repeater*.

- Host: In Host mode, the RAELink3/3 Mesh functions as a host modem and communicates with multiple wireless modems. The host is connected directly to the computer with ProRAE Guardian software. There can only be one host in the network.
- Remote: In Remote mode, the RAELink3/3 Mesh Remote functions as a slave modem and communicates to a host modem with the same network ID. Air monitoring equipment is

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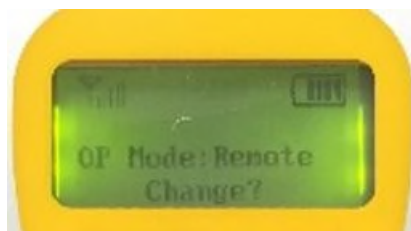


connected to the remote by wireless, Bluetooth, or a cable connection. In remote mode, the RAELink3/3 Mesh has capabilities of connecting to a host from up to 2 miles.

- Repeater: In Repeater mode, the RAELink3/3 functions as a repeater for RAELink3/Mesh3 in remote mode (or AreaRAE or RAELink series products) with the same network ID. Each repeater can extend the signal up to 2 miles.

When set up in Host mode, RAELink3/3 Mesh can be networked with up to 64 RAELink equipped monitors. In Remote mode, up to 9 monitors can connect to one RAELink3 Mesh using mesh radio (8) and serial cable (1) connection, while a RAELink3 in Remote mode can connect with up to 2 monitors using Bluetooth (1) and serial cable (1) connection.

1. Press and hold both **MODE** and **N/-** for 3 seconds. The RAELink3/3 Mesh enters programming mode.
2. Scroll to the Operation Mode menu by pressing the **N/-** button. The Operations Mode screen looks like this:

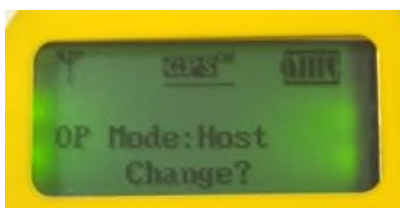


NOTE: The RAELink3/3 Mesh are preset in Remote mode.

3. If changing the operation mode, Press **Y/+** to change.
4. Press the **N/-** button to shift through the options. The options are Host, Remote, and Repeater.

If setting up as a Host, continue to the next step. If setting up as Remote, continue to step **4.4**. If setting up as Repeater, go to step **4.6**.

- 4.1. When the Host mode is showing, press **Y/+** to save the setting. The screen will then revert back to the beginning screen for the Operation Mode, with Host being displayed.



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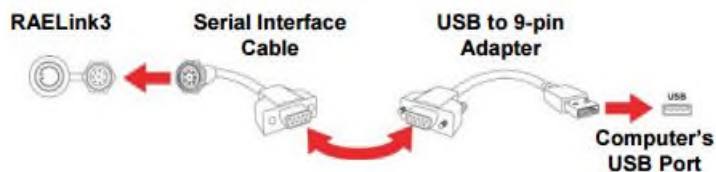
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- 4.2. Once in Host mode, press the **MODE** button to exit the menu. The screen should appear as such:



- 4.3. As the Host, the RAELink3/3 Mesh needs to have a connection to the laptop in order to communicate to ProRAE Guardian and other RAELink3/3 Mesh units. To connect to a laptop follow the instructions below or refer to the ProRAE Guardian Quick Start Guide. The serial connection cable, and how it connects to the RAELink3/3 Mesh and computer can be seen below:



- 4.4. When Remote mode is showing, press **Y/+** to save the setting. The screen will then revert back to the beginning screen for Operation Mode, with Remote being displayed.



- 4.5. Once it has been made the Remote, press the **MODE** button to exit the menu. The screen should appear as such:



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- 4.6. When Repeater mode is showing, press **Y/+** to save the setting. The screen will then revert back to the beginning screen for Operation Mode, with Repeater being displayed.
- 4.7. Once it has been made the Repeater, press the **MODE** button to exit the menu. The screen should appear as such:



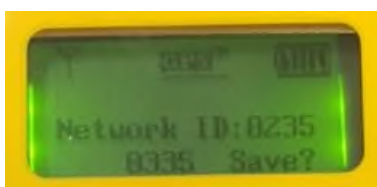
NOTE: When put in Repeater mode, the GPS function is turned off.

2.2 Setting the Network ID

All RAElink3/3 Mesh transmitters and any other Remote, Repeater, or Host units in a network must have the same Network ID. The Network ID allows RAElink3/3 Mesh units to communicate with each other through a central network.

Note: If using an EPA AreaRAE kit, the network ID used for the AreaRAE kit should be used for the Network ID. Network IDs on the AreaRAEs are either set by RAE Systems or require direct connection to the radio device to change the Network ID.

1. Press and hold both **MODE** and **N/-** for 3 seconds. The RAElink3/3 Mesh enters programming mode.
2. The first menu option is Network ID. Click **Y/+** to set or change.
3. When changing the Network ID, the cursor flashes on the selected digit. To change the digit, press **Y/+** to increase the number and **N/-** to decrease the number.
4. Press **Mode** to advance to the next digit.
5. Input a unique Network ID. To accept, press and hold the **Mode** button for 2 seconds. A confirmation screen appears:



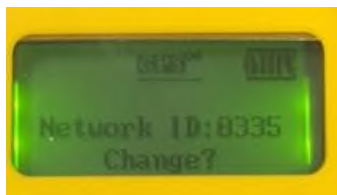
NOTE: The Network ID can be any value set between 1 through 4095, except 255.

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6. Press **Y/+** to save, or press **N/-** to abort. If you save the Network ID, you will see this display:



2.3 Changing Unit ID

When RAELink3/3 Mesh is configured as a Repeater or Host, it does not require a Unit ID. Some portable monitors require setting the Unit ID on the monitor. The Unit ID is used to identify the RAELink3 Mesh within ProRAE Guardian. ProRAE Guardian shows the unit ID number, and any monitors connected to that RAELink3 Mesh show up with a unit ID that is equal to the unit ID of the RAELink3 Mesh followed by a dash and the radio serial number of the gas monitor; for example, RAELink3 Mesh with Unit ID 1, then ToxiRAE Pro with Unit ID of 1-xxxx.

1. Access the menu screen on the RAELink3/3 Mesh by holding the **Mode** and **N/-** buttons at the same time for 3 seconds.
2. Scroll by pressing **N/-** to the menu option called Change Unit Number. Press the **Y/+** button to change.
3. When changing the unit number, the cursor flashes on the selected digit. To change the digit, press **Y/+** to increase the number and **N/-** to decrease the number.
4. Input a unit number (ranging from 1 to 9). To accept, press and hold the **Mode** button for 2 seconds. The screen will return to the beginning Change Unit number screen.

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3.0 Connecting RAELink3 Mesh with EPA Equipment

One RAELink3 Mesh is capable of connecting up to 9 air monitors using mesh radio (8) and serial cable (1) connection. However, a limited number of RAE Systems devices and third party devices are capable of connecting to the RAELink3 Mesh. The devices are provided in the table below.

Product	Connection	Setting
ToxiRAE Pro Series	Mesh Radio	Set with PAN ID
MultiRAE Series	Mesh Radio	Set with PAN ID
AP4C	Cable	AP4C
ChemRAE	Cable	ChemRAE
DustTrak2	Cable	DustTrak2
MiniRAE	Cable	Bypass
MultiRAE Plus	Cable	Bypass
ppbRAE Plus	Cable	Bypass
QRAE Plus	Cable	RAE PTP

This Quick Start Guide only covers connecting RAELink3 Mesh to AreaRAE Gamma Steel units, MultiRAE Pro units, and DustTrak2 units as described in the sub-sections below.

3.1 AreaRAE

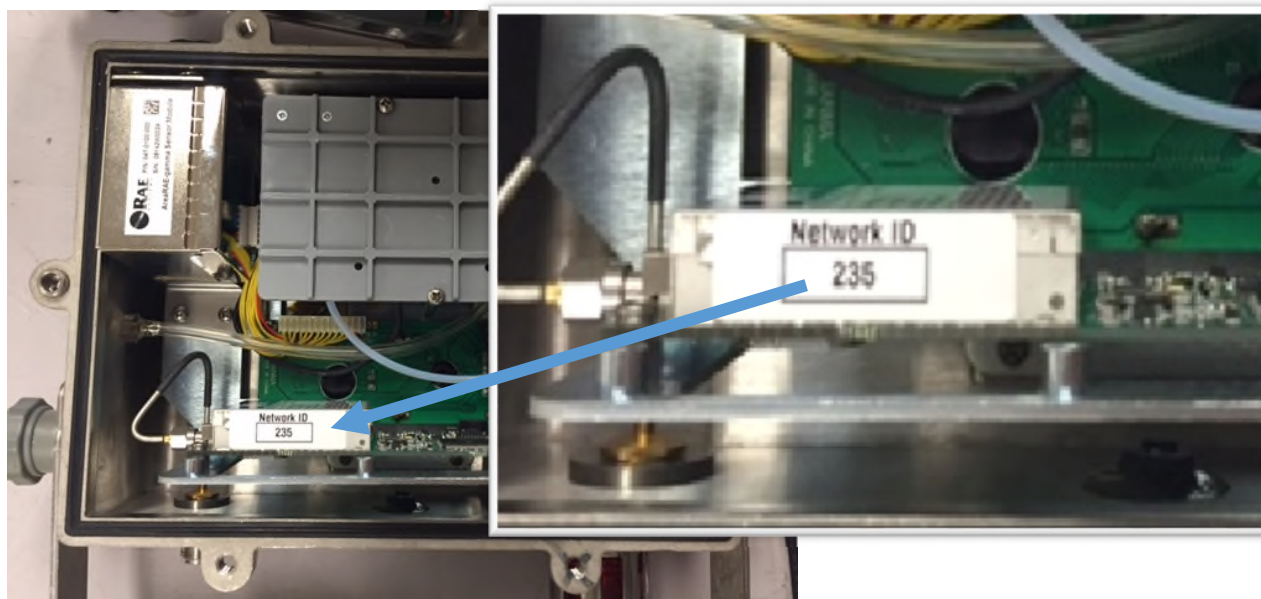
The AreaRAE is unique to other devices because it can communicate directly to the host without using a RAELink3 Mesh in Remote mode. However, the distance it can communicate may be extended using a RAELink3 Mesh.

The network ID on the AreaRAE is preset from RAE Systems and cannot be changed easily. Therefore, the steps to connect the AreaRAE to the RAELink3 Mesh begins with determining the network ID.

1. Disconnect the battery and open the back of the AreaRAE referring to the AreaRAE Quick Start Guide. Inside the AreaRAE, you will find the AreaRAE Radio with the Network ID as shown in the picture below:

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2. Determine that the Network ID in the AreaRAE matches that of the existing network. If it does, turn on radio on the AreaRAE as shown by the Radio Button and the red light immediately above it. The AreaRAE is now able to communicate with ProRAE Guardian.



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3.2 MultiRAE Pro

The MultiRAE Pro operates on mesh radio frequency that is compatible with the RAELink3 Mesh. To pair the MultiRAE Pro with the RAELink3 Mesh both devices require the proper settings. The RAELink3 Mesh configuration is described in subsection 3.2.1 and the MultiRAE Pro configuration is described in subsection 3.2.2.

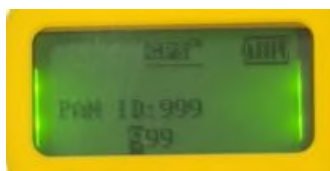
3.2.1 Configuring RAELink3 Mesh

Prior to configuration, the RAELink3 Mesh will be set to Remote (Section 2.1) and the Network ID will be matched with the RAELink3 Mesh Host.

1. Make sure that your RAELink3 Mesh is set to Remote mode (see Section 2.1).
2. Access the menu screen on the RAELink3 Mesh by holding the **Mode** and **N/-** buttons at the same time for 3 seconds. For wireless connections, continue to the next step. For cable connections, skip to step 4. If unsure which equipment can be connected wireless or by a cable, use the table in section 3.0 below for guidance:
3. Scroll by pressing **N/-** to the menu option called PAN ID. Press **Y/+** to enter if you want to change PAN ID. The PAN ID of the RAELink Mesh and any connected wireless instrument must match.



- 3.1. When changing the PAN ID, the cursor flashes on the selected digit. To change the digit, press **Y/+** to increase the number and **N/-** to decrease the number. Press **Mode** to advance to the next digit.



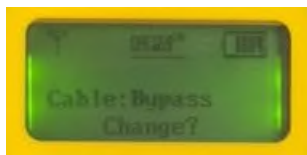
- 3.2. Input a unique PAN ID (ranging from 001 to 999). To accept, press and hold the **Mode** button for 2 seconds. A confirmation screen appears.
- 3.3. Press **Y/+** to save, or press **N/-** to abort. Once the PAN ID is saved, switch to the air monitoring equipment you want to wirelessly connect with.

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4. Scroll by pressing **N/-** to the menu option called Cable. Press **Y/+** to enter if you want to change the Cable setting. Refer to the table in section 3.0, for the correct setting to choose with your device.



5. Scroll through the options by pressing **N/-**. Once correct setting is chosen, confirm by pressing **Y/+**.

3.2.2 Configuring MultiRAE Pro to RAELink3 Mesh

After subsection 3.2.1 in complete, proceed with configuring the MultiRAE Pro to pair with the RAELink3 Mesh as described below.

1. Access the menu screen on the MultiRAE by holding the **Mode** and **N/-** buttons at the same time for 3 seconds.
2. Scroll by pressing the **→** button until you are on the wireless setting icon. Press the **Select** button to open the Wireless menu.



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3. The Wireless Menu screen should appear as the following:



4. Select the Radio ON/OFF option. Scroll down to ON, and press select.



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5. Scroll down to the PAN ID option and select. Enter the same PAN ID as the RAELink3 Mesh. Press the **↑ button** to adjust the numbers, and the **→ button** to move to the next number. After it has been entered, select **Done** to save.



6. Scroll down to the Join Network option and click select. Check to make sure the PAN ID on the MultiRAE and RAELink3 Mesh are the same. Click **Yes** button to join the RAELink network.



NOTE: Choosing Join Network in the MultiRAE setup menu automatically sets the Channel to match the channel of the corresponding Remote modem with the same PAN ID.

7. If the Channel does not automatically set when joining the RAELink network, then go to the Channel Option and click **Select**. Enter the same Channel as the RAELink. Press the **↑ button** to adjust the numbers, and the **→ button** to move to the next number. Select **Done** to save.

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8. Exit the Wireless Menu, and exit the MultiRAE Menus to return to the read out screen. When the MultiRAE is connected, it will have signal bars in the top left corner of the display.

4.0 Connecting RAELink3 with EPA Equipment

A RAELink3 can connect with up to 2 monitors using Bluetooth (1) and serial cable (1) connection. The RAELink3 differs from the RAELink3 Mesh in that it operates on a Bluetooth connection. A cable connection may also be used on selected instruments as tabulated below.

Product	Connection	Setting
AP4C	Cable	AP4C
BioHarness	Bluetooth	BioHarness
ChemRAE	Cable	ChemRAE
DustTrak2	Cable	DustTrak2
GammaRAE II R	Bluetooth	GammaRAE2
MiniRAE 2000	Cable	Bypass
MiniRAE 3000	Bluetooth	Bypass
MultiRAE Plus	Cable	Bypass
ppbRAE 3000	Bluetooth	Bypass
ppbRAE Plus	Cable	Bypass
QRAE Plus	Cable	RAE PTP
UltraRAE 3000	Bluetooth	Bypass

This Quick Start Guide only covers connecting MiniRAE 3000, UltraRAE 3000, and DustTrak2 as described in the sub-sections below. Section 4.1 describes configuring the RAELink3 to accept a Bluetooth connection. Once a Bluetooth connection is established, the MiniRAE 3000 (Section 4.2), the UltraRAE

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3000 (Section 4.3), or any other Bluetooth device listed above may be pair. The DustTrak2 may also be connected via a cable to the RAELink3 as described in Section 4.4.

4.1 Configuring RAELink3 to Bluetooth

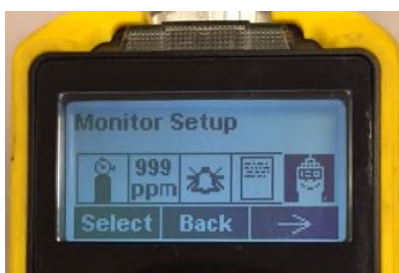
The following instruction describe configuring RAELink3 to Bluetooth. Once the RAELink3 is configured to accept a Bluetooth signal, proceed with connecting the MiniRAE 3000 and UltraRAE 3000.

1. Make sure that your RAELink3 is set to Remote Operation mode. In Section 2.1, see Step 4, specifically steps 4.4 to 4.5.
2. Access the menu screen on the RAELink by holding the **Mode** and **N/-** buttons at the same time for 3 seconds. For Bluetooth connections, continue to the next step. For cable connections, skip to step 4. If unsure which equipment can be connected wireless or by a cable, use the chart in section 4.0 (above) for guidance.
3. Scroll by pressing **N/-** to the menu option called BT. Press **Y/+** to enter if you want to change BT.
 - 3.1. Press **Y/+** if you want to change the BT setting.
 - 3.2. Scroll through the options by pressing **N/-**. Once the correct setting is chosen, confirm by pressing **Y/+**.
4. Scroll by pressing **N/-** to the menu option called Cable. Press **Y/+** if you want to change the Cable setting. Once correct setting is chosen, confirm by pressing **Y/+**.

4.2 Connecting with MiniRAE 3000

Once the RAELink3 is configured to accept a Bluetooth signal proceed with the following steps.

1. Access the menu screen on the MiniRAE by holding the **Mode** and **N/-** buttons at the same time for 3 seconds.
2. Scroll by pressing the **→** button until you are on the Monitor Setup icon. Press the **Select** button to open the Monitor Setup menu.



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3. The Monitor Setup screen should appear as the following:



4. Select the Radio Power option. Scroll to On, press **Select**, and then exit back to the Monitor Setup menu.
5. Scroll down using the ↓ button to the Real Time Protocol option and click **Select**. Select the P2P (Wireless) Option, and press **Done**.



NOTE: The Baud rate for the MiniRAE P2P (Wireless) connection is 19200 bps. Check to make sure the RAELink's Baud rate is set at 19200 bps so it can properly communicate with the MiniRAE.

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4.3 Connecting with UltraRAE 3000

Once the RAELink3 is configured to accept a Bluetooth signal proceed with the following steps.

1. Access the menu screen on the UltraRAE by holding the **Mode** and **N/-** buttons at the same time for 3 seconds.
2. Scroll by pressing the **→** button until you are on the Monitor Setup icon. Press the select button to open the Monitor Setup menu.



3. The Monitor Setup screen should appear as the following:



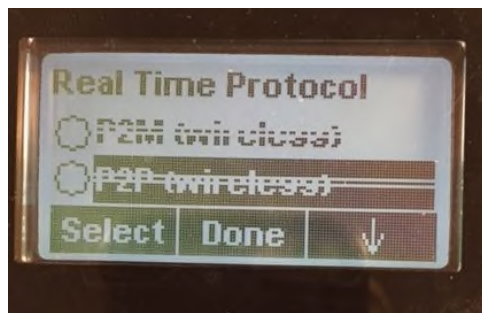
4. Select the Radio Power option. Scroll to On, press **Select**, and then exit back to the Monitor Setup menu.
5. Scroll down using the **↓** button to the Real Time Protocol option and click **Select**.

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6. Select the P2P (Wireless) Option, and press **Done**.



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5.0 Troubleshooting

Problem	Possible Reason & Solution
Trouble connecting multiple devices	<ul style="list-style-type: none">Both devices could have the same Unit Number. Check/change the unit numbers for the RAELink3/3 Mesh, and for the devices being connected to the RAELink3/3 Mesh.
Monitoring device does not allow the selection of wireless option	<ul style="list-style-type: none">The monitoring device may not be equipped with wireless capabilities. The connection will need to be done via a cable.
Trouble connecting wireless device	<ul style="list-style-type: none">Could be that the PAN ID and Channel do not match the RAELink3 Mesh. Confirm they are the same.If there are multiple devices, check to make sure the unit numbers are different. Having the same unit numbers causes a conflict with the RAELink3/3 Mesh
Device is connected with the RAELink, but not sending data	<ul style="list-style-type: none">It is possible that the Baud rates aren't matching. Go to the Baud Rate menus in both the monitoring device and RAELink3/3 Mesh to make sure they are the same.