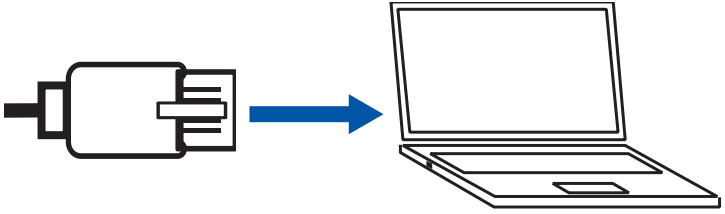
3 Plug the other end of the standard RJ45 Ethernet cable into an **Ethernet port** on the Management Computer.



What Can I Do Now?

- Connect an MPU5 to a computer for configuration

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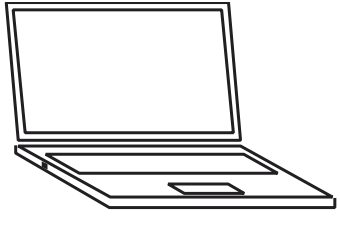
Section C: Accessing the Web Management Interface

What Will I Learn?

- How to access the Web Management Interface to configure the MPU5

Parts List

Web Browser (Internet Explorer 7+, Firefox 3+, or Chrome



Management Computer with properly configured IP address and subnet mask & Ethernet Port

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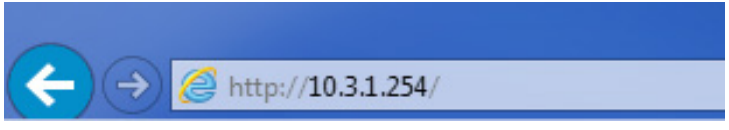
1 Open the web browser

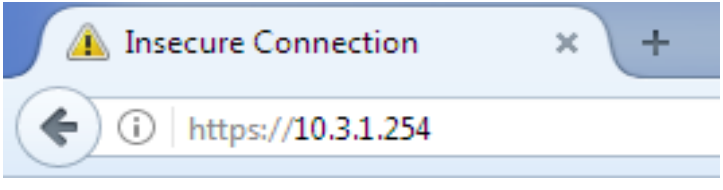
Microsoft Internet Explorer 7+

Google Chrome Mozilla Firefox 3+

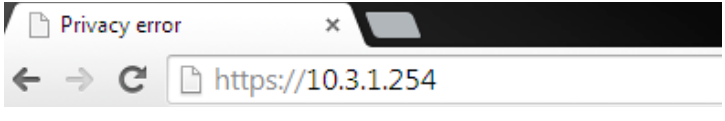
2 In the address bar, type **https://10.3.1.254** then press the **Enter** key.



Microsoft Internet Explorer 7+



Mozilla Firefox 3+



Google Chrome

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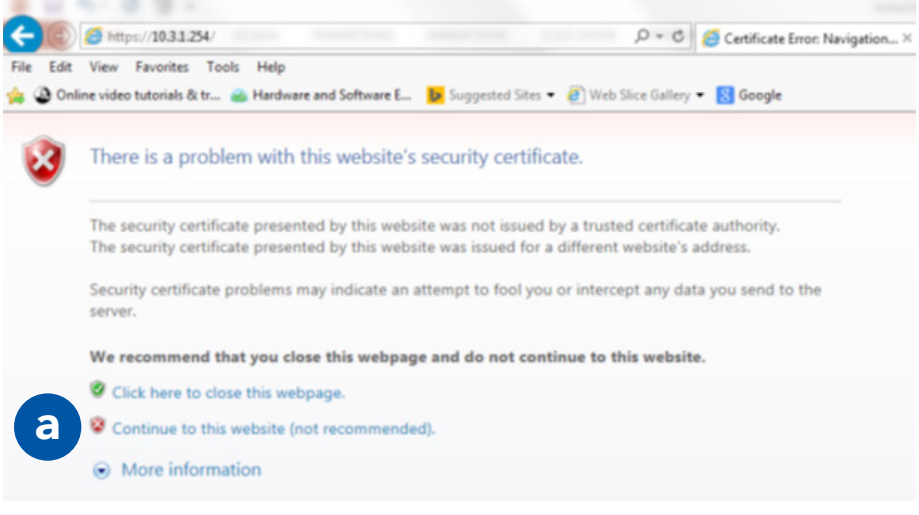
3 The web browser will ask you to accept a security certificate.

In Internet Explorer:



a Click **Continue to this website (not recommended)**

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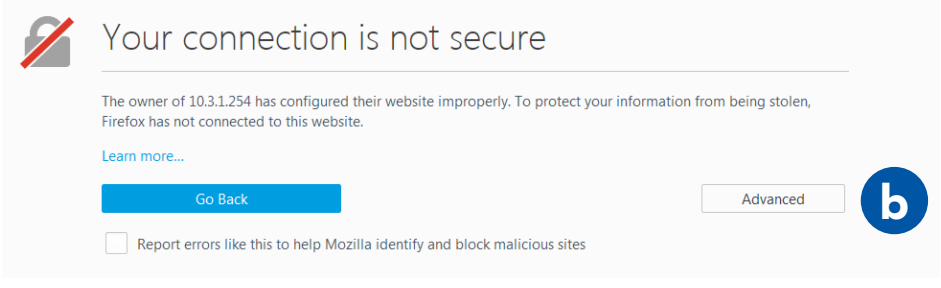
In Firefox:



Click **I Understand the Risks**

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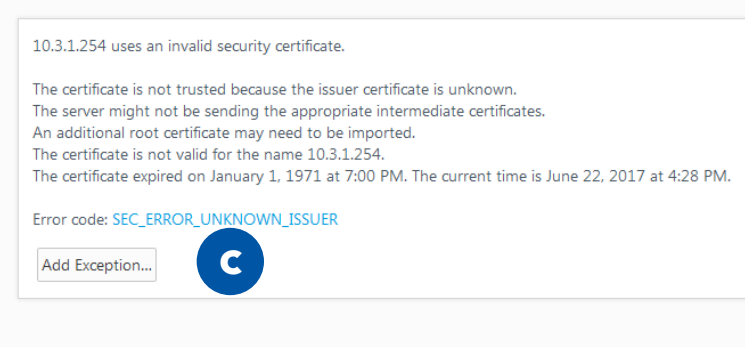

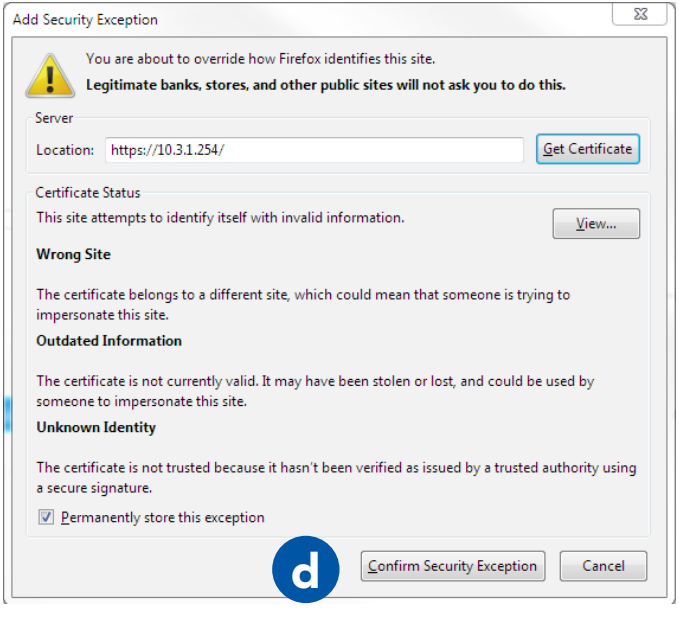

c Click **Add Exception**

d Click **Confirm Security Exception**

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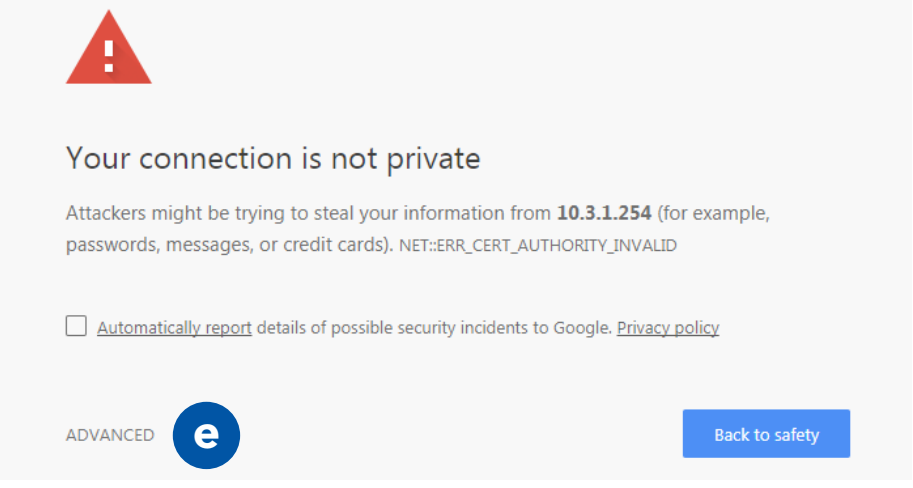
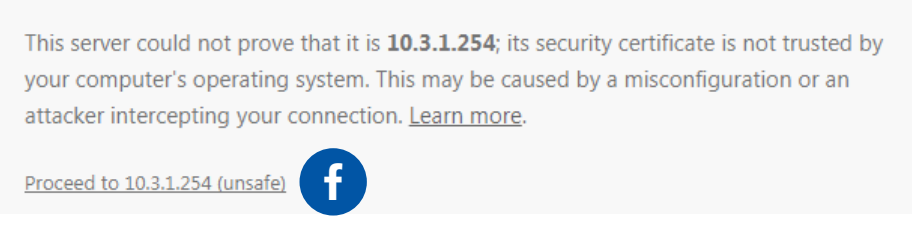
In Chrome:



Click **Advanced**



Click **Proceed to 10.3.1.254 (unsafe)**

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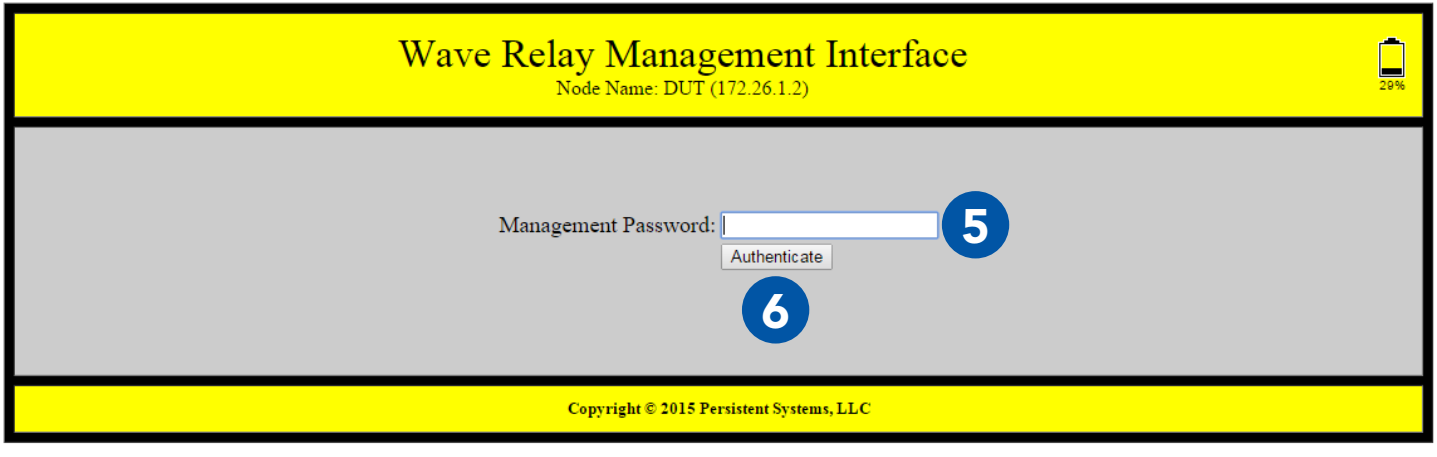
4 Wait for the Web Management Interface page to load

5 In the **Management password** field, type **password**

6 Click **Authenticate**.



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Why does the Security Exception Page or the Web Management Interface page not load?

1. Verify that you configured the Management Computer IP address and subnet mask properly.
2. Ensure that all cables are connected properly
3. Ensure that you are accessing the correct management IP address (10.3.1.254).
4. Ensure that you are using a compatible web browser.
5. Reboot the node.

What Can I Do Now?

- Access the Web Management Interface for any node you connect to your computer.

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Section D: Basic Network Setup

Security Key

What Will I Learn?

- How to set the security key and crypto mode on an MPU5

1. Click the **Security** tab.
2. In the **Set Key** section, locate the **Update** drop down menu. Select **Node**.
3. In the **Crypto Mode** drop down menu, select the desired **Crypto Mode**.

   Note: All nodes must have the same Crypto Mode in order to communicate.
4. In the **Enter key** field, type the desired security key or click the **Generate** button to generate a random key.
5. **Copy** and **paste** the security key to a text file in a secure place on the Management Computer.
6. Click the **Set** button to set the key for the node.

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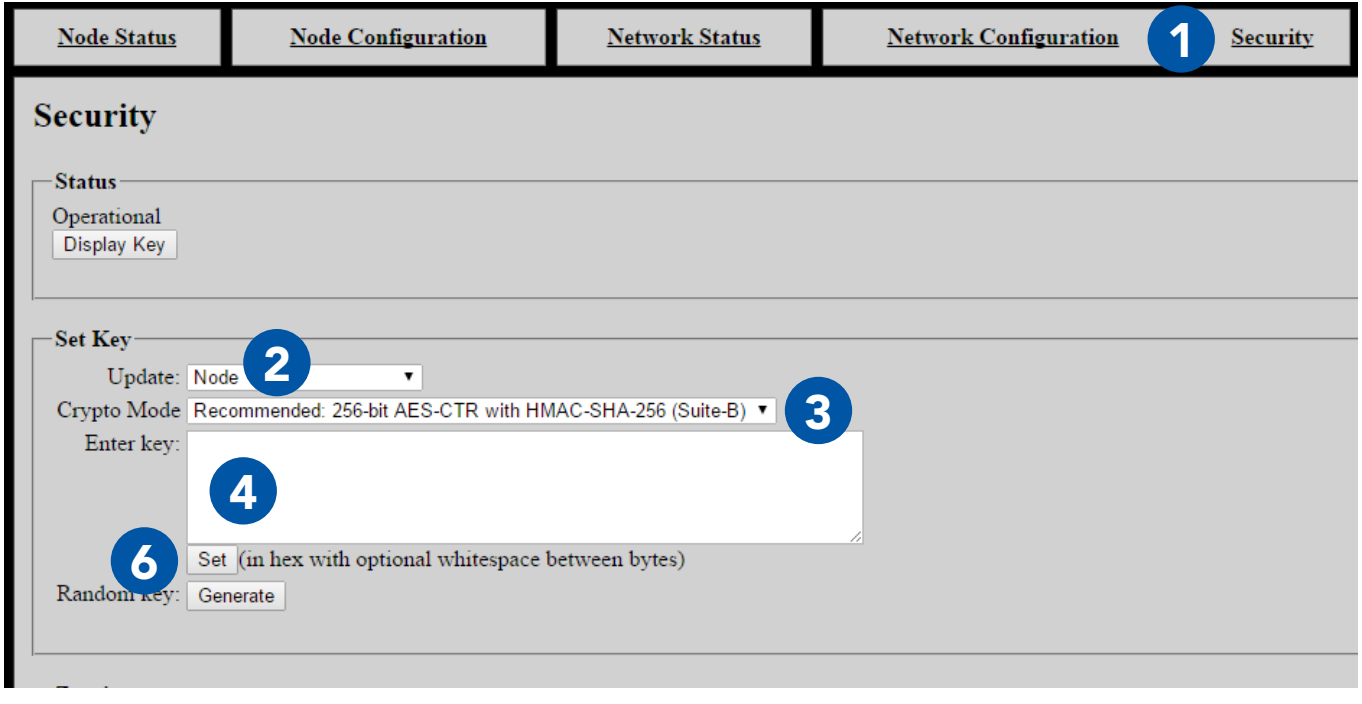

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What Can I Do Now?

- Set or change the security key and crypto mode for a single node
- Generate a random security key
- Save a security key in a text file to copy to other nodes

Assigning IP Address and Interface Names

What Will I Learn?

- How to set and change the Node Name and IP Address of a node

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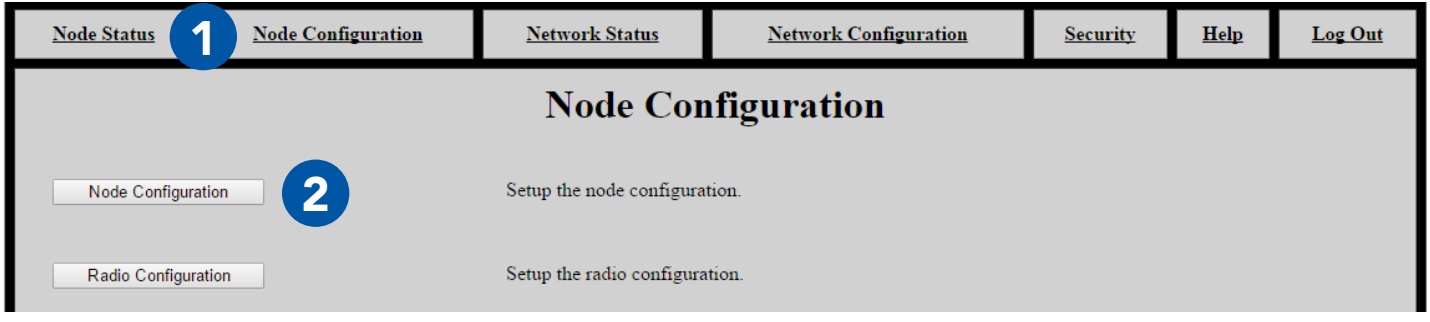
1 Click the **Node Configuration** tab.

2 Click the **Node Configuration** button.



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SOFTWARE SETUP: ASSIGNING IP ADDRESS AND INTERFACE NAMES

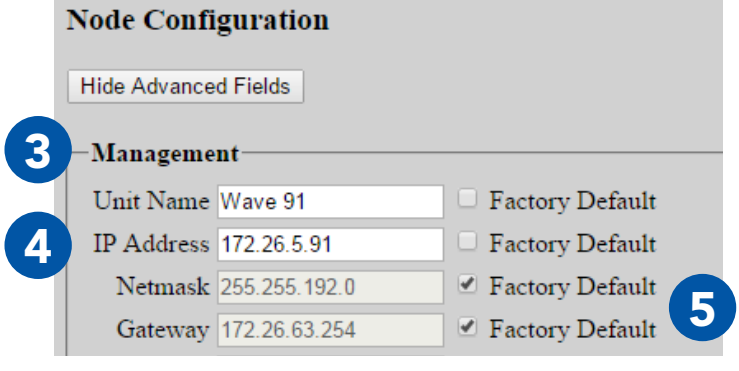
3. In the **Management** section, find the **Node Name** field and enter the desired Node Name.

4. In the **IP Address** field, enter the desired IP Address.

5. Enter a **Netmask** and **Gateway**, if required. Otherwise, **check** the **Factory Default** box.

6. Scroll to the bottom of the page and click the **Save & Reconfigure Unit** button.

7. Wait for the page to reload.



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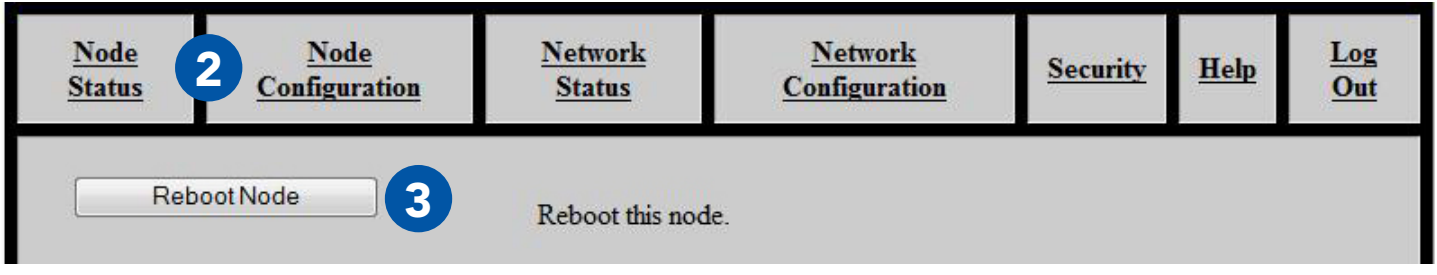
What Can I Do Now?

- Access the Node Configuration page for an individual node
- Set the Node Name and IP Address of a node to fit the node into your IP scheme and identify the node in status functions

Rebooting an Individual Node

1. Log into the node.
2. Click the **Node Configuration** tab.
3. Scroll down and click the **Reboot Node** button.



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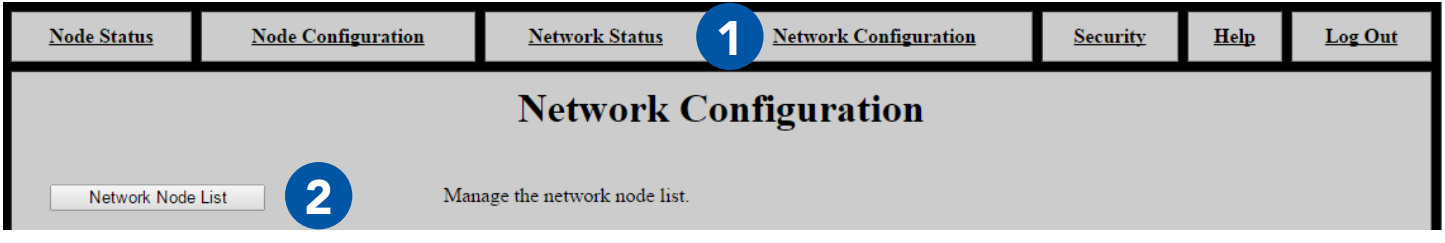
Network Node List

What Will I Learn?

- How to add and remove nodes from the Management Node List
- How to push the Management Node List to all nodes in your network

1 Click the **Network Configuration** tab.

2 Click **Network Node List**.



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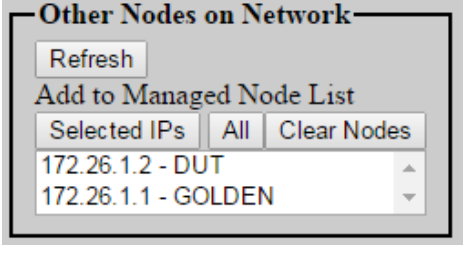
The **Network Node List** creates a list of nodes for **Network Status** and **Network Configuration** functions. Those functions will **ONLY** operate on nodes that are in the Network Node List.

Adding Nodes to the Network Node List

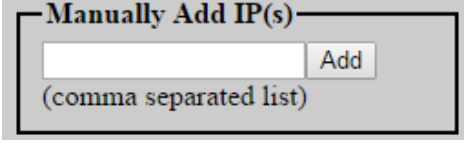
1. Ensure that all your nodes are powered on and that you have configured their IP addresses and node names. These will appear in the **Other Nodes on Network** box.



2. Click **Refresh** if all nodes do not appear.

3. Click **All** to add all nodes in the box to the Network Node List. Alternatively, select one or more nodes and click **Selected IPs** to add those nodes to the Network Node List. Hold the **shift** key or **ctrl** key while clicking to select multiple nodes.

4. Nodes can be added manually as well. Enter a comma separated list of all IP addresses to add in the **Manually Add IP(s)** box, then click **Add**.



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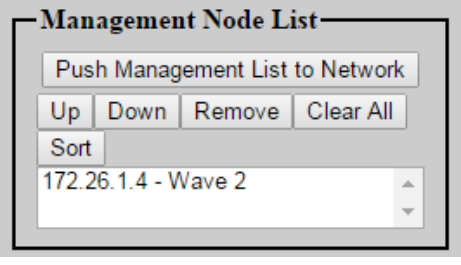
Managing the Network Node List

1. After you add nodes to the Network Node List, they will appear in the box on the left of the page.

2. Use the **Up**, **Down**, **Remove**, **Clear All**, and **Sort** buttons to reorder or delete nodes from the Network Node List.

3. Click **Push Management List to Network** to copy the Network Node List to all the nodes in the Network Node List. This will ensure that Network Status and Network Configuration functions will work properly on all nodes in the network.



Note: ensure that all nodes are turned on and have the same RF settings (i.e. they are able to be contacted). If nodes are not able to be contacted, they will not receive the Network Node List.

Note: remember to add new nodes to the Network Node List when you are expanding your network.

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What Can I Do Now?

- Add new nodes to the Network Node List
- Remove nodes from the Network Node List
- Synchronize the Network Node List between all nodes on your network

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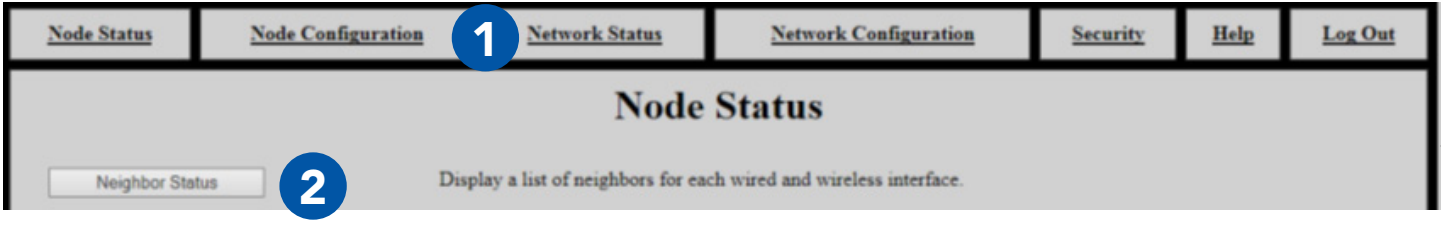
Part III: Testing Connectivity

What Will I Learn?

- How to tell if nodes are connected
- How to see the connection strength between Neighbor Nodes
  - Neighbor Nodes are nodes connected without hops through other nodes
- How to test bandwidth between nodes

Check Neighbor Node Status

1. Click the **Network Status** tab.
2. Click the **Neighbor Status** button.



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3 Verify that all nodes are communicating with the network.

Neighbor SNR

Interface	Neighbor	Receive SNR
Radio 3	13-A window (172.26.6.50) - Radio 3	6.79
Radio 3	2-B lunchroom window (172.26.6.40) - Radio 4	24.87
Radio 3	2-B mainroom window (172.26.6.70) - Radio 3	46.27
Radio 3	2-D DH desk (Reciever) (172.26.0.121) - Radio 1	30.83
Radio 3	2-E JH_EL desk (172.26.0.145) - Radio 1	45.53

Return to Menu | MANET Monitor

Notes:

- This table only displays Neighbor Nodes (nodes directly connected without hops through other nodes. If you spread nodes apart, they may disappear from the Neighbor Nodes Status page when they become connected via a hop.
  - The Neighbor Nodes status page displays:
  - Node Names
  - IP Addresses
  - Receive Signal-to-Noise Ratio (SNR) between nodes

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Perform a Throughput Test

1. Click the **Node Status** tab.

2. Click the **Bandwidth Test** button.

3. Select a **destination node** for the throughput test from the **Destination** drop-down menu. This menu is populated from the Node List.

4. Enter the desired **test duration (in seconds)** in the **Test Duration** field.

   Note: Persistent Systems recommends the test duration to be set to a minimum of 5 seconds.

5. **Check** or **uncheck** the **Upload only test** box. If this box is checked, only upload speed to the destination node will be tested.

! **WARNING!:** During long duration tests, data will continue to be sent for the full specified duration even if a different data flow is started or the web browser is exited.

6. Click **Run Test** and wait for the test to complete.

7. The page will display the upload speed to and download speed from the destination node.

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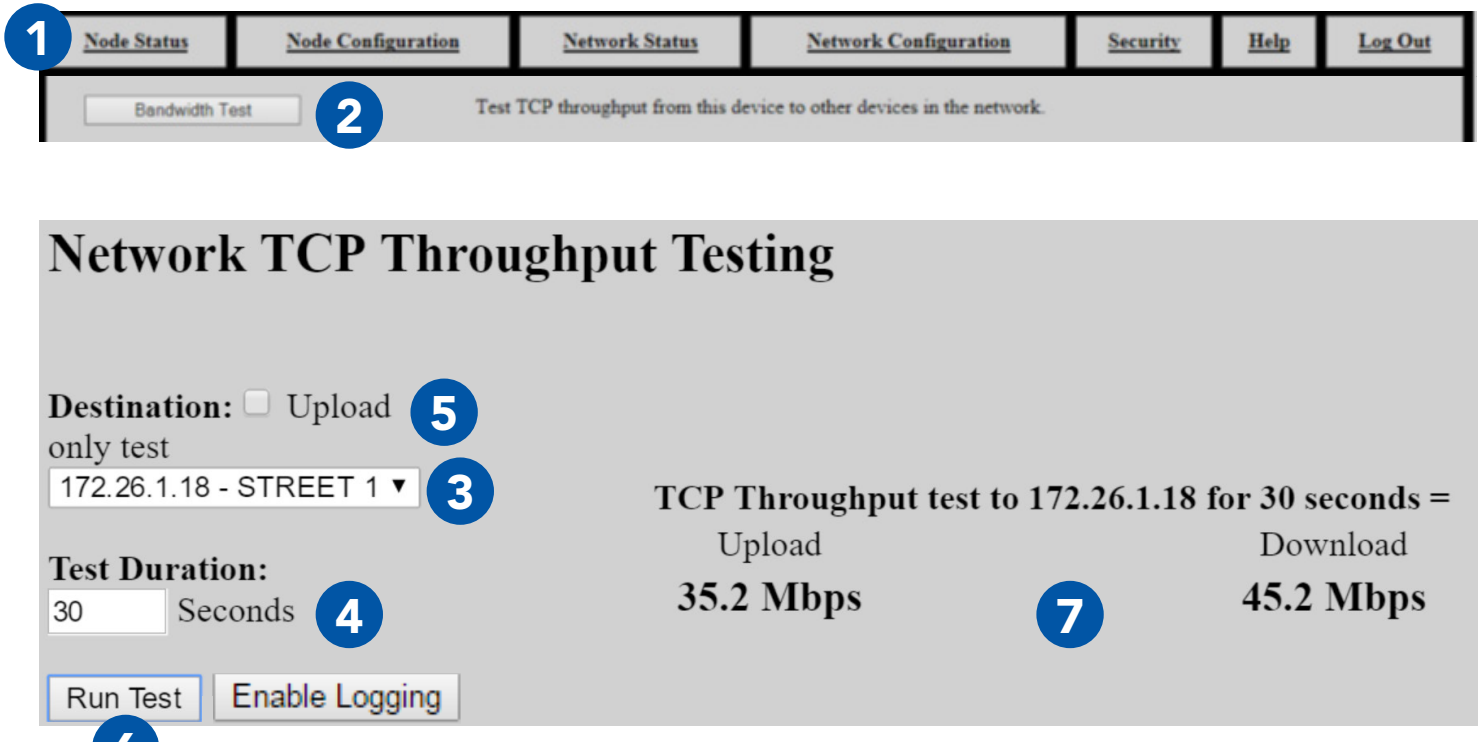

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Throughput Test Logging

1. Click the **Enable Logging** button.

2. When the throughput test is run, data will be collected in a table at the bottom of the page.

Position Status

```
Source:             Internal GPS
Position:           Unknown
Satellites Used:    0
Satellites Visible: 6
Satellite ID/PRN:    6 31 32 133 135 138
Satellite SNR:      28 25 26   0   0   0 dB
```

Clear | Download CSV | Download KML

Time	Lcl Iface	SNR(dB)	Chain1(dB)	Chain2(dB)	Chain3(dB)	Tx Rate	Dist(m)	Rem Name	Lcl Name	Rx(%)	Tx(%)	Cs(%)	Tl(%)	Bw Tx(Mbps)	Bw Rx(Mbps)	Interval(s)
Fri Jul 22 14:02:48 2016									W36					53.7		0.0-1.0
Fri Jul 22 14:02:49 2016	Radio 1	45	39	40	42	MIMO 4:3		W20	W36	2	25	0	29	70.7		1.0-2.0
Fri Jul 22 14:02:50 2016	Radio 1	45	39	40	42	MIMO 4:3		W20	W36	2	25	0	29	70.7		2.0-3.0
Fri Jul 22 14:02:51 2016	Radio 1	45	39	40	42	MIMO 4:3		W20	W36	2	77	1	81	70.7		3.0-4.0
Fri Jul 22 14:02:52 2016	Radio 1	45	39	40	42	MIMO 4:3		W20	W36	2	77	1	81	77.8		4.0-5.0
Fri Jul 22 14:02:52 2016	Radio 1	45	39	40	42	MIMO 4:3		W20	W36	2	77	1	81	68.9		0.0-5.0
Fri Jul 22 14:02:55 2016	Radio 1	46	40	40	42	MIMO 4:3		W20	W36	2	82	1	86		34.5	0.0-1.0
Fri Jul 22 14:02:56 2016	Radio 1	44	37	37	41	MIMO 4:3		W20	W36	21	0	0	23		41.5	1.0-2.0
Fri Jul 22 14:02:57 2016	Radio 1	44	37	37	41	MIMO 4:3		W20	W36	21	0	0	23		40.9	2.0-3.0
Fri Jul 22 14:02:58 2016	Radio 1	45	39	40	43	MIMO 4:3		W20	W36	69	1	1	72		45.1	3.0-4.0
Fri Jul 22 14:02:59 2016	Radio 1	45	39	40	43	MIMO 4:3		W20	W36	69	1	1	72		50.3	4.0-5.0
Fri Jul 22 14:02:59 2016	Radio 1	45	39	40	43	MIMO 4:3		W20	W36	69	1	1	72		42.6	0.0-5.0

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Position Status: displays GPS status information for the current node. See the Check GPS Status section for an explanation of these fields.

Clear: clears all data from the table

Note: If Clear is not pressed before beginning a test, the new throughput test data will be appended sequentially to the existing table of data.

Download CSV: downloads all throughput test data in the table as a CSV file

Download KML: downloads all throughput test data in the table as a KML file

Time: date and time for each line of test data
Interface: interface used to communicate during the test
SNR (dB): Signal-to-Noise Ratio at which the destination node is heard
Chain 1/2/3 (dB): Signal-to-Noise Ratio for each chain on the source node
Tx Rate: MIMO or SISO rate used to communicate between nodes in the format **MIMO|SISO [Rate]:[Number of streams]**.
Dist (m): distance between nodes, in meters, if available
Rem Name: Node Name of the destination node
Lcl Name: Node Name of the source node
Rx(%): percentage of the channel used to receive
Tx(%): percentage of the channel used to transmit
Cs(%): percentage of the channel occupied by noise
Tl(%): total percentage of channel used
Bw Tx (Mbps): Upload Bandwidth, in Mbps
Bw Rx (Mbps): Download Bandwidth, in Mbps
Interval (s): time interval of the throughput test for each line of throughput test data

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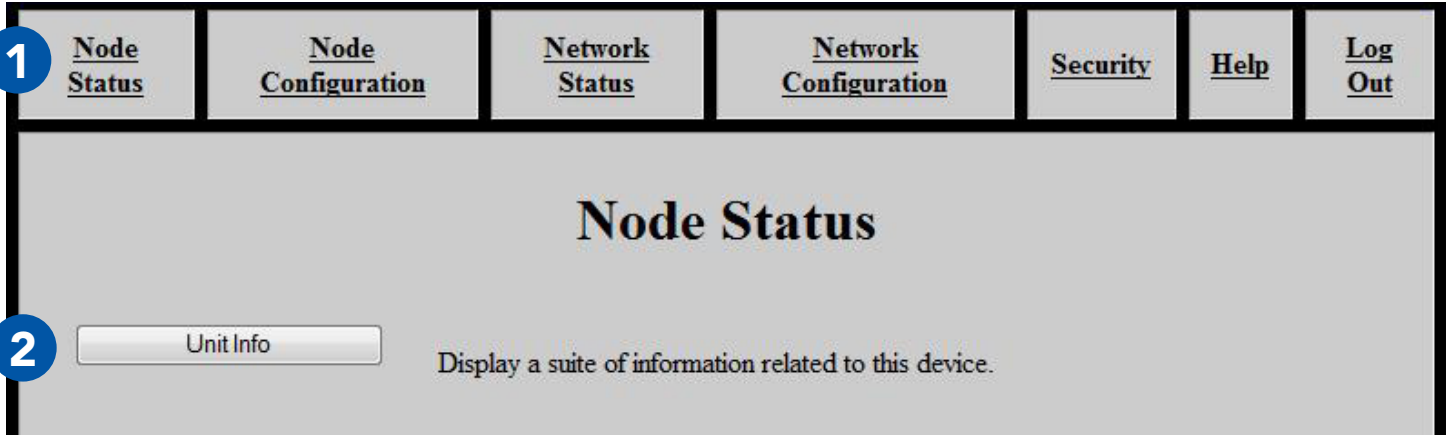
Part IV: Using the Web Management Interface

View Individual Node Information

1. Click the **Node Status** tab.
2. Click the **Unit Info** button.



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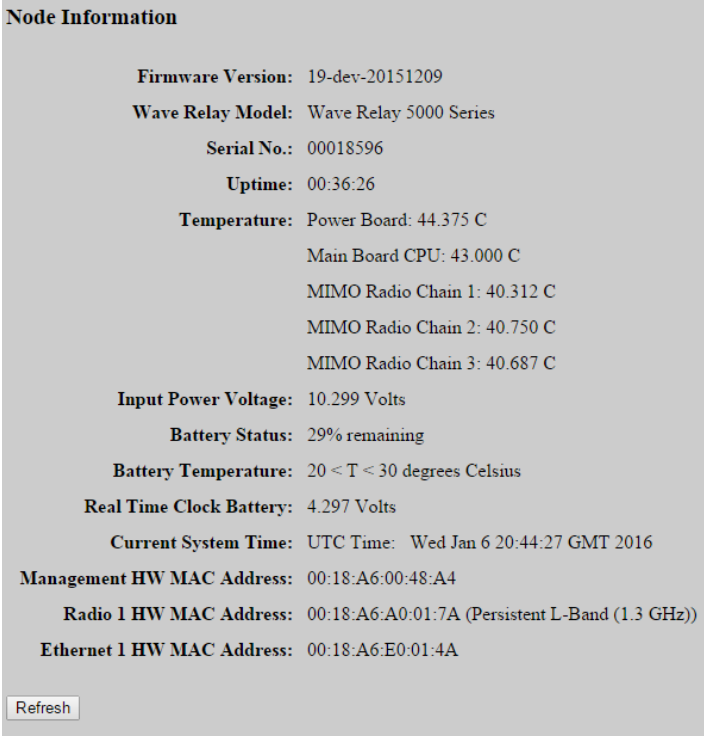
3 The page will display:

Firmware Version: Wave Relay® firmware version loaded on the node
Wave Relay Model: Device model
Serial No.: Serial number of the node
Uptime: Operating time since the node was last powered on or rebooted
Temperature: Temperature of the power board, main board CPU, and all three RF chains
Input Power Voltage: Voltage supplied to node
Battery Status: Battery percentage remaining
Battery Temperature: Appx. temperature of battery
Real Time Clock Battery: Voltage of real-time-clock keep-alive battery (on units with RTC)
Current System Time: Current system time of the node (in both UTC and current time zone if not UTC)
Management HW MAC Address: MAC Address for the management hardware of the node
Radio 1 HW MAC Address: MAC Address and frequency band for the RF module installed in the node
Ethernet 1 HW MAC Address: MAC Address for the Ethernet port in the node



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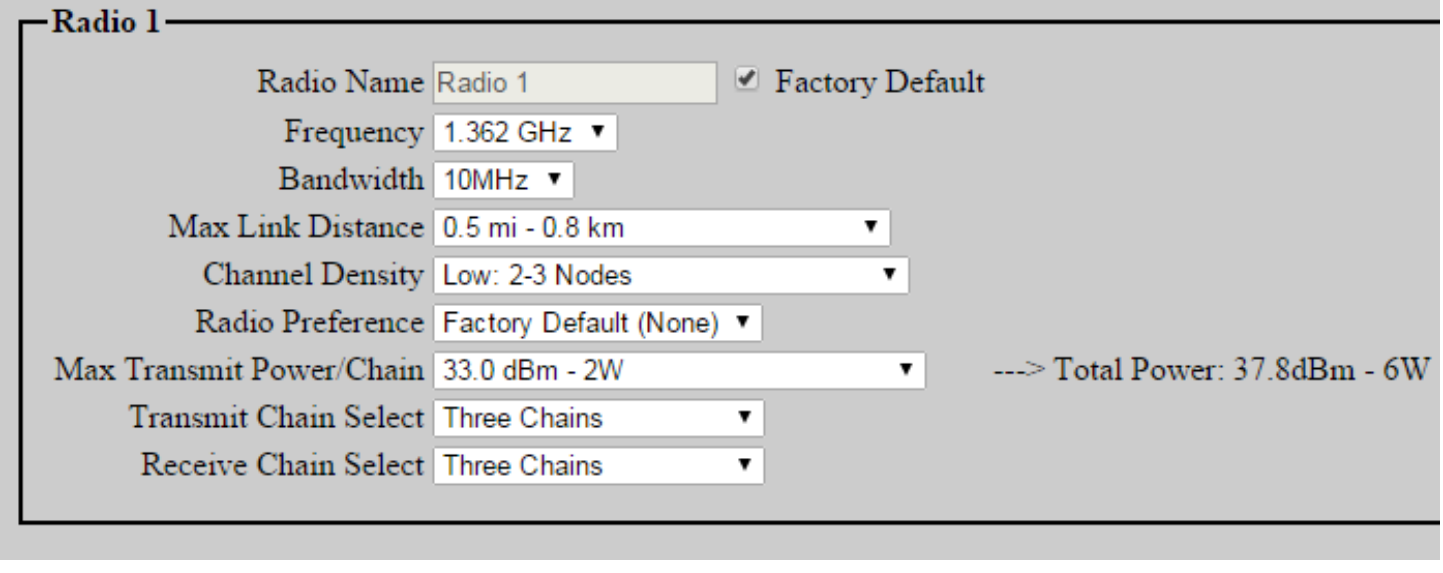
Configuring RF Settings for a Single Node

1. Click the **Node Configuration** tab.
2. Click the **RF Configuration** button.
3. Scroll to the **RF Configuration** section



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4 Configure settings if needed.

Note: changing these settings may cause poor performance or loss of connectivity.

Radio Name: Assign a name - check the **Factory Default** box to use the factory default name.

Frequency: Assign a frequency to operate on. Nodes must be operating on the same frequency to communicate. Ensure that the frequency is set to match the RF module installed in the unit.

WARNING!: User **MUST** refer to the **Professional Installer – Compliance** Section of this manual for approved power levels and approved channels. This warning applies only to RF-2100 with the FCC ID 2AG3J-RF2100, RF-5100 with the FCC ID 2AG3J-RF5100, and RF-2150 with the FCC ID 2AG3J-RF2150.

Bandwidth: Assign a bandwidth to operate on. Nodes must be set to the same bandwidth to communicate. Bandwidth should be increased for shorter distances and decreased for longer distances.

Max Link Distance: Set Max Link Distance to the maximum distance any individual link between nodes in the network may need to be. All nodes on the network must be set to the same Max Link Distance.

Channel Density: Select the menu item that corresponds to the number of nodes in the network.

Radio Preference: Increasing radio preference will make the routing protocol more likely to choose this node when routing traffic in the network.

Max Transmit Power/Chain: Adjust transmit power of the node - this setting is per chain. The total power is shown to the right of the drop down menu.

WARNING!: User **MUST** refer to the **Professional Installer – Compliance** Section of this manual for approved power levels and approved channels. This warning applies only to RF-2100 with the FCC ID 2AG3J-RF2100, RF-5100 with the FCC ID 2AG3J-RF5100, and RF-2150 with the FCC ID FCC ID 2AG3J-RF2150.

Transmit Chain Select: Choose which RF chains to use to transmit - you may select one, two, or three chains. The Auto setting will instruct the MPU5 to select Transmit Chains on its own.

Receive Chain Select: Choose which RF chains to use to receive - you may select one, two, or three chains. The Auto setting will instruct the MPU5 to select Receive Chains on its own.

5 Scroll to the bottom of the page and click **Save & Reconfigure Unit**.

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Upgrading Firmware

1. Click the **Node Configuration** tab.
2. Click the **Firmware Upgrade** button.
3. Click **Choose File**, then navigate to and select the firmware file you wish to load.
4. Click **Upload**.

! **WARNING!**: A firmware upgrade will cause the node to be reconfigured, an operation that causes a period of downtime. Do not perform a firmware upgrade during mission critical operations that cannot tolerate such disruptions. Perform firmware upgrades only during scheduled maintenance or other appropriate times.

! **WARNING!**: when upgrading or downgrading a node's firmware, the LED will turn purple. Do not unnecessarily disturb devices during an upgrade. Loss of power during the upgrade can permanently damage the device.

Note: when new firmware is available for the MPU5, you will receive an email with the new firmware file to upgrade your units.

Note: MPU5 firmware will NOT load on legacy Wave Relay® devices (MPU4, MPU3, QUAD).

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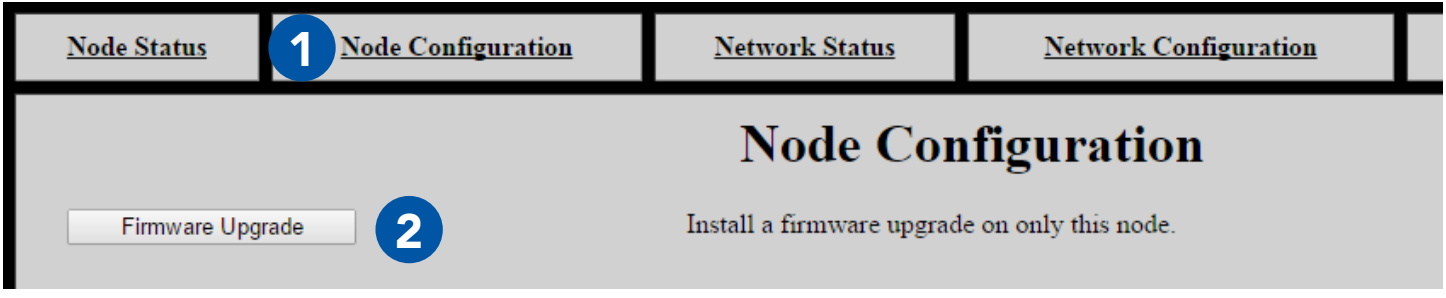

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Creating a Configuration File

1. Click the **Node Configuration** tab.
2. Click the **Config Management** button.
3. Click **Store File**.
4. Click **Store**.
5. A prompt will appear to choose where to save the configuration file.

Note: this file contains settings (both Network Configuration and Node Configuration settings) for the current node only.

Note: do not save configuration files from nodes without a RF module installed.

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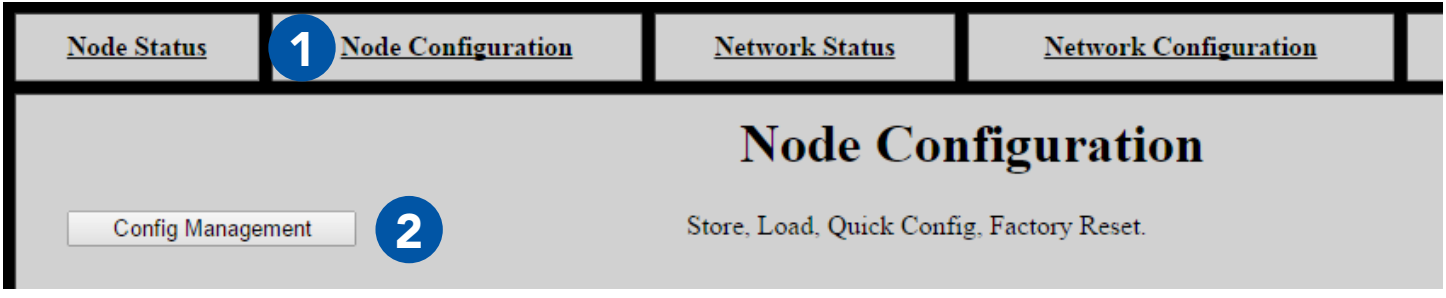

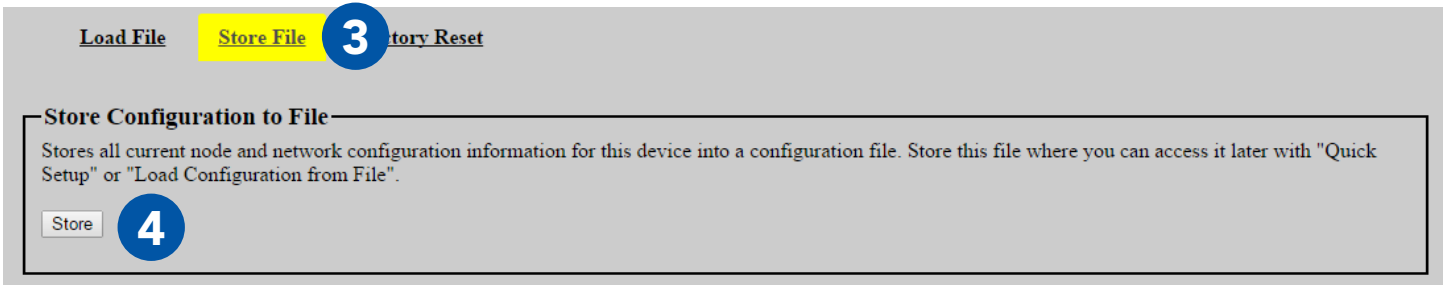

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Loading Settings from a Configuration File

1. Click the **Node Configuration** tab.
2. Click the **Config Management** button.
3. Click **Load File**.
4. Configure **Node Name and Management IP configuration (IP, Netmask, Gateway) source**.
   Keep Current Settings: Node Name, Management IP, Netmask, and Gateway will not change after the configuration file is loaded.
   Pull from Config File: Node Name, Management IP, Netmask, and Gateway will be set to the values in the Config File you are loading.
   Quick Setup: A box will appear that will allow you to enter a Node Name and Management IP Address to be set when the Config File is loaded.
5. Configure Push to Managed Node List.
   No: The configuration file will be loaded on this node only.
   Yes, Require All: The configuration file will be loaded on every node in the Managed Node List if and only if all nodes in the Managed Node List are able to be contacted. If at least one node in the Managed Node List is not able to be contacted, the configuration file will not be loaded onto any nodes.
   Yes, Any Available: The configuration file will be loaded onto any node in the Managed Node List that is able to be contacted. The configuration file will not be loaded on any nodes in the Node List that are not able to be contacted.

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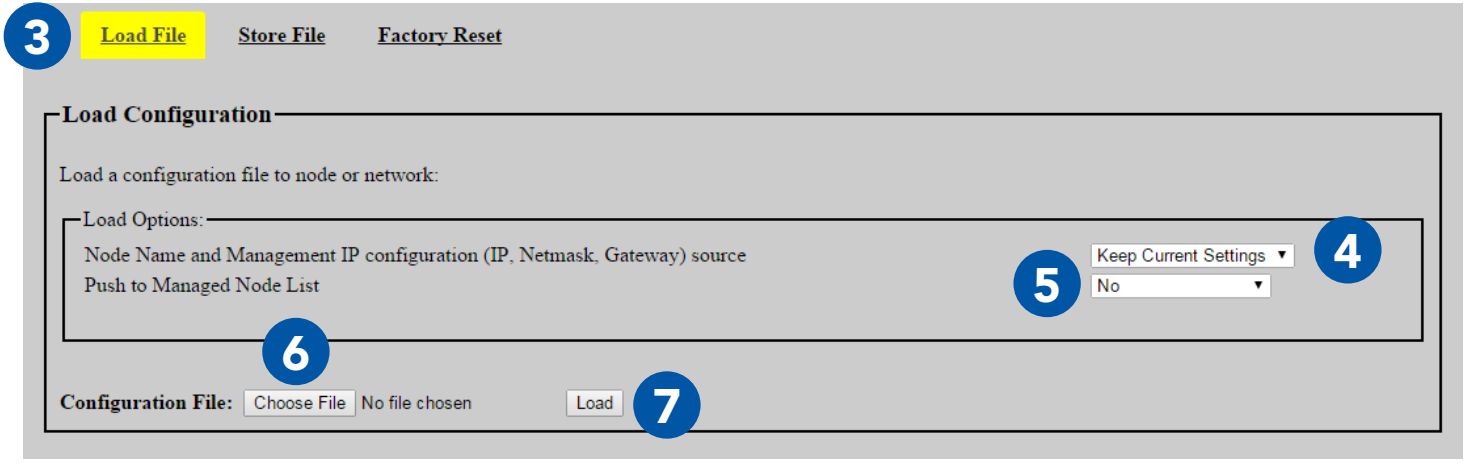
6 Click **Choose File**. Navigate to the desired configuration file to load.

Note: the configuration file should be from a device with the same firmware version and RF hardware configuration as the device being configured.

Note: do not load configuration files that have been saved from nodes with no RF module installed.

7 Click **Load**.



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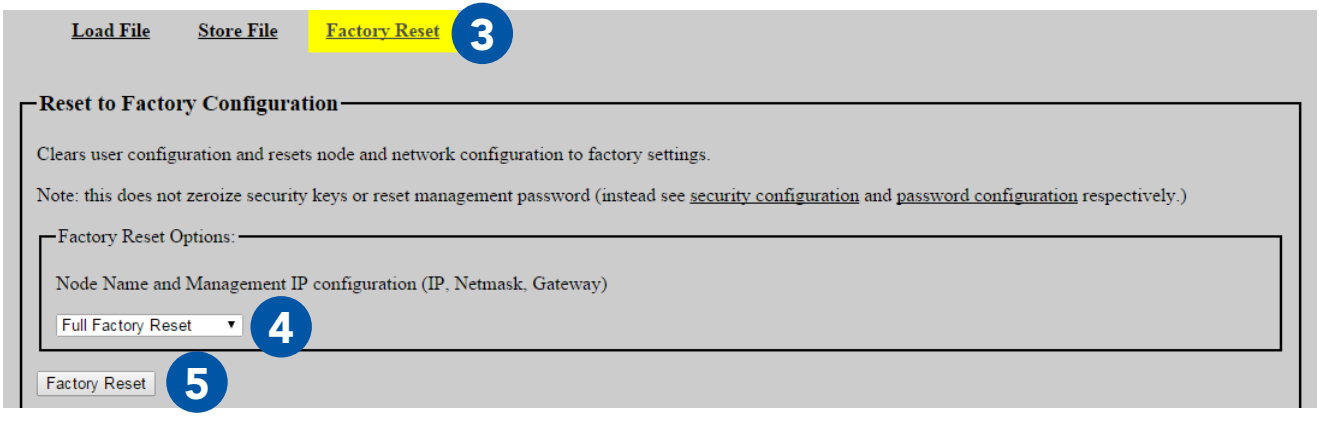
Reset Node to Factory Configuration

1. Click the **Node Configuration** tab.
2. Click **Config Management**.
3. Click **Factory Reset**.
4. Configure **Node Name and Management IP configuration (IP, Netmask, Gateway)**.
   Keep Current Settings: Node Name, Management IP, Netmask, and Gateway will not change after the node is reset to factory configuration.
   Full Factory Reset: All settings will be reset to factory configuration.
5. When you are ready to remove all custom configuration and restore the node to factory settings, click the **Factory Reset** button.



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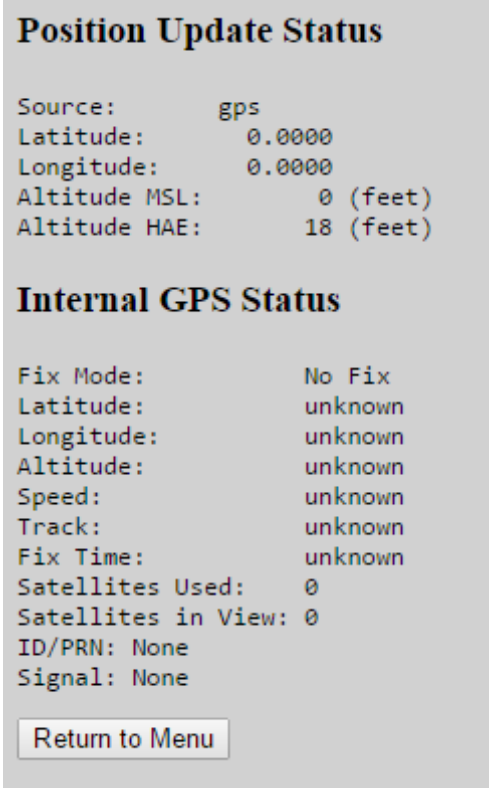
Check GPS Status

1. Click the **Node Status** tab.

2. Click the **GPS Status** button.

3. The page will display:

   Source: GPS information source
   Latitude: Current latitude of the node
   Longitude: Current longitude of the node
   Altitude: Current altitude of the node as MSL (above sea level) and HAE (above ellipsoid)



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Network Status Tab

The **Network Status** tab allows you to view information about every node in the network at the same time. Besides MANET Monitor, Network Visualization, and Channel Plan, each page displays the same information as its counterpart on the Node Status page, but for every node in the network.

Unit Info: general node information for every node in the network
Neighbor Status: neighbors and SNR for every node in the network
MANET Monitor: number of nodes in the network, serial number, node name, IP address, velocity and direction, altitude, neighbors, battery percentage remaining, SNR for every node in the network
GPS Status: GPS information for every node in the network
Network Traffic Load: traffic load information for every node in the network
Network Visualization: view the network in Google Earth
Channel Plan: channel setting for each node
IP Flow List: IP flows on the network
IP Multicast Status: IP Multicast information

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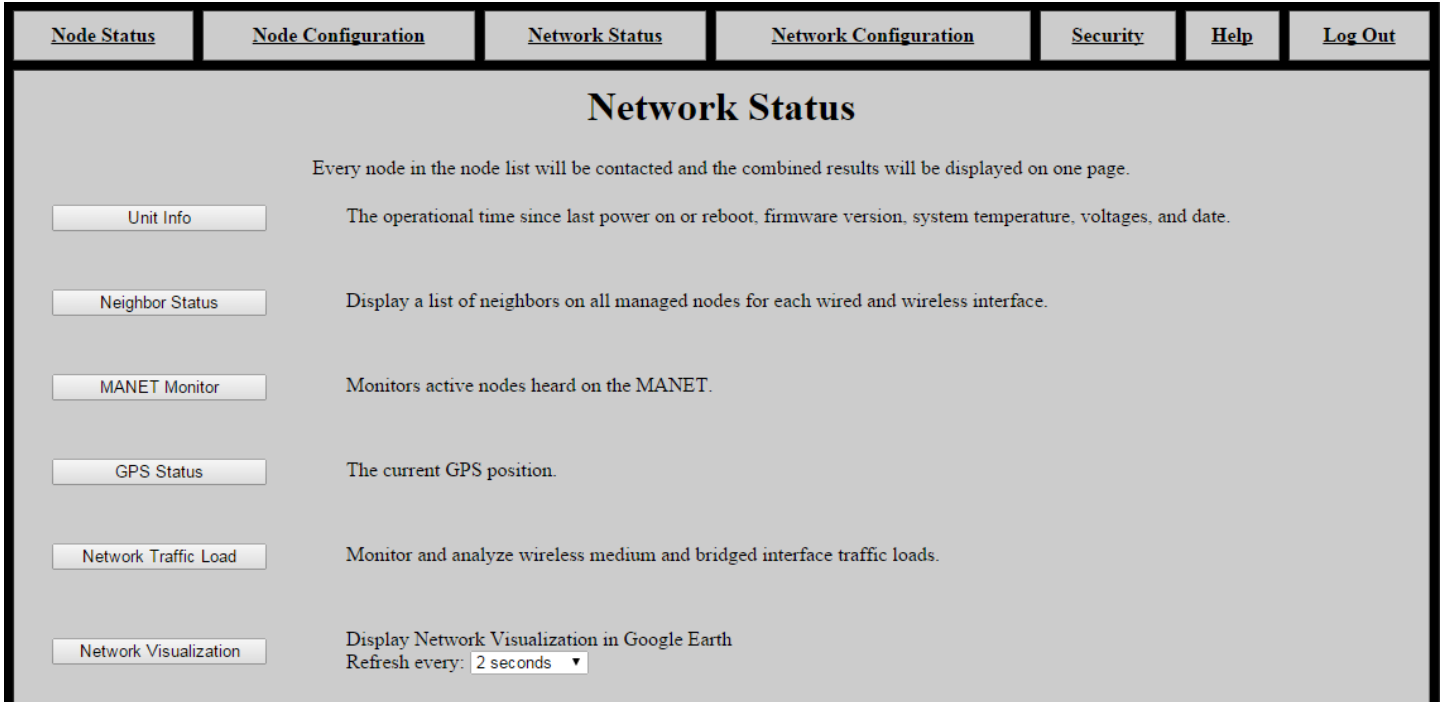

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Configuring Visualization Settings

1. Click the **Node Configuration** tab.
2. Click **Node Configuration**.
3. Scroll to the **Wave Relay SA** box.
4. Configure Wave Relay Situational Awareness settings:

   Enable/Disable WRSA Packets: select Enabled to enable Wave Relay SA
   WRSA Multicast Address: defines the multicast address for sending and receiving Wave Relay SA packets - uncheck the Factory Default box to modify this field.
   SA Neighbor Info: enables or disabled SA Neighbor info - if disabled, Google Earth will not display SNR lines, and SNR will not appear in the MANET monitor. Disable this setting to reduce network overhead and improve scalability and performance of high density networks.
   Visualization Icon: select an icon to represent the node in Google Earth.

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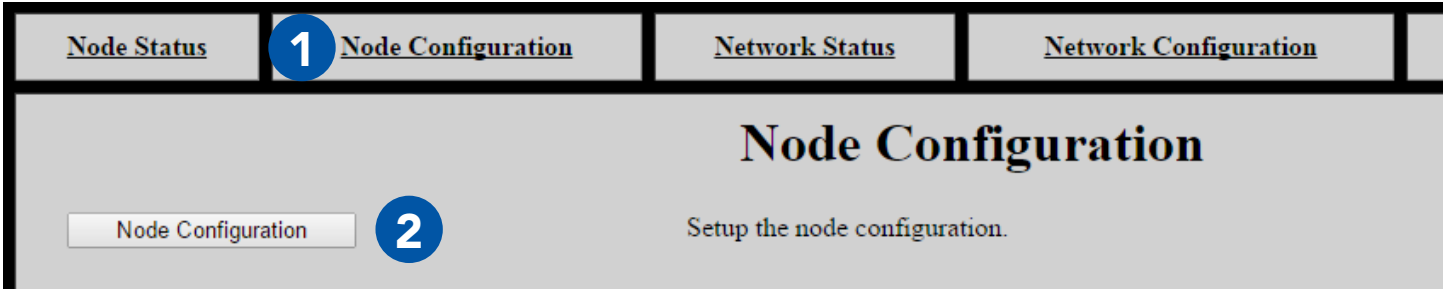

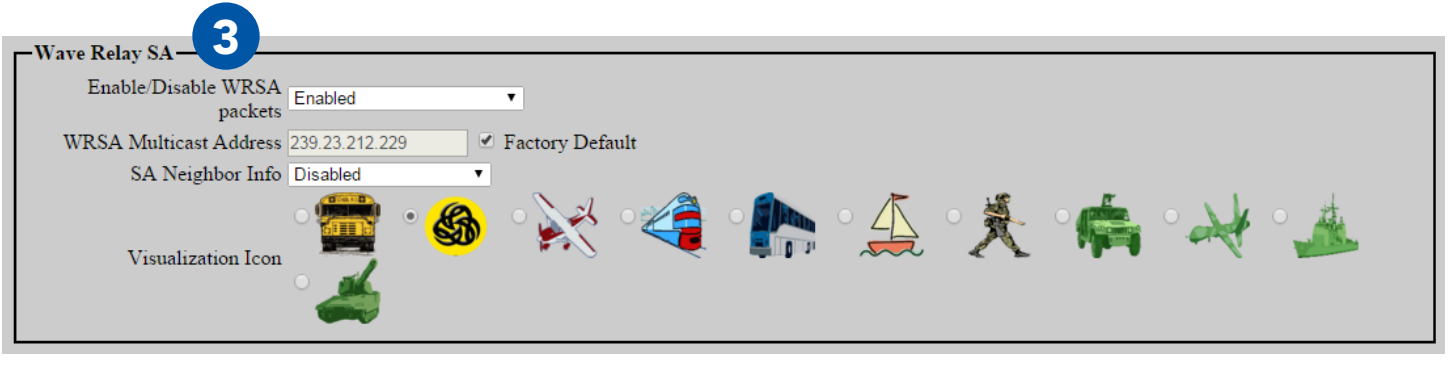

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Viewing Network Visualization

1. Click the **Network Status** tab.
2. Scroll to **Network Visualization**.
3. Select a refresh rate from the drop-down menu. Faster refresh rates will use more bandwidth.
4. Click Network Visualization. A file named node-monitor.kml will download.
5. Open this file in Google Earth to view network visualization.

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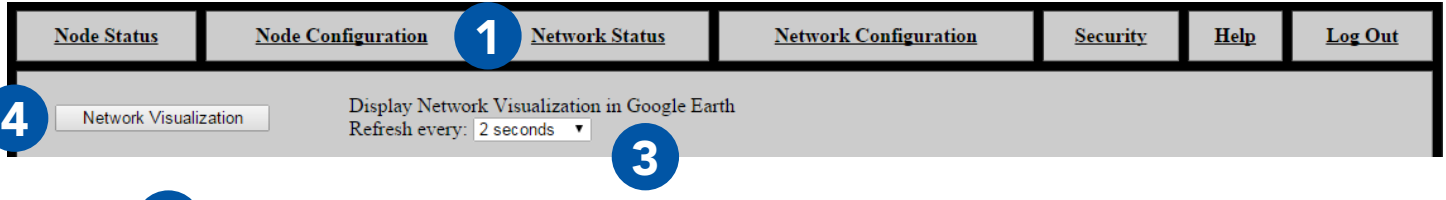

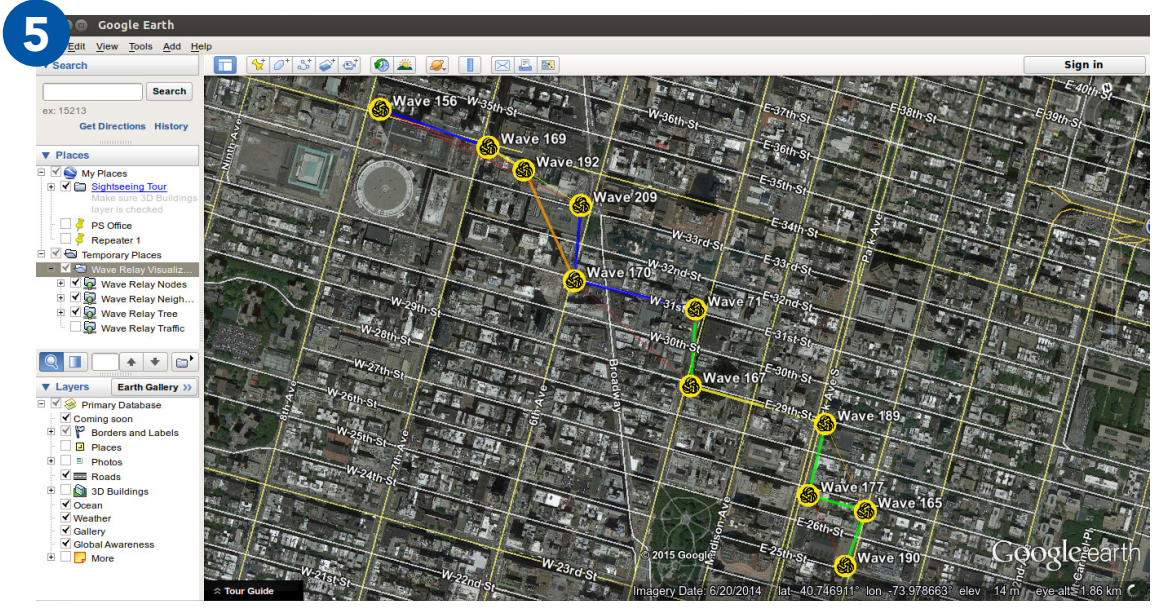

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Part V: Device Operation

Zeroize the Security Key

1. **Pull down** the **zeroize latch** on the top of the unit.

2. With the zeroize latch held down, **twist** the **Power Knob** counterclockwise from the **OFF** position to the **Z** position.

   Note: the status indicator LED will blink red once when the key is zeroized.

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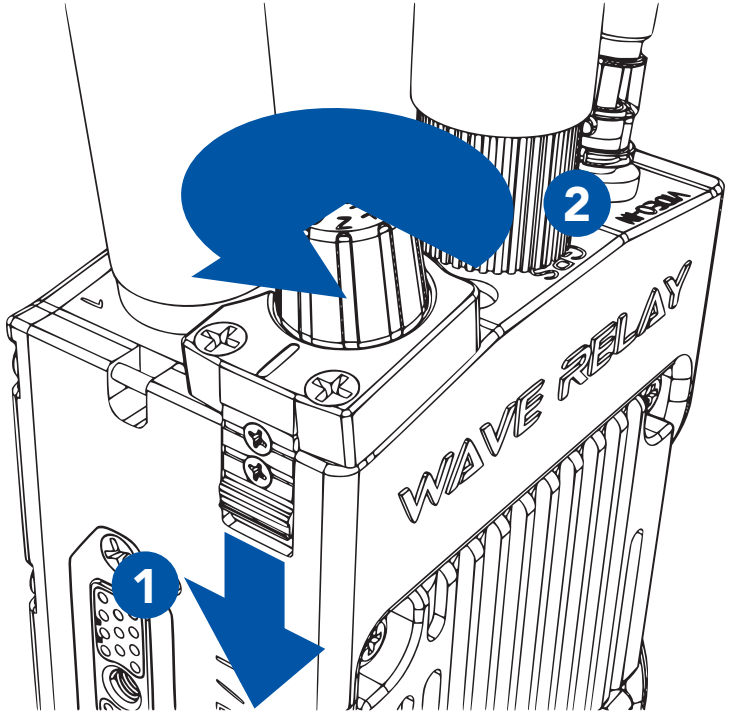

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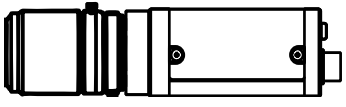
Connect a Camera to the MPU5

Parts List

For HD-SDI Connection:

HD-BNC to BNC Cable
CBL-VID-2001



Camera with BNC output

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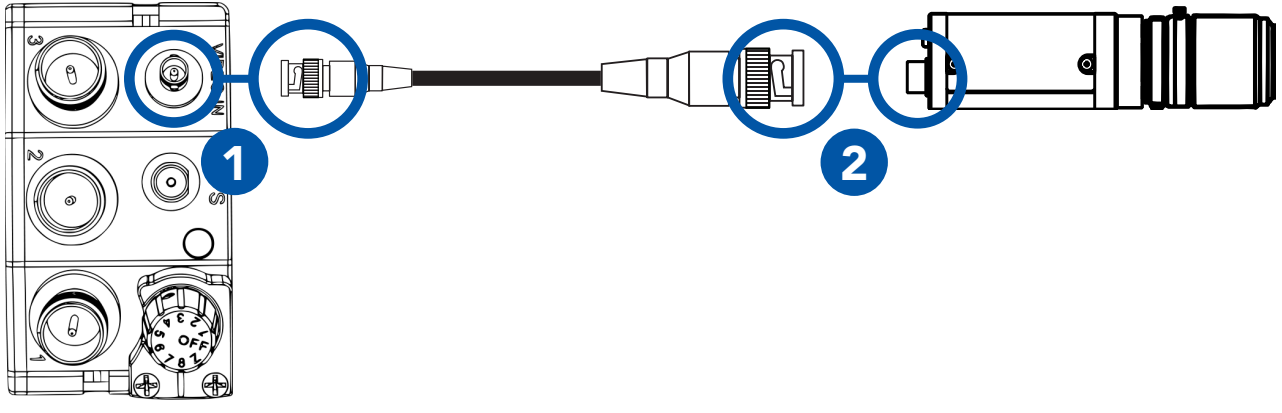
1. Connect the **HD-BNC** end of **CBL-VID-2001** to the **HD-BNC** connector on the top of the MPU5.

2. Connect the **BNC** end of **CBL-VID-2001** to the **BNC** connector on the camera.



Note: the Video In connector does not supply power to the camera. Ensure that your camera is properly powered via another source.

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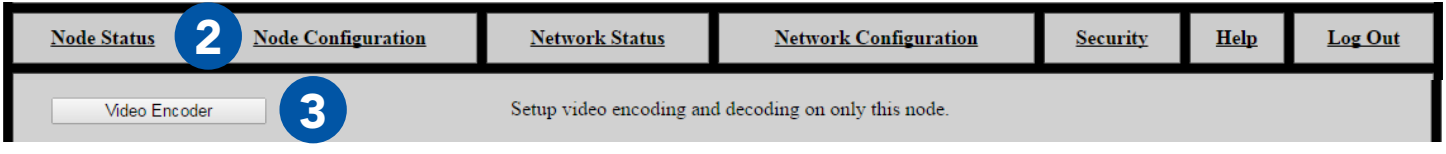
Configuring Video Settings

1. Connect the MPU5 to the Management Computer and log into the Web Management Interface.
2. Click the **Node Configuration** tab.
3. Click the **Video Configuration** button.



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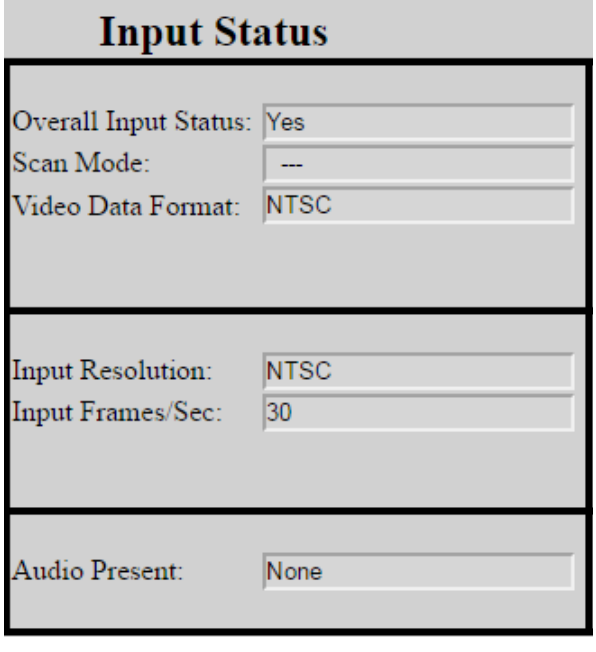
Check Camera Input Status

1 The left column displays status information for the camera connected to the MPU5. Use this status information to verify that the connected camera is configured and working properly.

Overall Input Status: displays Yes if a camera is connected; displays No otherwise.
Scan Mode: scan mode setting of the connected camera, if available
Video Data Format: output format setting of the connected camera, if available

Input Resolution: resolution setting of the connected camera, if available
Input Frames/Sec: frame rate setting of the connected camera, if available

Audio Present: audio status from the connected camera, if available



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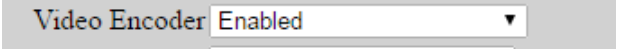
Encoder Configuration

The center column displays configuration settings for the MPU5's onboard video encoder.

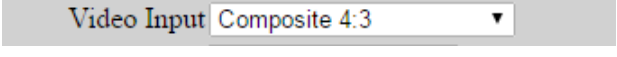
Enable/Disable Video Encoding

1. In the **Enable/Disable** drop-down menu, select **Enabled**.



2. To disable Video, select **Disabled**.

Select Video Input



1. Select the video source that corresponds to your camera from the **Video Input** drop-down menu.
   - **3G-SDI:** 3G-SDI input via the **Video In** connector on the top of the MPU5
   - **Composite 4:3:** Composite input with a 4:3 aspect ratio via the **Video In** connector on the top of the MPU5
   - **Composite 16:9:** Composite input with a 16:9 aspect ratio via the **Video In** connector on the top of the MPU5

Note: you **MUST** manually configure the correct input source. If the correct input source is not selected, input status will show no camera detected.

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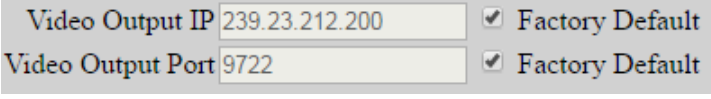
Configure Video Output IP Address and Port



1. Enter an IP address for the video in the **Video Output IP** field. Pick a unique IP address. Uncheck the **Factory Default** box to make changes to this field. Check the **Factory Default** box to use the Factory Default Video Output IP.

2. Enter a port for the video stream in the **Video Output Port** field. Uncheck the **Factory Default** box to make changes to this field. Check the **Factory Default** box to use the Factory Default Video Output Port.

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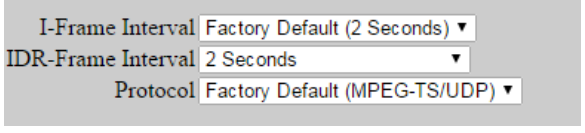
Advanced Video Configuration Options

1. Click **Show/Hide Advanced Settings**. This will show or hide drop-down menus for **I-Frame Interval**, **IDR-Frame Interval**, and **Protocol**.



I-Frame Interval (Advanced): Sets the time between I-Frames (in seconds). The shorter amount of time between I-Frames, the better video quality will be, but the video stream will use more bandwidth. It is not recommended for non-advanced users to change this setting.

IDR-Frame Interval (Advanced): Sets the time between IDR-Frames (in seconds). Increasing IDR-Frame interval will decrease the bandwidth used by the stream, but it may reduce video quality. It is not recommended for non-advanced users to change this setting.

Note: Available IDR-Frame Interval options change based on the selected I-Frame interval. If you change I-Frame Interval and the selected IDR-Frame Interval setting is available for that I-Frame Interval, the IDR-Frame Interval will not change. If you change I-Frame Interval and the selected IDR-Frame Interval setting is not available for that I-Frame Interval, IDR-Frame Interval will be set to the factory default setting for that I-Frame Interval.

Protocol (Advanced): Selects the streaming protocol for the video stream. Options are: **MPEG-TS/UDP** or **RTP/UDP**.

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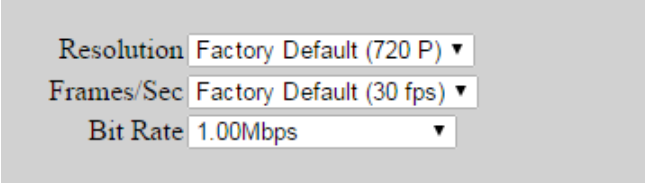
Select Video Encoding Settings

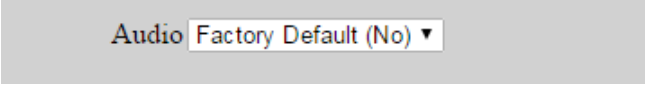


1. Select a resolution from the Resolution drop-down menu. This setting selects the resolution at which video will be encoded. Options are:

2. Select a frame rate from the Frame Rate drop-down menu. This setting selects the frame rate at which video will be encoded.

3. Select a bit rate from the Bit Rate drop-down menu. This setting selects the bit rate at which video will be encoded.

Note: Available frame rate and bit rate options change based on the selected resolution. If you change resolution and the selected frame rate and bit rate settings are available for that resolution, they will not change. If you change resolution and the selected frame rate or bit rates settings are not available for that resolution, frame rate and bit rate will be set to the factory default setting for that resolution.



4. If you wish to encode audio with the video stream, select **Yes** from the **Audio** drop-down menu. Otherwise, select **No**.

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6 When you are finished configuring settings, click **Save & Reconfigure Unit**.

7 Use the **Camera Motion & Estimated Video Quality** table on the bottom left of the page to check if the bit rate you have selected will be sufficient for good-quality video based on how much your camera will be moving. If it is not, adjust the bit rate setting accordingly.

Camera Motion	Estimated Video Quality
VeryLow/None:	Good
Low:	Good
Medium:	Good
High:	Good
Very High:	Sub-optimal

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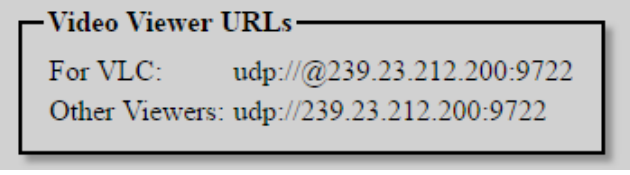
Video Viewer URLs



The **Video View URLs** page will display two URLs below the Video Configuration settings. To pull video from this node, enter the **For VLC** URL into VLC or the **Other Viewers** URL in another video player.

Note: if you change **Video Output IP** or **Video Output Port** on the **Video Configuration** page, these URLs will change as well.

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Video Encoding Status

The center column displays configuration settings for the MPU5's onboard video encoder.

Overall Encoder Status: displays whether this node is encoding video or not.

Subscribers: displays whether there are users on the network subscribing to the video from this node.

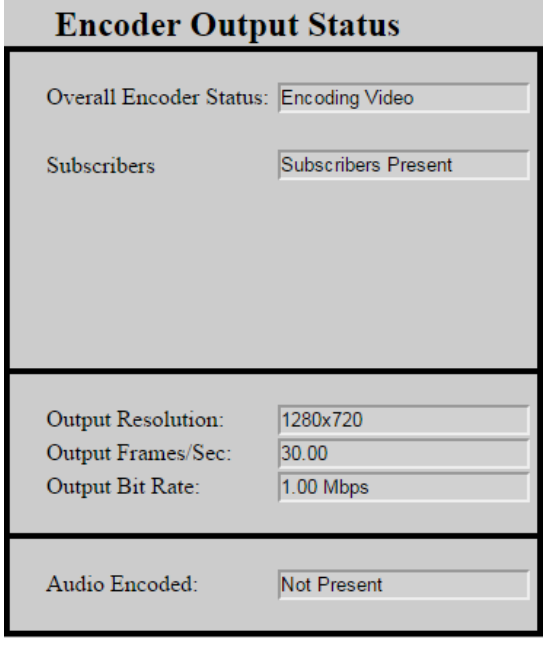
Note: if no one is subscribed to the video from this node, the node will not encode video.

Output Resolution: displays the resolution of the encoded video being output

Output Frames/Sec: displays frame rate of the encoded video being output

Output Bit Rate: displays the bit rate of the encoded video being output

Audio Encoded: displays whether audio is being encoded with the video stream or not



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What do I do if video is not being encoded?

1. Ensure that the camera is powered and all cables are connected securely to the correct connectors.
2. Ensure Video Encoding is enabled on the node. You must click the Save & Reconfigure Unit button for settings to take effect.
3. Ensure that the correct video input is selected on the Video Encoding Configuration page.
4. If there are no subscribers to the video, video will not be encoded. Check if video is being encoded when a subscriber is present.
5. Ensure the correct Video Viewer URL is entered into your video viewer.

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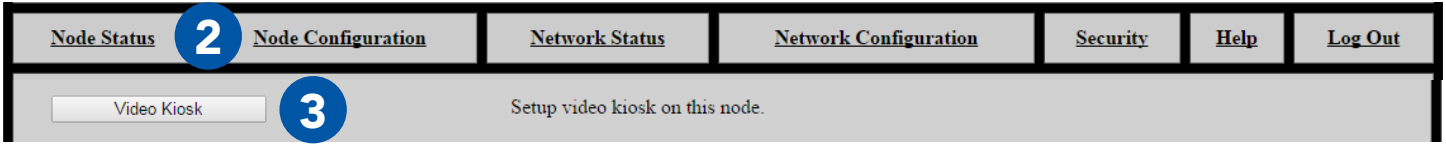
Video Kiosk Mode

Video Kiosk Mode allows you set up the MPU5 as a kiosk video player. When Kiosk Mode is enabled, up to four video feeds may be configured. The MPU5 will automatically display one of these video feeds, and the standard MPU5 Android interface is disabled. The video being viewed can be changed from within the Web Management Interface or toggled by using the keypad.

Configuring Video Kiosk Mode

1. Connect the MPU5 to the Management Computer and log into the Web Management Interface.
2. Click the **Node Configuration** tab.
3. Click the **Video Configuration** button.



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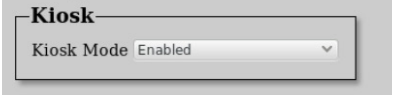
Enable Video Kiosk Mode

1. In the **Enable/Disable** drop-down menu, select **Enabled**.



2. To disable Video, select **Disabled**.

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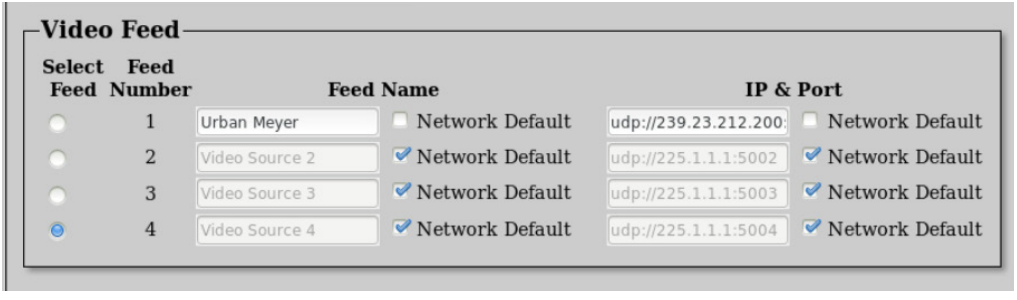
Configure Video Feed Settings



The **Video Feed** box configures settings for each of the 4 feeds to be viewed in Video Kiosk Mode.

Select Feed: this column controls which video feed will be displayed by default in Video Kiosk Mode. Click the circle for the video feed you wish to be the default.
Feed Number: displays the number of each of the four video feeds. When in Video Kiosk Mode, you may select a feed to be displayed using the corresponding keypad number or the left and right arrow keys.
Feed Name: assigns a custom name to each video feed. Uncheck the Network Default box to edit this field.
IP & Port: sets the IP address and Port for the video feed to be accessed in the format **<IP Address>:<Port>**. Uncheck the Network Default box to edit this field.

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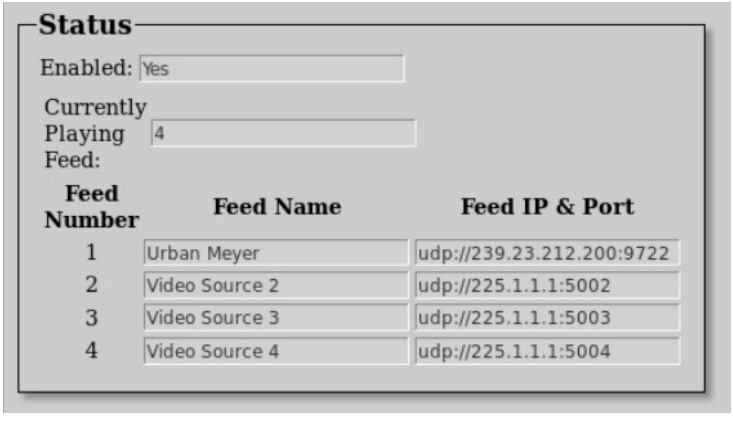
Video Kiosk Mode Status



The **Status** box displays Video Kiosk Mode status information.

Enabled: displays **Yes** if Video Kiosk Mode is enabled and displays **No** if Video Kiosk Mode is disabled
Currently Playing Feed: displays the number of the video feed that is currently being viewed in Video Kiosk Mode
Feed Number: displays the number of each of the four video feeds
Feed Name: displays the name for each video feed
Feed IP & Port: displays the IP address and port for each video feed

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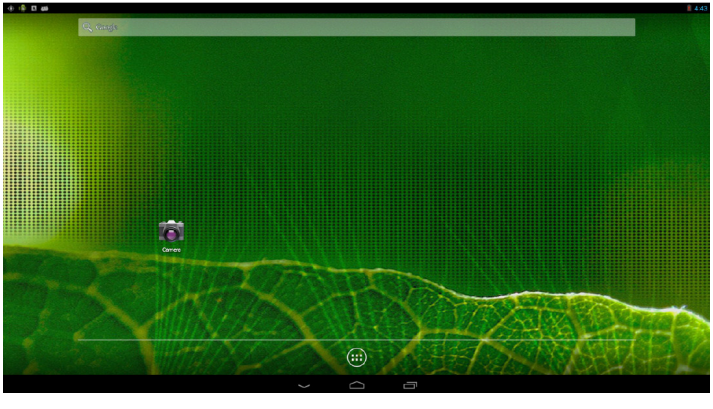
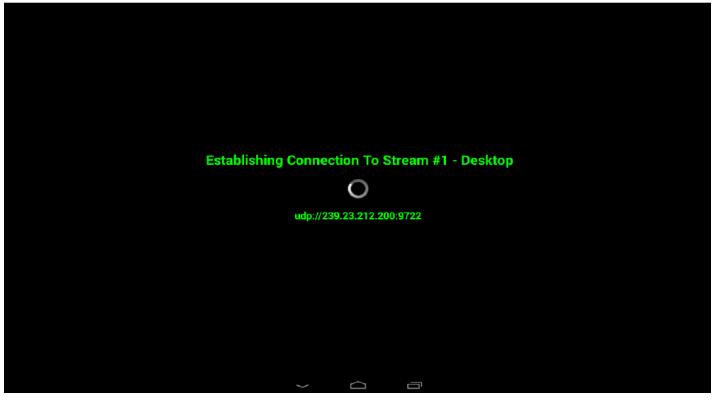
Video Kiosk Mode Operation

- The video kiosk app will automatically restart if video encoding settings change or a problem occurs.
- The only way to exit the video kiosk player is to disable Video Kiosk Mode from the Web Management Interface.



Video Kiosk Mode Disabled



Video Kiosk Mode Enabled

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- The video feed being viewed can be changed from the Web Management Interface or from the app:
  - With num lock disabled, use the left and right arrow keys
  - With num lock enabled, use the keypad to select the corresponding video feed

Num Lock Disabled

Num Lock Enabled

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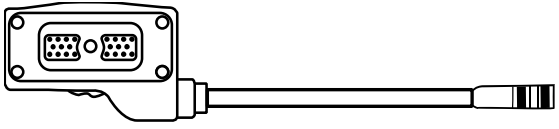
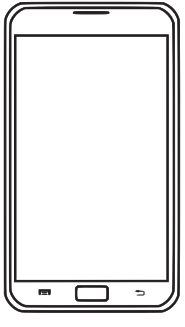
Connect an EUD or Handheld Display to the MPU5

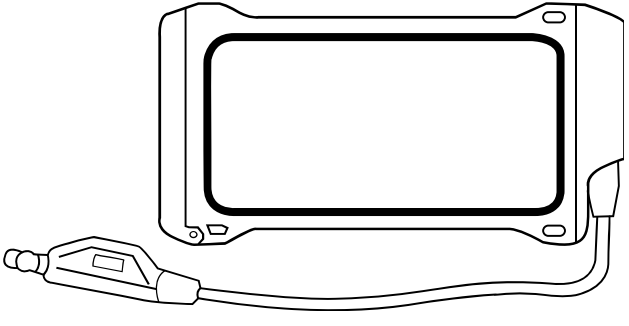
Parts List



22-Pin to 6-Pin USB Push Pull Android™ Tether Cable
CBL-DATA-2004



Android™ EUD
ACC-EUD-0001



EUD IP67 Enclosure
MOLLE-IP67-N3

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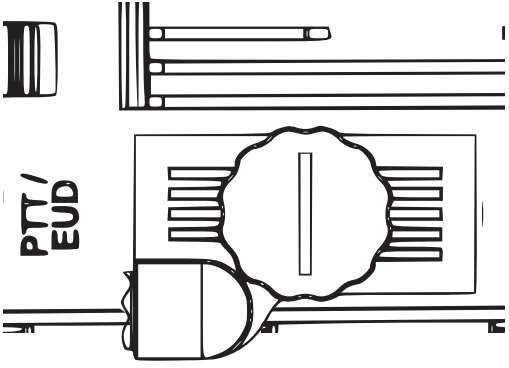
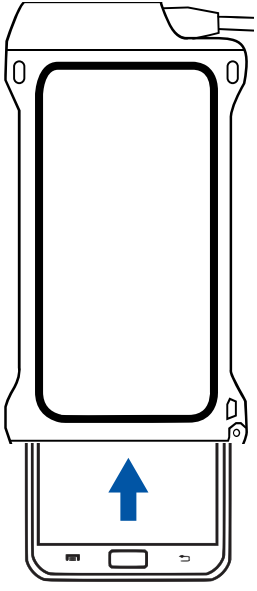
DEVICE OPERATION: CONNECTING AN EUD OR HANDHELD DISPLAY

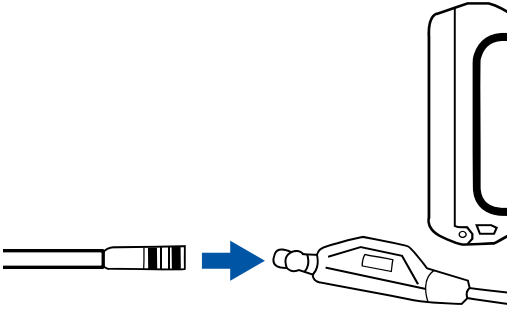
1. Connect **CBL-DATA-2004** to the **PTT/EUD** side connector on the MPU5.



2. Insert the Android™ EUD into the Juggernaut Case.



3. Connect the **6-Pin Push Pull connector** on the Juggernaut Case to the **6-Pin Push Pull connector** on **CBL-DATA-2004.**



4. The MPU5 Android™ OS will be displayed on the EUD or Display.

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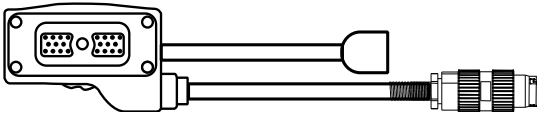
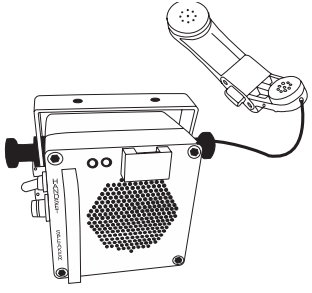
Connect a Monitor or TV to the MPU5

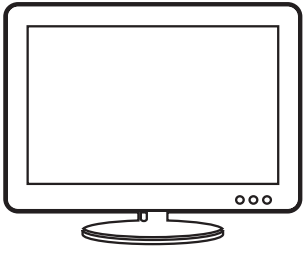
Parts List



22-Pin to Audio and Video Out
CBL-DATA-3002



Speaker Box or Headset with U-328 Connector



Monitor or TV with HDMI Input

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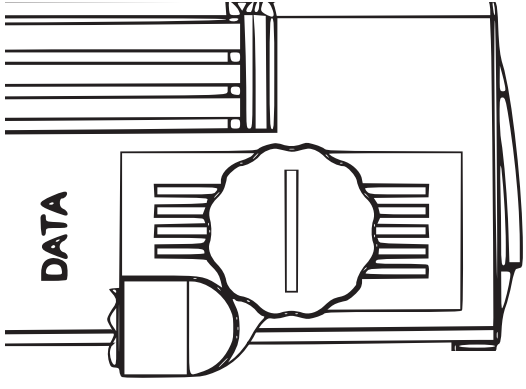
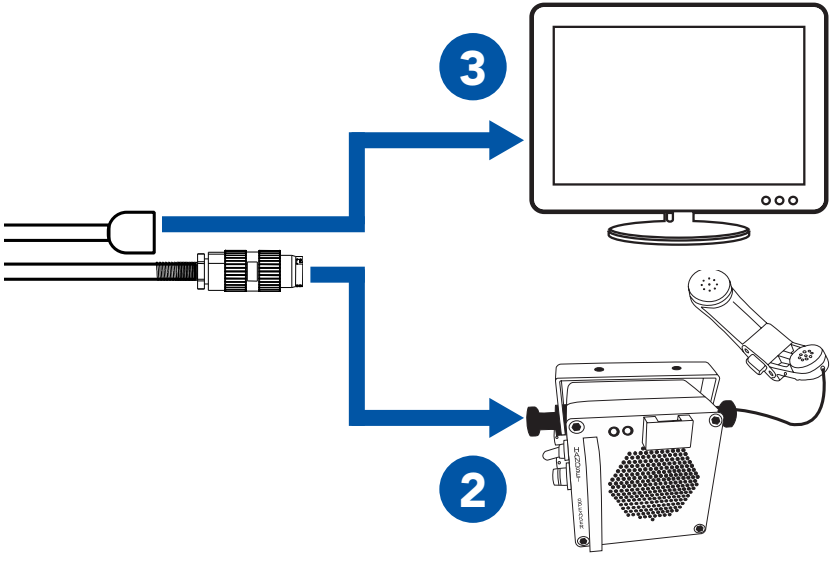
1. Connect **CBL-DATA-3002** to the **DATA** side connector on the MPU5.
2. Connect the speaker box or headset to the **U-328 audio connector** on **CBL-DATA-3002**.
3. Connect the **HDMI** end of **CBL-DATA-3002** to the **HDMI Input** on the monitor or TV.





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Why can't I see video on my Monitor or TV?

1. Ensure that the Monitor or TV is powered on.
2. Ensure that all cables are connected properly.
3. Ensure that the Monitor or TV is set to the correct HDMI input.
4. Reboot the node.

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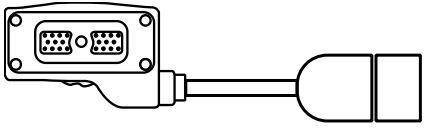
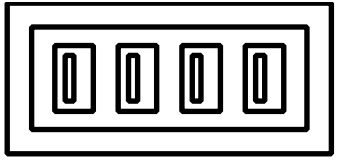
Connect USB Accessories to the MPU5

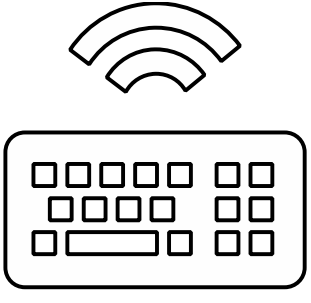
Parts List



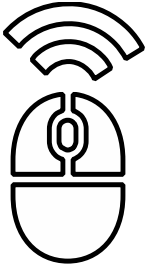
22-Pin to Type A Female USB 2.0 Receptacle
CBL-DATA-2003



USB Hub
(Optional)



USB Keyboard
(Optional)



USB Mouse
(Optional)

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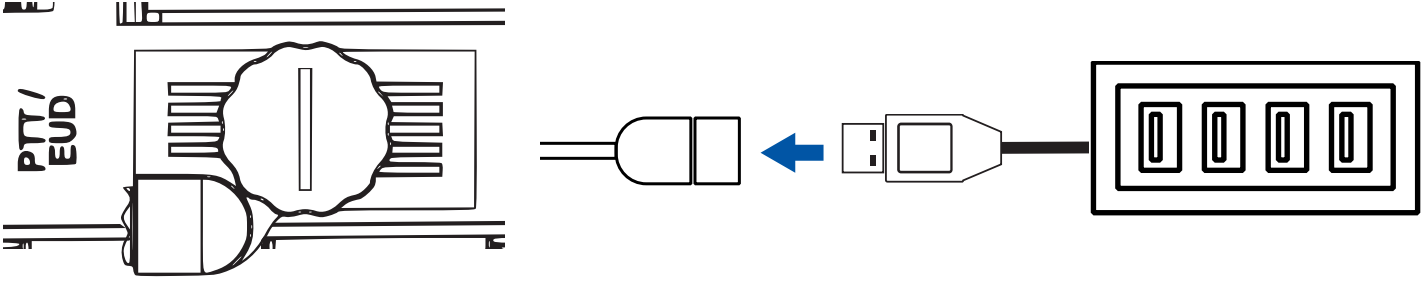
DEVICE OPERATION: USB ACCESSORIES

1. Connect **CBL-DATA-2003** to an unused side connector on the MPU5.
2. Connect the USB Hub or one USB accessory to the **USB receptacle** on the end of CBL-DATA-2003.
3. If you are using a USB Hub, connect USB accessories to the USB receptacles in the USB Hub.



Why don't my USB accessories work?

1. Ensure all cables are connected properly.
2. Ensure that all wireless accessories (keyboards/mice/etc.) are powered (i.e. batteries are not dead)
3. If you are using a USB Hub, connect the USB accessory directly to CBL-DATA-2003. If the accessory works, replace the USB hub.
4. If available, test a different CBL-DATA-2003. If the accessory works, the original CBL-DATA-2003 may be defective.
5. Reboot the node.
4. Your USB accessory may not be compatible. Contact Persistent Systems support.

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Install Android™ Apps on the MPU5

Parts List

.apk file for Android™ App(s)

Management Computer

Note: the Operating System on the MPU5 is Android™ version 5.0 (Lollipop). Ensure that the app you wish to install is compatible with this version of the Android™ OS.

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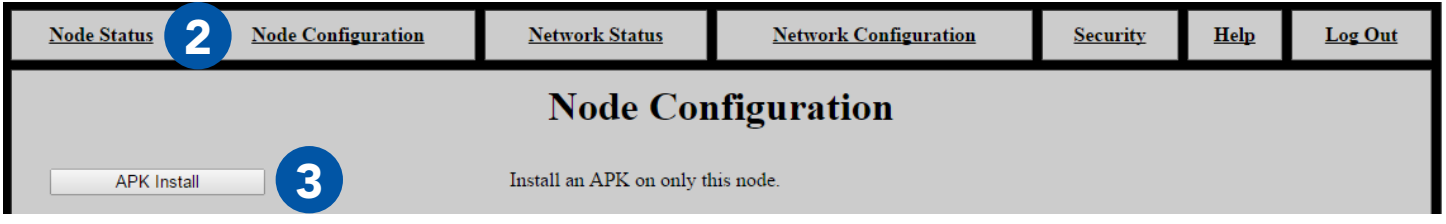
1. Connect the MPU5 to the Management Computer and log into the Web Management Interface.
2. Click the **Node Configuration** tab.
3. Click **APK Install**.



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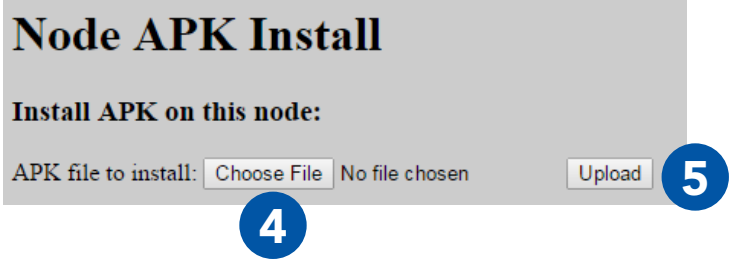
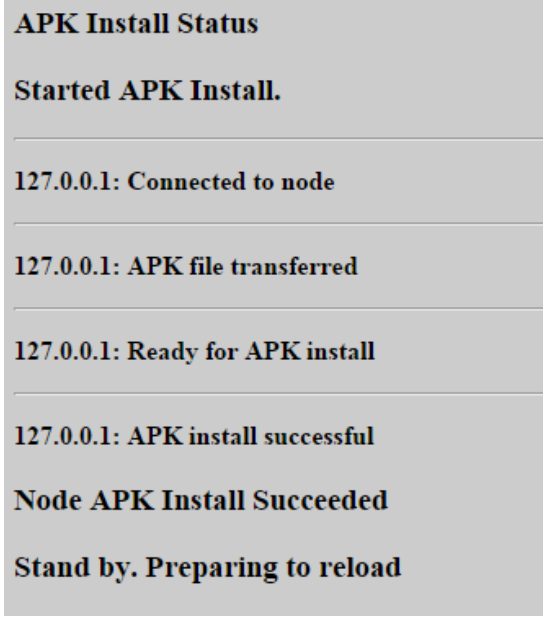
4 Click **Choose File** and navigate to the .apk file you wish to install.

5 Click **Upload** and wait for the on-screen prompt to say Node APK Install Succeeded. The page will then reload.





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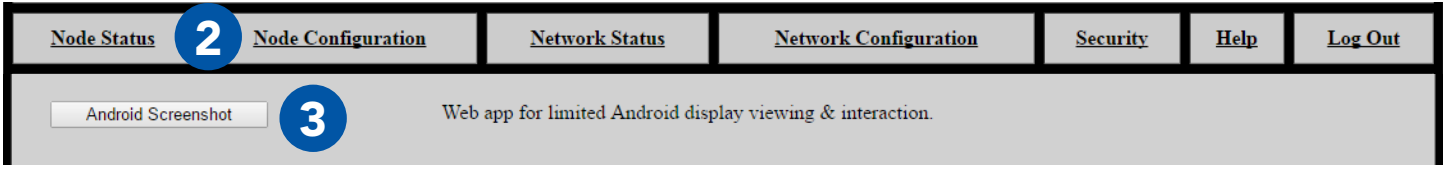
View Android™ OS via the Web Management Interface

- The Android™ Screenshot page allows users to view and control Android™ on the MPU5 via the Web Management Interface

Accessing the Android™ Screenshot Page

1. Connect the MPU5 to the Management Computer and log into the Web Management Interface.
2. Click the **Node Status** tab.
3. Click the **Android™ Screenshot** button.



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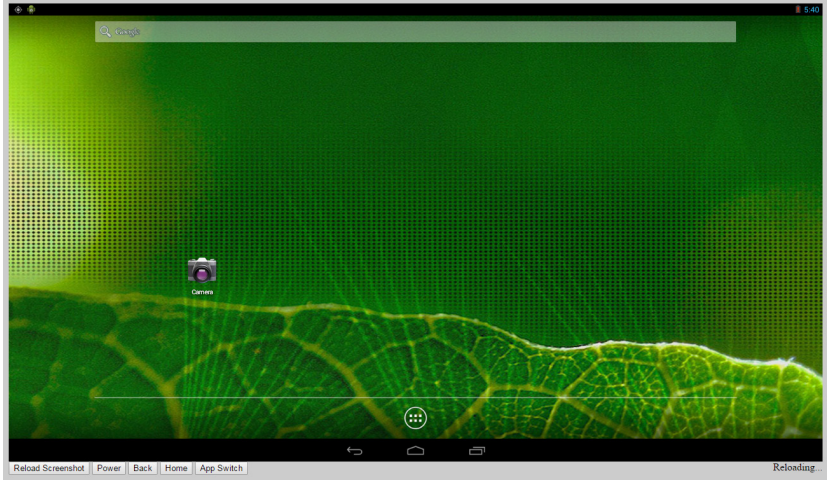
Using the Android™ Screenshot Page



Mouse Click: tap/swipe as if using a touch screen EUD
Reload Screenshot: refreshes the displayed image of the Android™ OS
Power: powers on/off the Android™ display - this will not close apps
Back: returns to the previous page
Home: returns to the Android™ Home Screen
App Switch: allows the user to toggle between open apps

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Network Configuration Tab

The **Network Configuration** tab allows you to perform actions on all nodes in the network.

Network Node List: manage the Network Node List
Network Upgrade: upgrade firmware on all nodes
Network Password: change the Management Password for all nodes
Network APK Install: install an APK on all nodes in the network
Reboot Network: reboot all nodes in the network

Each action on this tab is the same as the corresponding action on the Node Configuration tab.

Network Upgrade and Network APK install have a box labeled Require All. If this box is checked, the firmware or .apk file will only be installed if and only if all nodes in the Network Node List are able to be contacted. If any node is unable to be contacted, the firmware or .apk file will not be installed on any node. If this box is unchecked, the firmware or .apk file will only be installed on nodes that are able to be contacted. The firmware or .apk file will not be installed on nodes that are unable to be contacted.

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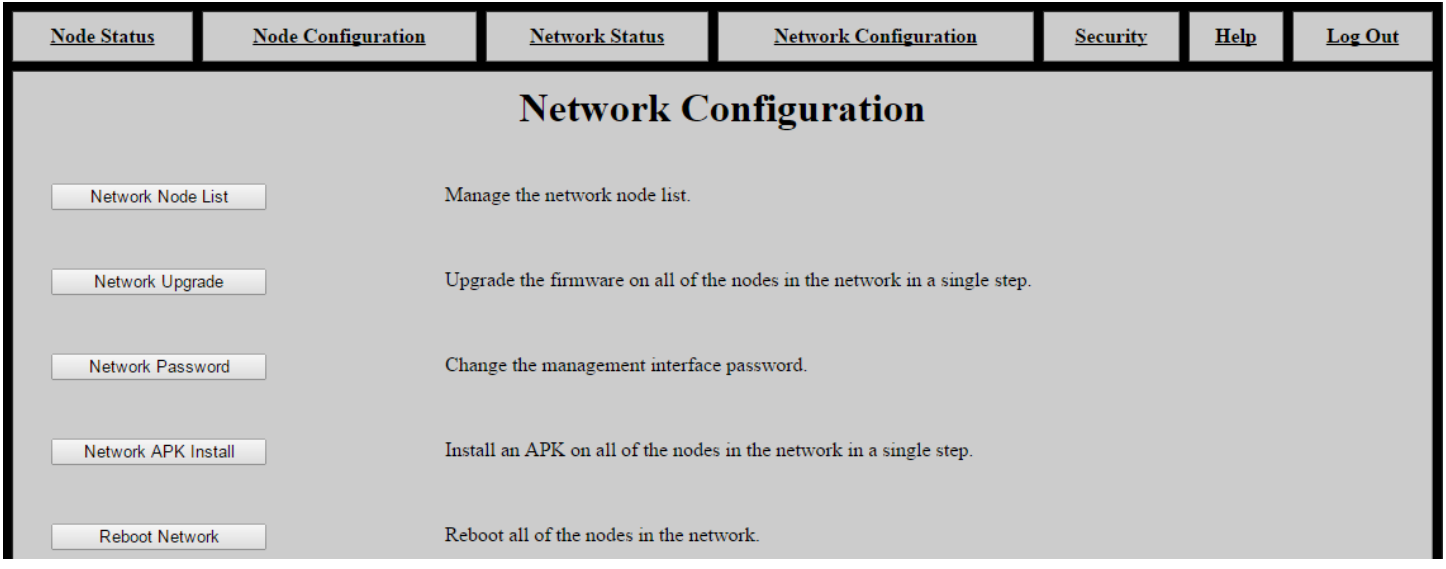

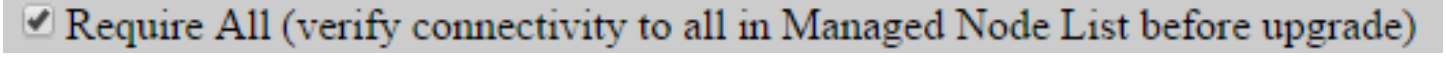

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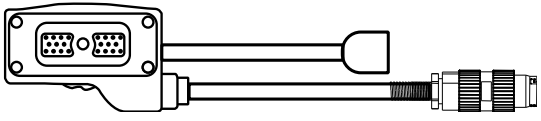
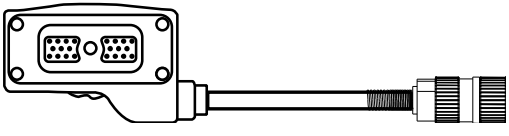
Connect a PTT Device to the MPU5

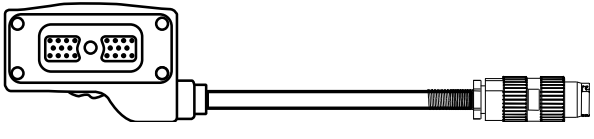
Parts List



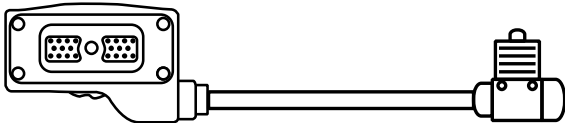
22-Pin to audio and Video Out
CBL-DATA-3002



22-Pin to U-329
CBL-AUD-0001

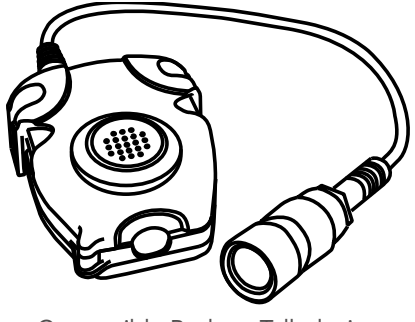


22-Pin to U-328
CBL-AUD-0002



22-Pin to U94 Receptacle
CBL-AUD-0003

The cable you need is dependent on what connector your PTT device has.



Compatible Push-to-Talk device

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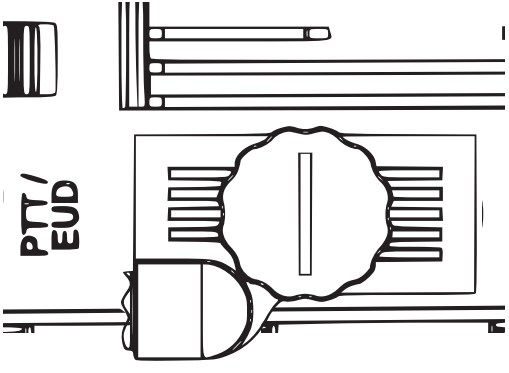
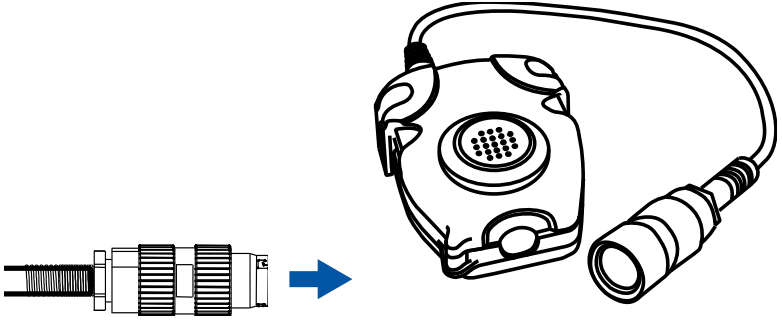
1. Connect the cable to the **PTT/EUD** side connector on the MPU5.



2. Connect the PTT device to the connector on the end of the cable.



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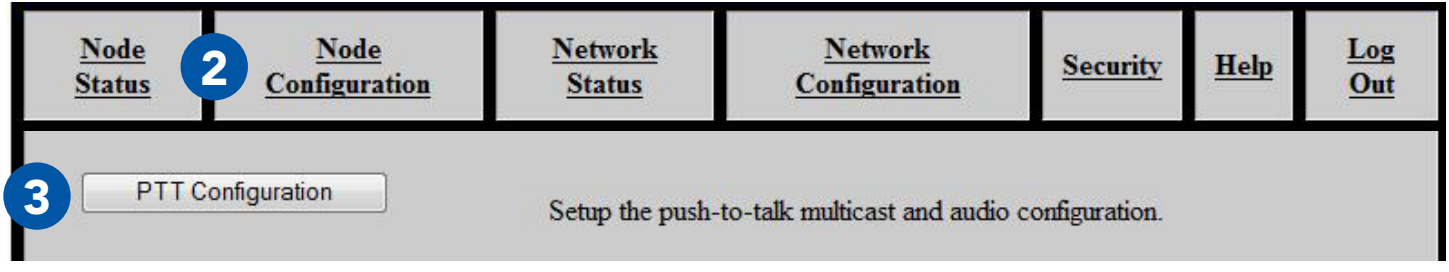
Configure PTT Settings

1. Connect the MPU5 to the Management Computer and log into the Web Management Interface.
2. Click the **Node Configuration** tab.
3. Click the **PTT Configuration** button.



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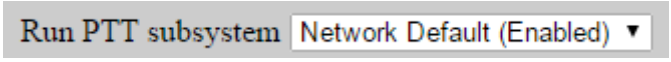
Enable Push-to-Talk

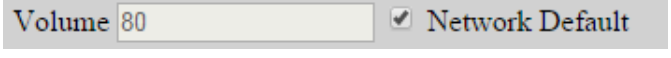
1. In the **Run PTT Subsystem** drop-down menu, select **Enabled**.



2. To disable Push-to-Talk, select **Disabled**.

Set Earpiece Volume

1. Next to Volume, **check** the **Network Default** box to use the Network Default earpiece volume.



2. To customize earpiece volume, **uncheck** the **Network Default** box.

3. In the **Volume** field, enter a value **0 - 125**. Values above 100 are digitally amplified.

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Set Microphone Level

1. Next to Microphone Level, **check** the **Network Default** box to use the Network Default microphone level.

2. To customize microphone level, **uncheck** the **Network Default** box.

3. In the **Microphone Level** field, enter a value:
   auto: Uses automatic gain control for microphone input - recommended for most users
   0 - 100: valid microphone level volumes

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Set Transmit Mode

1 Select a setting from the **Transmit Mode** drop-down menu:

OnKeyPress: audio is transmitted only when the PTT button is pressed on the headset

Continuous: audio is continuously transmitted.

Note: other nodes may monitor the channel only. Selected Channel audio transmissions will interrupt monitored continuously transmitted audio.

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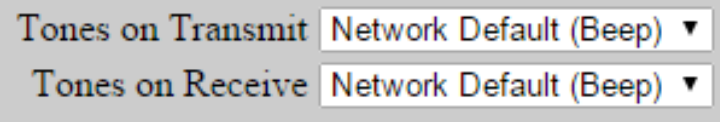
Set Transmit or Receive Audible Checktone

1. From the **Tones on Transmit** and **Tones on Receive** drop down menus, select:
   Quiet: no audible checktone
   Beep: audible checktone will be set to a beep
   Voice: audible checktone will be a vocalized "one"
   Network Default: audible checktone will be set to the network default setting



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Enable/Disable Low Battery Audible Notification

1. Select a setting in the **Low Battery** drop-down menu:
   Enabled: when the battery is depleted to 5%, the node will play an audible notification every 5 minutes.
   Disabled: no low battery audible notification will occur.
   Network Default: network default setting

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1. In the **Selected** column, click the circle for the channel(s) you wish to transmit on.
2. In the **Monitor** column, check the box for each channel you wish to monitor. You will be able to hear PTT audio on the monitored channel.

Pro Tip: you may select any number of channels to monitor. In the Monitor column, check the box for each channel you wish to monitor. You will NOT be able to transmit PTT audio on channels other than the one you selected in Step 3.

Customize a PTT Channel

3. In the **Channel** field, uncheck the **Network Default** box and enter the desired channel name.
4. In the **Multicast Address** field, uncheck the **Network Default** box and enter the desired multicast address and multicast port in the form <multicast address>:<multicast port>.

Note: valid multicast address values are in the range **224.0.0.0 - 239.255.255.255**
Note: valid multicast port values are in the range **1 - 65534**
Note: each channel MUST have a unique multicast address and multicast port.

5. Scroll to the bottom of the page and click **Save**.

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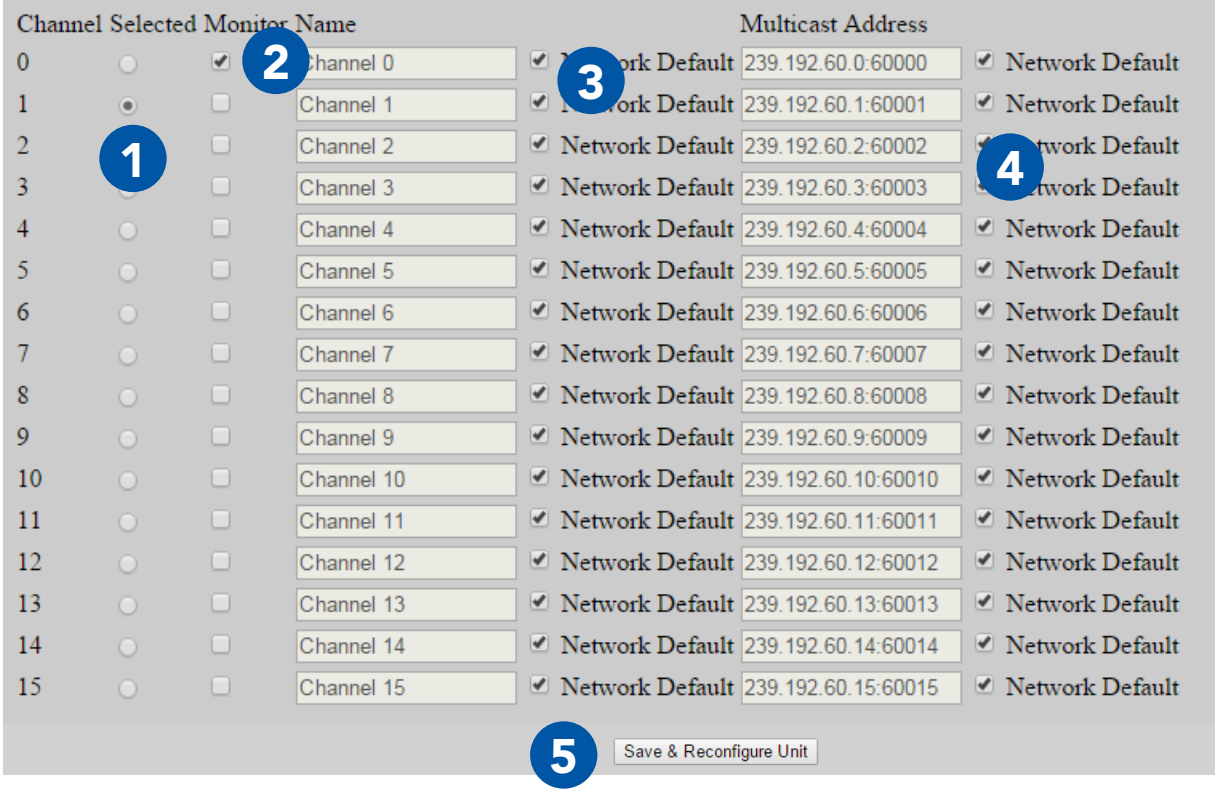

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DEVICE OPERATION: CONFIGURING PTT SETTINGS

1. Ensure that your PTT device is connected and channel settings have been configured properly and as desired.
2. **Press and hold** the PTT button on the PTT device.
3. Wait to hear a single beep.
4. Talk.
5. **Release** the PTT button when you are finished talking.

- You may talk or listen, but you may not do both simultaneously.
- Transmissions from an individual user are broadcast to all other users on the network using the same channel.
- Only one person may talk on a channel at one time. If you try to PTT while another user is transmitting, you will hear a busy signal.
- Selected Channel audio will interrupt Monitored Channel audio.
- Flash Override audio will interrupt both Selected Channel and Monitored Channel audio.

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Flash Override is a feature that allows a user to transmit audio to all nodes on the network regardless of which channel they are operating on.

Flash Override audio will interrupt all audio on all channels.

1. To activate Flash Override, **"tap-tap-hold"** the PTT button (**press and release** the PTT button quickly in succession, then **press and hold** the PTT button for the duration of the transmission)
2. The transmitting user and all receiving users will hear three beeps.
3. Talk.
4. **Release** the PTT button when you are finished talking.

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PROFESSIONAL INSTALLER - COMPLIANCE

USA

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The following notes refer to these part numbers:

Persistent Systems P/N	Description	FCC ID
RF-2100	S-Band RF Module	2AG3J-RF2100
RF-5100	Upper C-Band RF Module	2AG3J-RF5100
RF-2150	10W S-Band RF Module	2AG3J-RF2150

This device complies with part 15 of the FCC rules. Operation is Subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

NOTE II: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

OPERATING FREQUENCY: Operating frequency is determined by the installer. It is important that the frequency configured meets local regulations.

NOTE III: Please note that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC ID: XXX" where XXX = the radio module's FCC ID. Any similar wording that expresses the same meaning may be used.

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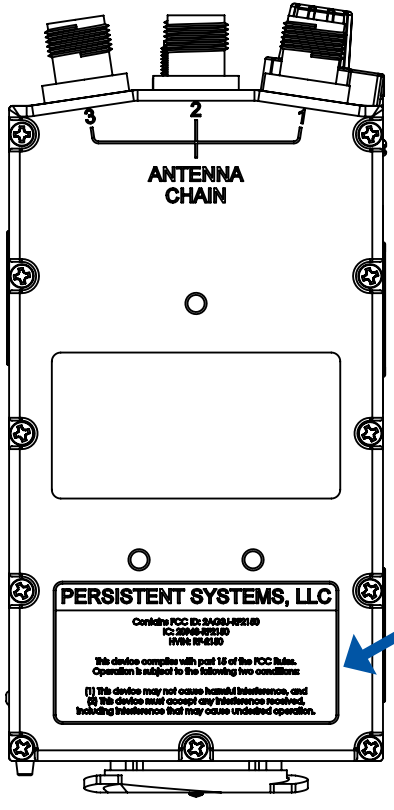
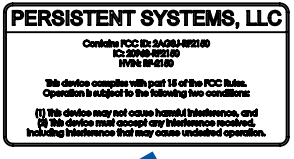


When the MPU5 is paired with RF-2150, professional installer is responsible for attaching included label to the MPU5 in this location.



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P/N: RF-2100
FCC ID: 2AG3J-RF2100

US Power Limits						
Mode:	SISO: Only One Port Active		MIMO (2x2): 2 Ports Active Power Setting / Port		MIMO (3x3): All 3 Ports Active Power Setting / Port	
CHANNEL:	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)
1	28	32	26	31	24.5	31
2	30	35	26	32	24.5	31
3	30	36	26	32	24.5	31
4	30	36	26	32	24.5	31
5	30	36	26	32	24.5	31
6	30	36	26	32	24.5	31
7	30	36	26	32	24.5	31
8	30	36	26	32	24.5	31
9	30	36	26	32	24.5	31
10	30	33	26	32	24.5	31
11	29	32	26	31	24.5	31

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P/N: RF-2150
FCC ID: 2AG3J-RF2150

US Power Limits 2.15 dBi Omnidirectional Antenna						
Mode:	**SISO: Only One Port Active**		**MIMO (2x2): 2 Ports Active Power Setting / Port**		**MIMO (3x3): All 3 Ports Active Power Setting / Port**	
CHANNEL:	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**
1	14.0	17.0	12.5	21.5	9.5	22.4
2	17.5	20.2	17.0	26.1	15.5	28.2
3	18.5	21.6	18.0	27.0	16.0	29.2
4	19.5	22.6	18.5	28.1	17.5	30.8
5	23.0	25.6	21.0	29.7	19.5	32.0
6	23.5	26.1	22.5	31.6	21.0	33.0
7	23.5	26.1	23.0	32.0	21.5	33.1
8	22.0	24.6	21.0	30.0	20.0	32.1
9	21.0	23.5	19.0	28.2	17.5	30.6
10	19.5	22.0	17.0	26.3	16.5	29.3
11	14.5	17.6	13.0	22.1	10.0	22.7

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P/N: RF-2150
FCC ID: 2AG3J-RF2150

US Power Limits 4 dBi Omnidirectional Antenna						
Mode:	**SISO: Only One Port Active**		**MIMO (2x2): 2 Ports Active Power Setting / Port**		**MIMO (3x3): All 3 Ports Active Power Setting / Port**	
CHANNEL:	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**
1	12.5	17.8	11	22.3	9	24.3
2	17	22	15.5	26.8	14.5	29.3
3	18	23.2	17.5	28.7	16	31.4
4	19.5	24.7	18	29.9	17	32.5
5	22	26.2	20.5	31.5	19	33.6
6	22.5	26.9	22	32.9	20.5	34.6
7	23	27.5	22.5	33.1	21	34.8
8	21.5	25.9	21	31.9	19.5	33.8
9	20	24.7	19	30.1	17	32.1
10	18	23	17	28.2	16	30.8
11	14	19.2	12.5	23.4	9.5	24.3

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P/N: RF-2150
FCC ID: 2AG3J-RF2150

US Power Limits 8.5 dBi Omnidirectional Antenna						
Mode:	**SISO: Only One Port Active**		**MIMO (2x2): 2 Ports Active Power Setting / Port**		**MIMO (3x3): All 3 Ports Active Power Setting / Port**	
CHANNEL:	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**
1	10.0	20.1	9.0	24.4	7.0	26.6
2	16.0	25.0	14.5	29.9	14.0	33.0
3	16.5	26.1	16.0	31.4	14.5	33.5
4	19.0	28.4	16.5	32.1	15.0	34.1
5	20.0	28.9	18.5	33.9	15.0	34.0
6	21.0	29.8	20.0	35.8	15.5	34.9
7	21.5	30.2	20.0	34.9	15.5	34.6
8	21.0	29.8	16.5	31.8	15.0	34.3
9	18.0	27.9	16.0	31.4	15.0	34.6
10	16.5	25.7	15.5	30.9	14.5	33.4
11	12.5	21.6	9.5	24.8	8.0	27.6

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P/N: RF-5100
FCC ID: 2AG3J-RF5100

Antenna Type and Gain (dBi): Omnidirectional / 3.5 dBi

USA

Freq (MHz)	Channel (WLAN)	Channel Width (MHz)	SISO Max. Power Setting Approved (dBm)	2x2 Max. Power Setting Approved (dBm)	3x3 Max. Power Setting Approved (dBm)	Max. EIRP Approved (dBm)
5180	36	20	17.0	14.0	11.5	21
5200	44	20	17.0	14.0	11.5	21
5240	48	20	17.0	14.0	12.0	21
5745	149	20	29.5	26.5	24	36
5787	157	20	29.5	26.5	24	36
5825	165	20	29.5	26.5	24	36

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Operations outside of the FCC grant will require special licensing.

Approved Antennas:

The radio transmitters listed in the table below have been approved by the FCC to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Part Number	FCC ID	Antenna Type	Max. Gain Approved (dBi)
RF-2100	2AG3J-RF2100	Omni	7.4
RF-5100	2AG3J-RF5100	Omni	3.5
RF-2150	2AG3J-RF2150	Omni	8.5

EIRP (Isotropic Radiated Power) = Power Setting + Antenna Gain - Cable Loss

National regulations may require that operations may be limited to portions of the frequency range shown in the channel selection page of the interface.

Radios operated in a portable configuration can be attached to dismount users using a holster via a MOLLE attachment method. As required by ANSI C95.1 Specific Absorption Rate, all portable configurations, using 2.15dBi antennas, are required to maintain a separation distance of 5cm from the body.

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Minimum Safe Distance (MSD)			
	Antenna Gain (dBi)	***Occupational Exposure Distance (cm)**	**Non Occupational Exposure Distance (cm)**
Dipole (Omnidirectional)	2.1	7.0	20.0
	3.5	7.0	20.0
	4.0	8.0	20.0
	7.4	**11.0	**25
	8.5	10	24

In addressing the MSD for operation of the RF-2100 S-Band (2200 MHz – 2500 MHz) RF module with **FCC ID 2AG3J-RF2100**, the RF-5100 Upper C-Band (5100 MHz – 6000 MHz) RF module with **FCC ID 2AG3J-RF5100,** and the RF-2150 10W S-Band (2200 MHz – 2500 MHz) RF module with **FCC ID 2AG3J-RF2150**, the applicable Maximum Permissible Exposure (MPE) limits were obtained IAW the FCC rules for radio frequency radiation exposure limits under ***FCC Title 47, Chapter 1 Subpart 1 Article 1.1310***.

For compliance information, contact Persistent Systems' Quality Management Department.

(212)-561-5895
support@persistentsystems.com

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The following notes refer to these part numbers:

Persistent Systems P/N	Description	IC ID
RF-2100	S-Band RF Module	20968-RF2100
RF-5100	Upper C-Band RF Module	20968-RF5100
RF-2150	10W S-Band Radio	20968-RF2150

This device complies with Industry Canada license-exempt RSS standard(s). Operation is Subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

OPERATING FREQUENCY: Operating frequency is determined by the installer. It is important that the frequency configured meets local regulations.

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P/N: RF-2100
IC ID: 20968-RF2100

Canada Power Limits						
Mode:	SISO: Only One Port Active		MIMO (2x2): 2 Ports Active Power Setting / Port		MIMO (3x3): All 3 Ports Active Power Setting / Port	
CHANNEL:	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)
1	28	32	26	31	24.5	31
2	30	35	26	32	24.5	31
3	30	36	26	32	24.5	31
4	30	36	26	32	24.5	31
5	30	36	26	32	24.5	31
6	30	36	26	32	24.5	31
7	30	36	26	32	24.5	31
8	30	36	26	32	24.5	31
9	30	36	26	32	24.5	31
10	30	33	26	32	24.5	31
11	29	32	26	31	24.5	31

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P/N: RF-2150
IC ID: 20968-RF2150

Canada Power Limits 2.15 dBi Omnidirectional Antenna						
Mode:	**SISO: Only One Port Active**		**MIMO (2x2): 2 Ports Active Power Setting / Port**		**MIMO (3x3): All 3 Ports Active Power Setting / Port**	
CHANNEL:	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**
1	14.0	17.0	12.5	21.5	9.5	22.4
2	17.5	20.2	17.0	26.1	15.5	28.2
3	18.5	21.6	18.0	27.0	16.0	29.2
4	19.5	22.6	18.5	28.1	17.5	30.8
5	23.0	25.6	21.0	29.7	19.5	32.0
6	23.5	26.1	22.5	31.6	21.0	33.0
7	23.5	26.1	23.0	32.0	21.5	33.1
8	22.0	24.6	21.0	30.0	20.0	32.1
9	21.0	23.5	19.0	28.2	17.5	30.6
10	19.5	22.0	17.0	26.3	16.5	29.3
11	14.5	17.6	13.0	22.1	10.0	22.7

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P/N: RF-2150
IC ID: 20968-RF2150

Canada Power Limits 4 dBi Omnidirectional Antenna						
Mode:	SISO: Only One Port Active		MIMO (2x2): 2 Ports Active Power Setting / Port		MIMO (3x3): All 3 Ports Active Power Setting / Port	
CHANNEL:	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)	Max. Power Setting Approved (dBm)	Max. EIRP (dBm)
1	12.5	17.8	11	22.3	9	24.3
2	17	22	15.5	26.8	14.5	29.3
3	18	23.2	17.5	28.7	16	31.4
4	19.5	24.7	18	29.9	17	32.5
5	22	26.2	20.5	31.5	19	33.6
6	22.5	26.9	22	32.9	20.5	34.6
7	23	27.5	22.5	33.1	21	34.8
8	21.5	25.9	21	31.9	19.5	33.8
9	20	24.7	19	30.1	17	32.1
10	18	23	17	28.2	16	30.8
11	14	19.2	12.5	23.4	9.5	24.3

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P/N: RF-2150
IC ID: 20968-RF2150

Canada Power Limits 8.5 dBi Omnidirectional Antenna						
Mode:	**SISO: Only One Port Active**		**MIMO (2x2): 2 Ports Active Power Setting / Port**		**MIMO (3x3): All 3 Ports Active Power Setting / Port**	
CHANNEL:	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**	**Max. Power Setting Approved (dBm)**	**Max. EIRP (dBm)**
1	10.0	20.1	9.0	24.4	7.0	26.6
2	16.0	25.0	14.5	29.9	14.0	33.0
3	16.5	26.1	16.0	31.4	14.5	33.5
4	19.0	28.4	16.5	32.1	15.0	34.1
5	20.0	28.9	18.5	33.9	15.0	34.0
6	21.0	29.8	20.0	35.8	15.5	34.9
7	21.5	30.2	20.0	34.9	15.5	34.6
8	21.0	29.8	16.5	31.8	15.0	34.3
9	18.0	27.9	16.0	31.4	15.0	34.6
10	16.5	25.7	15.5	30.9	14.5	33.4
11	12.5	21.6	9.5	24.8	8.0	27.6

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P/N: RF-5100
IC ID: 20968-RF5100

Antenna Type and Gain (dBi): Omnidirectional / 3.5 dBi

Canada

SISO Max. Power Approved (dBm)	2x2 Max. Power Approved (dBm)	3x3 Max. Power Approved (dBm)	Max. EIRP Approved (dBm)
n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a
29.5	26.5	24	36
29.5	26.5	24	36
29.5	26.5	24	36

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Operations outside of the IC Technical Acceptance Certificate (TAC) will require special licensing.

Approved Antennas:

The radio transmitters listed in the table below have been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Part Number	IC ID	Antenna Type	Max. Gain Approved (dBi)
RF-2100	20968-RF2100	Omni	7.4
RF-5100	20968-RF5100	Omni	3.5
RF-2150	20968-RF2150	Omni	8.5

EIRP (Isotropic Radiated Power) = Power Setting + Antenna Gain - Cable Loss

National regulations may require that operations may be limited to portions of the frequency range shown in the channel selection page of the interface.

Radios operated in a portable configuration can be attached to dismount users using a holster via a MOLLE attachment method. As required by ANSI C95.1 Specific Absorption Rate, all portable configurations, using 2.15dBi antennas, are required to maintain a separation distance of 5cm from the body.

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Minimum Safe Distance (MSD)			
	Antenna Gain (dBi)	*Occupational Exposure Distance (cm)	Non Occupational Exposure Distance (cm)
Dipole (Omnidirectional)	2.1	7.0	20.0
	3.5	7.0	20.0
	4.0	8.0	20.0
	7.4	**11.0	**25
	8.5	10	24

In addressing the MSD for operation of the RF-2100 S-Band (2200 MHz – 2500 MHz) RF module with **IC ID 20968-RF2100**, the RF-5100 Upper C-Band (5100 MHz – 6000 MHz) RF module with **IC ID 20968-RF5100**, and the RF-2150 10W S-Band (2200 MHz – 2500 MHz) radio with **IC ID 20968-RF2150**, the applicable Maximum Permissible Exposure (MPE) limits were obtained IAW the IC rules for radio frequency radiation exposure limits under ***Industrial Canada RSS-102, Section 2.6***.

En abordant la MSD pour le fonctionnement des RF-2100 S-Band (2200 MHz - 2500 MHz) radio avec **IC ID 20968-RF2100**, et RF-5100 Upper C-Band (5100 MHz – 6000 MHz) radio avec **IC ID 20968-RF5100**, et RF-2150 10W S-Band (2200 MHz - 2500 MHz) radio avec **IC ID 20968-RF2150**, l'exposition maximale admissible applicable (MPE) limites ont été obtenus conformément à la IC règles pour les limites d'exposition aux radiations de fréquences radio sous **industriel Canada RSS-102, Section 2.6.**

For compliance information, contact Persistent Systems' Quality Management Department.
Pour plus d'informations de conformité, le service de qualité contact Persistent Systems.
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support@persistentsystems.com

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JAPAN

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Notes:

* Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

** Cable loss is the minimum cable loss that may exist between the antenna port and the 7.4dBi antenna. 0.50dB cable loss was taken into consideration when calculating minimum distance.

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Radio P/N: RF-5100 Japan ID 209-J00294

Country: Japan (Government)

Mode of Operation: MIMO 3x3

Antenna Types and Gain (dBi)

Antenna 1: Omnidirectional / 3.5 dBi **Antenna 2:** Blade / 9 dBi **Antenna 3:** Patch 4x4 / 13 dBi

Japan Power Limits

Channel (MHz)	Channel Width (MHz)	Antenna 1		Antenna 2		Antenna 3	
		Max. Power Approved (dBm)	Max. EIRP Approved (dBm)	Max. Power Approved (dBm)	Max. EIRP Approved (dBm)	Max. Power Approved (dBm)	Max. EIRP Approved (dBm)
5660	20	25.2	36	22.2	36	18.2	36
5655	10	25.2	36	22.2	36	18.2	36
5665	10	25.2	36	22.2	36	18.2	36
5675	10	25.2	36	22.2	36	18.2	36
5680	20	25.2	36	22.2	36	18.2	36
5685	10	25.2	36	22.2	36	18.2	36
5695	10	25.2	36	22.2	36	18.2	36
5700	20	25.2	36	22.2	36	18.2	36
5705	10	25.2	36	22.2	36	18.2	36
5715	10	25.2	36	22.2	36	18.2	36
5720	20	25.2	36	22.2	36	18.2	36
5725	10	25.2	36	22.2	36	18.2	36
5740	10	25.2	36	22.2	36	18.2	36
5745	20	25.2	36	22.2	36	18.2	36
5750	10	25.2	36	22.2	36	18.2	36

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Radio P/N: RF-2150 Japan IC 209-J00337					
Country: Japan (Government)					
Mode of Operation: MIMO 2x2					
Antenna Types and Gain (dBi)					
Antenna 1:	Omnidirectional / 3 dBi Total EIRP = 13 dBm/MHz	**Antenna 2:**	Omnidirectional / 2.15 dBi Total EIRP = 12.15 dBm/MHz	**Antenna 3:**	Omnidirectional / 0 dBi Total EIRP = 10 dBm/MHz

Japan Power Limits (same for all antenna types)

Channel (MHz)	Channel Width (MHz)	Amplitude Measured (dBm/MHz)	Max. Output Power Level Per Chain (dBm)
2407	5	7	13.4
2407	10	7	16.4
2412	5	7	13.4
2412	10	7	16.4
2412	20	7	19.7
2417	5	7	13.4
2417	10	7	16.4
2417	20	7	19.7
2422	5	7	13.4
2422	10	7	16.4
2422	20	7	19.7
2427	5	7	13.4
2427	10	7	16.4
2427	20	7	19.7
2432	5	7	13.4
2432	10	7	16.4

Japan Power Limits (same for all antenna types) [continued]

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Channel (MHz)	Channel Width (MHz)	Amplitude Measured (dBm/MHz)	Max. Output Power Level Per Chain (dBm)
2432	20	7	19.7
2437	5	7	13.4
2437	10	7	16.4
2437	20	7	19.7
2442	5	7	13.4
2442	10	7	16.4
2442	20	7	19.7
2447	5	7	13.4
2447	10	7	16.4
2447	20	7	19.7
2452	5	7	13.4
2452	10	7	16.4
2452	20	7	19.7
2457	5	7	13.4
2457	10	7	16.4
2457	20	7	19.7
2462	5	7	13.4
2462	10	7	16.4
2462	20	7	19.7
2467	5	7	13.4
2467	10	7	16.4
2472	5	7	13.4

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BAT-06 Technical Datasheet

Rechargeable, Lithium-Ion Battery

Features

- Communicates using a Single Wire DQ interface.
- UN/DOT 38.3 Rating: 73Wh
- Comparable to: BT-70716BE

Typical Applications

- Wave Relay System
- AN/PRC-148
- TRC-9110

Recommended Charging Platforms

Charger Part Number	Required Adapter Part Number
BTC-70801	BTA-70810
BTC-70844	BTA-70810
BTC-70819, -1, -3	BTA-70810
BTC-70836	BTA-70830, BTA-70830-1
BTC-70870, -1, -3	BTA-70830, BTA-70830-2
BTC-70824-1	BTA-70810S
BTC-70663	BTA-70810S
BTC-70716-1	Not Required

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Technical Specifications

National Stock Number	Pending
BT Part Number	BT-70716BG
Dimensions	Length: 2.8 in. (71 mm) Width: 1.6 in. (41 mm)
	Height: 3.4 in. (86 mm)
Weight	0.75 lbs (0.34 kg)
Nominal Voltage	10.8V
Maximum Voltage	12.6V
Capacity	6.4Ah
Discharge	6A Max Continuous
Pulse Discharge	40A ≤ 1 ms
Operating Temperature	-30°C to +60°C (-22°F to +140°F)
Recommended Storage Temperature	-40°C to +40°C (-40°F to +104°F)
Connector	Flat Contacts (bottom), Fly Wheel Connection (top)
State of Charge Indicator	Not Applicable
Disposal	Check local regulations (Contains 0% Mercury or Cadmium)

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Bren-Tronics, Inc.
"Intelligent Military Batteries & Charging Systems"™
10 Brayton Court, Commack, NY 11725-3197

MATERIAL SAFETY DATA SHEET

From: Bren-Tronics Inc.
10 Brayton Court
Commack, N.Y. 11725

Telephone: 631-499-5155
Fax: 631-499-5504
www.bren-tronics.com

Emergency Telephone: If no answer above, contact Chem-Tel Corporation at 1-800-255-3924 or 1-813-248-0585

Effective Date: 01 Jan 2013

BT-70716BE **(BT-70716BE-PS, BT-70716BE-TB, BT70716BE-TG, BT-70716BE-TT, BT-70716BG)**

1. Product Identification

Product Name: Lithium-Ion Battery
Chemical System: Lithium-Ion (Carbon/Lithiated Metal Oxide)
NSN: n/a
Nominal Weight: 0.380kg (0.84 lbs)
Nominal Voltage: 10.8V

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2. Composition/Information on Ingredients

Although the chemical composition of the various cell manufacturers is proprietary, the following is typical of the chemistry.

Hazardous Components (Specific Chemical Identity, Common Name(s))	%	CAS Number	LD_{50} (mg/kg) (oral-rat)	LC (mg/L)
Aluminum foil	0.1-1 w/w	7429-90-5	N/AV	A/AV
Biphenyl (BP)	0 -0.3 w/w	92-52-4	2400	N/AV
Copper foil	0.1 -0.3 w/w	7440-50-8	3.5(ipr-mouse)	N/AV
Dioxathiolane 2,2-Dioxide (DTD)	0 -3 w/w	1072-53-3	1600	N/AV
Linear and Cyclic Carbonic Solvents (See other information)	5 -17 w/w	N/APP	≈11000 (weighted avg)	N/AV
Graphite Powder	10-30 w/w	7440-44-0	440 (ivn-mouse)	N/AV
Lithium Carbonate	0 -0.3 w/w	554-13-2	525	N/APP
Lithium cobaltite ($LiCoO_2$)	01-3- w/w	12190-79-3	N/AV	N/AV
Lithium hexaflurorphosphate ($LiPF_6$)	1-5 w/w	21324-40-3	1702	Rat: >20
Poly (vinylidene fluoride) (PVDF)	0.1 -1 w/w	24937-79-9	N/AV	N/AV
Propane Sultone (PS)	0-3 w/w	1120-71-4	100	N/AV
Steel, nickel and inert polymer	Balance	N/APP	N/APP	N/APP

These chemicals and metals are contained in a sealed can.

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3. Hazards Identification

Routes of Entry:

Inhalation? Not anticipated. Respiratory (and eye) irritation may occur if fumes are released due to heat or an abundance of leaking batteries.

Skin? Yes

Ingestion? Yes

Potential Health Effects:

These chemicals are contained in a sealed can. Risk of exposure occurs only if the battery is mechanically or electrically abused. The most likely risk is acute exposure when a cell vents. Propylene Carbonate is mildly irritating upon eye and skin contact. Contact of electrolyte and extruded lithium with skin and eyes should be avoided. Inhalation or ingestion of lithium trifluoromethane sulfonate may be harmful.

Signs/Symptoms of Exposure:

Skin and eye irritation may occur following exposure to a leaking battery.

Medical Conditions Generally Aggravated by Exposure:

An acute exposure will not generally aggravate any medical condition.

4. First Aid Measures

Emergency & First Aid Procedures:

If battery is leaking and material contacts eyes, flush with copious amounts of clear, tepid water for thirty (30) minutes, exposed skin for at least fifteen (15) minutes. Contact Physician at once. Leaking contents may be irritating to respiratory passages. Remove to fresh air. Contact physician if irritation persists. If ingested, rinse mouth and surrounding area with clear, tepid water for at least fifteen (15) minutes. Consult physician immediately for treatment and to rule out involvement of the esophagus and other tissues.

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5. Fire Fighting Measures

Extinguishing Media:
Water spray, Carbon Dioxide, dry chemical powder or appropriate foam. Use agent appropriate for surrounding materials
Special Fire Fighting Procedures:
In burning, wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Unusual Fire and Explosion Hazards:
Organic components will burn if cell incinerated. Combustion of cell contents will cause evolution of extremely corrosive Hydrogen Fluoride gas.

6. Accidental Release Measures

Ventilation:
None under normal use conditions.
Protective Gloves:
None under normal use conditions. Use butyl gloves when handling leaking batteries.
Eye Protection:
None under normal use conditions. Wear safety glasses when handling leaking batteries.

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7. Handling and Storage

Precautions to be Taken in Handling and Storage:

For best service life: store batteries in a cool (below 70° F, 21°C) dry area that is subject to little temperature changes; do not place near heating equipment, nor exposed to direct sunlight for long periods. Elevated temperatures can result in reduced battery service life.

Other Precautions:

Do not diseassemble battery or battery pack. Do not puncture, crush or dispose of in fire.

8. Exposure Controls/Personal Protection

Steps to be Taken in Case Material is Released or Spilled:

Notify safety personnel of large spills. Evacuate the area and allow vapors to dissipate. Increase ventilation. Avoid eye or skin contact. **DO NOT** inhale vapors. Clean up personnel should wear appropriate protective gear. Remove spilled liquid with absorbent and contain for disposal.

Transport containers outdoors. Hold burned cells and fire cleanup solids for disposal as potential hazardous waste. Unburned cells are not hazardous waste. A fire with over 100 kg of burned cells will likely require reporting to environmental offices. Always consult and obey all international, federal and local environmental laws.

9. Physical and Chemical Properties

Appearance:

Rectangular box shape

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10. Stability and Reactivity

Stability:
Stable
Conditions to Avoid:
Do not heat, crush, disassemble, short-circuit or recharge.
Hazardous Decomposition or By-products:
Thermal degradation may produce hazardous fumes of manganese and lithium; hydrofluoric acid; oxides of carbon and sulfur and other toxic by-products.
Hazardous Polymerization:
Will not occur.
Incompatible Materials:
Contents incompatible with strong oxidizing agents.

11. Toxicological Information

Carcinogenicity:	NTP?	IARC Monograph?	OSHA Regulated?
	No	No	No

12. Ecological Information

N/A

13. Disposal Considerations

- Batteries must be completely discharged prior to disposal and/or the terminals must be taped or capped to prevent short circuit.
- Disposal of large quantities of batteries containing lithium cells may be subject to Federal, State or local regulations.

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14. Transportation Information: This lithium-ion battery is regulated as a Class 9 Misc hazardous material (dangerous goods). The UN number for the US is UN 3090; International is UN 3480. Equivalent Lithium Content, (ELC), per battery is 6.12g max. The Watt-hour rating is 73 Wh max. The battery and component cells conform to the requirements of Section 38.3 of the UN Manual of Tests and Criteria, (T1-T8 tests). The battery must be packaged and shipped according to the following regulations starting on January 1, 2013):

Domestic Transportation within the U.S. - All Modes: See 49 CFR Section 173.185; Special Provision 188:
Battery is "excepted" from Class 9 Hazardous Materials Regulations because it contains less than 8g ELC.
Battery must be packaged in a manner TO PREVENT SHORT CIRCUITS and in a strong outer package.
For quantities of 13 or more in one package, 1) mark "LITHIUM-ION BATTERIES INSIDE" on the package and that special procedures should be followed if package is damaged; (or IATA label shown below); 2) Accompany with a document indicating same information; 3) Package must be capable of being dropped 1.2 meters in any orientation without damage to cells or batteries contained in the package, without shifting of the contents that would allow short circuiting, and without release of package contents; 4) The maximum gross weight of the package may not exceed 30 kg (66lbs). *Note: these requirements will reflect Int'l regs below later in 2013. However, some U.S. carriers may require compliance now.*

International Transportation – All Modes: IMDG Code, ADR, ICAO Technical Instructions, IATA Dangerous Goods Regulations:

IMDG Code and ADR, Special Provision 188: Battery is "excepted" from Class 9 Dangerous Goods Regulations because it has a rating of less than 100 Wh. Battery must be packaged in a manner TO PREVENT SHORT CIRCUITS. Battery must be packed in inner packagings that completely enclose the battery, then placed in a strong outer package capable of withstanding a 1.2m drop test in any orientation without damage to the batteries, shifting of contents to allow battery to battery contact or release of contents. Package must carry label similar to the IATA lithium battery handling label shown below. Package must be accompanied with a document such as an air waybill with an indication that: the package contains lithium-ion batteries, must be handled with care, that a flammability hazard exists if the package is damaged, special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary, and a telephone number for additional information. Package may not exceed 30 kg (66 lbs) gross weight.

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IATA Dangerous Goods Regulations / ICAO Technical Instructions: Packing Instruction 965, Section II.
No more than 2 batteries per package. Packaging and documentation requirements are same as shown above for IMDG and ADR. IATA and ICAO specifically require lithium ion battery handling label shown below. No package weight limit.

IATA Dangerous Goods Regulations / ICAO Technical Instructions: Packing Instruction 965, Section IB.
More than 2 batteries per package. Packaging and documentation requirements are same as shown above for IMDG Code and ADR *and* package must carry Class 9 label and lithium battery handling label shown below. In addition, shipment must be offered to airline as fully-regulated Class 9 dangerous goods, accompanied with shipper's declaration for dangerous goods (or alternative document with similar entries) and employees must have dangerous goods training. Package may not exceed 10 kg (22 lbs) gross weight.

- Label dimensions: 120 x 110 mm (4.75" x 4.35") or 74 X 105 mm (2.9" x 4.13") if package cannot accommodate larger label
- Border color: Red on a contrasting background
- Pictogram colors: Glass, batteries, and flame can be black
- Label also can be used to comply with 49 CFR and IMDG Code

15. Regulatory Information

Batteries are considered to be "articles" and thus are exempt from TSCA regulation.

16. Other Information

Avoid mechanical or electrical abuse. **DO NOT** short circuit or install incorrectly. Batteries may explode, pyrolize or vent if disassembled, crushed, recharged incorrectly or exposed to high temperatures. Install batteries in accordance with equipment instructions.

This information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. Bren-Tronics Inc. makes no warranty, expressed or implied, regarding the accuracy of the data or the results to be obtained from the use thereof.

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MPU5
BASIC OPERATOR MANUAL
VERSION 2.11

PERSISTENT SYSTEMS

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