PHANTOM II™
BASE STATION

CalAmp®

USER MANUAL
PN 001-5199-200 REV 2
RELEASED AUGUST 2011

REVISION HISTORY

REV	DATE	REVISION DETAILS
0	January 7, 2011	Initial Release.
1	March 7, 2011	Updated most web page screen shots. Added information about SNMP : Section 6.8 Correct Part Numbers in Section 1.1.1 and 1.1.2 Removed Multispeed section.
2	August 29, 1011	QoS sections added, 6.9 and 6.10.

ABOUT CALAMP

CalAmp is a leading provider of wireless communications products that enable anytime/anywhere access to critical information, data and entertainment content. With comprehensive capabilities ranging from product design and development through volume production, CalAmp delivers cost-effective high quality solutions to a broad array of customers and end markets. CalAmp is the leading supplier of Direct Broadcast Satellite (DBS) outdoor customer premise equipment to the U.S. satellite television market. The Company also provides wireless data communication solutions for the telemetry and asset tracking markets, private wireless networks, public safety communications and critical infrastructure and process control applications. For additional information, please visit the Company's website at www.calamp.com.

IMPORTANT NOTICE

Because of the nature of wireless communication, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors), or be totally lost. Significant delays or losses of data are rare when wireless devices such as the Phantom II Base Station are used in a normal manner with a well-constructed network. The Phantom II Base Station should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. CalAmp accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Base Station, or for the failure of the Phantom II Base Station to transmit or receive such data.

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RF EXPOSURE COMPLIANCE REQUIREMENTS

The Phantom II Base Station is intended for use in the Industrial Monitoring and Control and SCADA markets. The Phantom II Base Station unit must be professionally installed and must ensure a minimum separation distance between the radiating structure and any person. See the individual radio user manuals for a listing of the minimum safety distance.

Radio	User Manual Part Number
Phantom II	001-5199-200

The Phantom II Base Station uses a low power radio frequency transmitter. The concentrated energy from an antenna may pose a health hazard. People should not be in front of the antenna when the transmitter is operating.

The installer of this equipment must ensure the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population. Recommended safety guidelines for the human exposure to radio frequency electromagnetic energy are contained in the Canadian Safety Code 6 (available from Health Canada) and the Federal Communications Commission (FCC) Bulletin 65.

Any changes or modifications not expressly approved by the party responsible for compliance (in the country where used) could void the user's authority to operate the equipment.

MAXIMUM EIRP

FCC Regulations allow up to 36dBm Effective Isotropic Radiated Power (EIRP). Therefore, the sum of the transmitted power (in dBm), the cabling loss and the antenna gain cannot exceed 36dBm.

TABLE OF CONTENTS

1.0 BASE STATION OVERVIEW

This document provides information required for the operation of the Phantom II Base Station. The information in this manual makes the assumption the user's PC has an NIC (Network Interface Card) with TCP/IP implemented. Setup requires the knowledge and authorization to modify the TCP/IP settings for the NIC.

Changing or installing new IP addresses in a network can cause serious network problems. If you have any questions or concerns, contact the Network Administrator for your system.

1.1 GENERAL DESCRIPTION

The Phantom II Base Station is available in three options: standard, repeater, and redundant. The Standard Base Station uses a single radio to transmit and receive data from remote radios. The Repeater Base Station uses two radios connected back to back to extend the range of a signal. The Redundant Base Station uses two radios, activating only one at a time, in order to provide a fail-safe in the event of a radio failure. The Phantom II Base Station has a main controller PC board which is accessible via HTML web pages. Access the Controller's web pages to configure the user programmable settings and to view the status of the Base Station.

Rugged Packaging. The Phantom II Base Station is housed in a rugged, 19" rack mountable, aluminum case. Built for industrial applications in a variety of environments, the Phantom II Base Station operates over an extended temperature range and provides worry-free operation in the roughest environments.

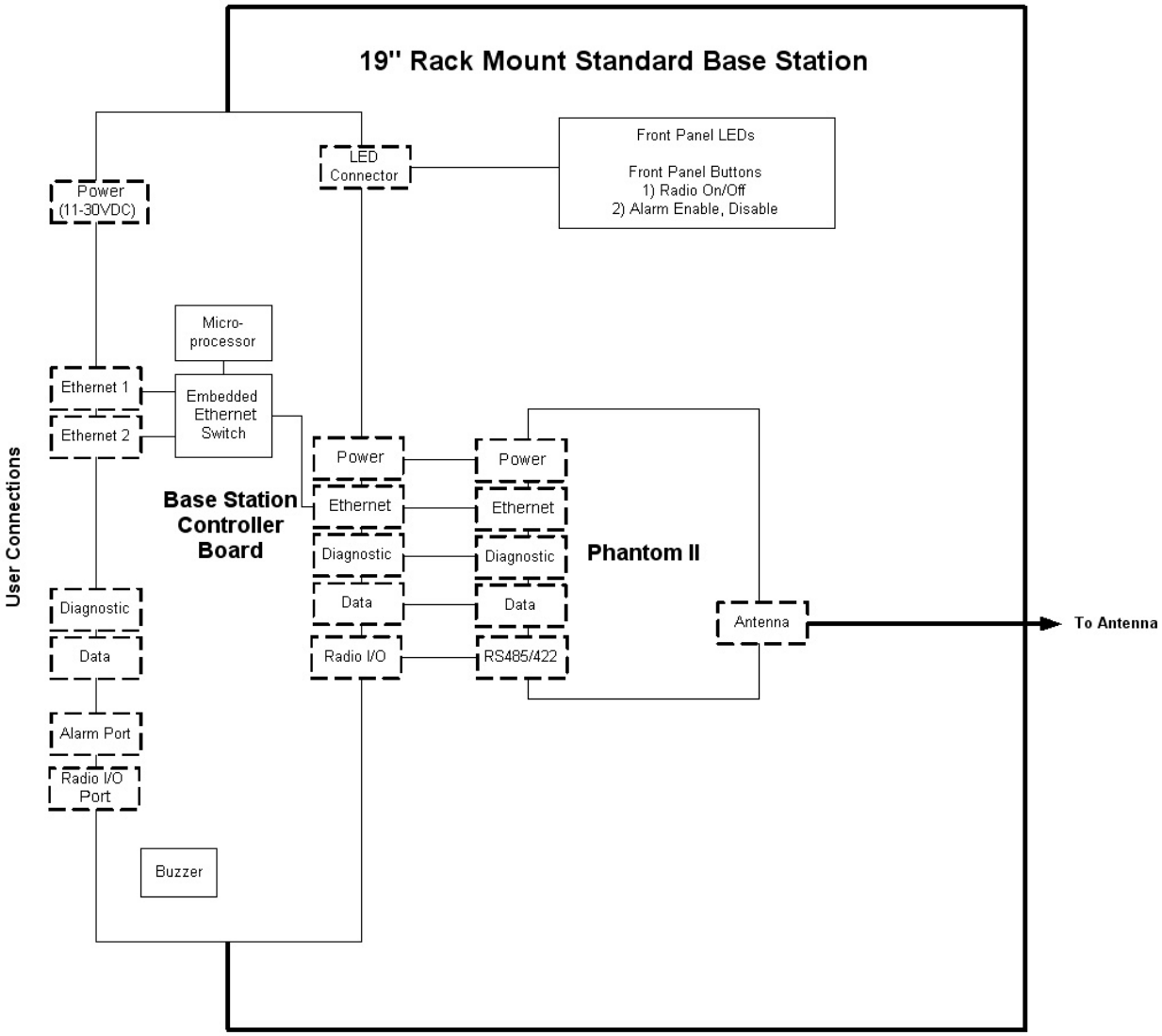
Simple Installation. Basic installation typically utilizes an omni-directional antenna at the Phantom II Base Station or Relay Point and a directional antenna at each remote site that is not a Relay Point. See Section 2 for information on Site and Antenna Selection. For basic service, just hook up an antenna, connect your Ethernet LAN to the Base Station's LAN port, apply primary power, and check and set operating parameters.

Flexible Management. Configuration, commissioning, maintenance and troubleshooting can be done locally or remotely. All operating parameters can be set via a web browser.

1.1.1 PHANTOM II STANDARD BASE STATION BLOCK DIAGRAM 242-5199-200

The figure below shows a simplified block diagram of a Phantom II Standard Base Station. The Phantom II Standard Base Station consists of a Base Station Controller board and one Phantom II contained in a 3U 19” rack mountable chassis.

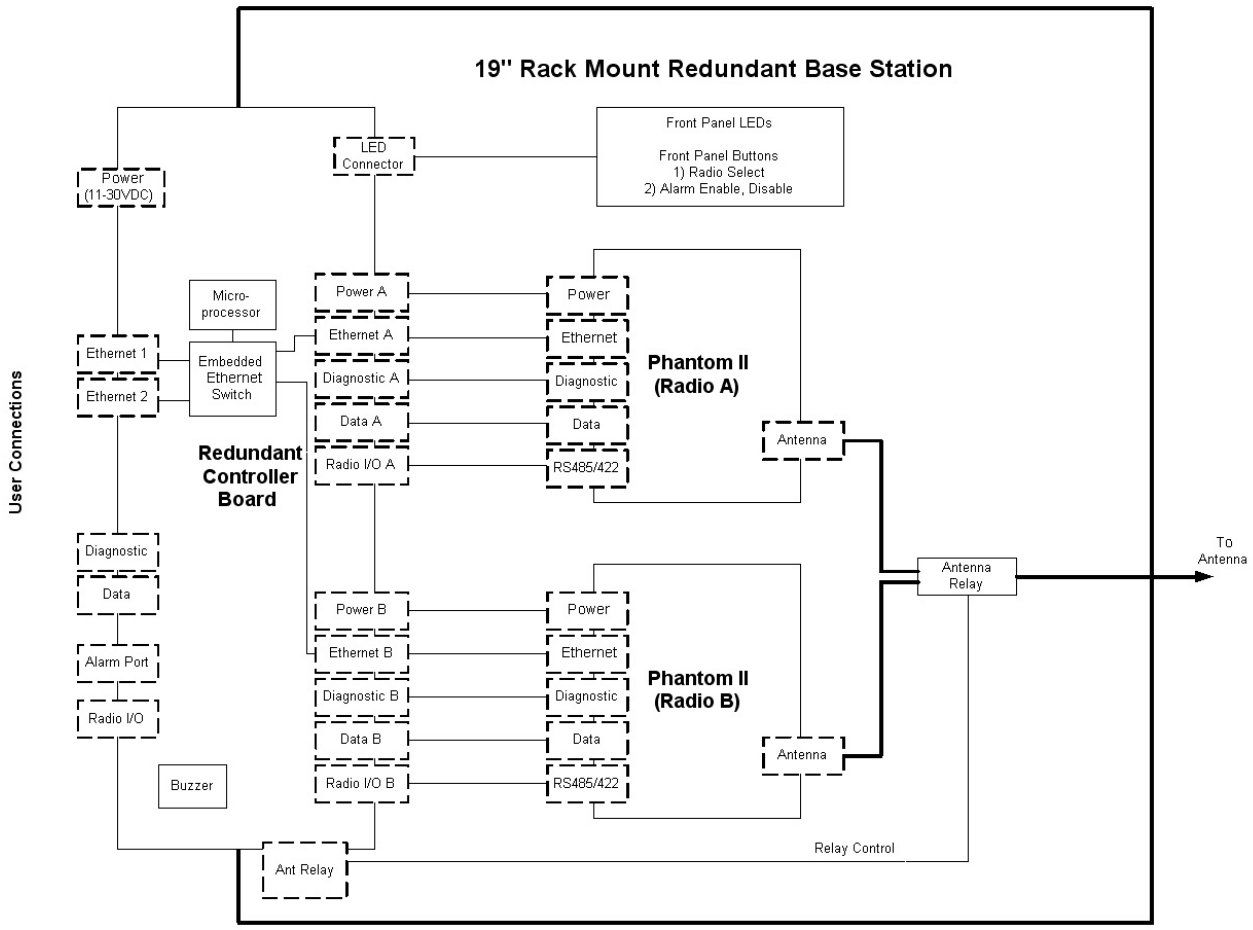
Figure 1 - Phantom II Standard Base Station Block Diagram



1.1.2 PHANTOM II REDUNDANT BASE STATION BLOCK DIAGRAM 242-5399-200

The figure below shows a simplified block diagram of a Redundant Base Station. The Phantom II Redundant Base Station consists of a Base Station Controller board, two Phantom IIs, and an antenna relay all contained in a 3U 19" rack mountable chassis. Only one Phantom II operates at a time. When an error is detected with the primary radio the Base Station Controller will automatically switch to the backup radio.

Figure 2 - Phantom II Redundant Base Station Block Diagram



1.2 PHYSICAL DESCRIPTION

The Phantom II Base Station consists of a Controller board, an LED display board, two fans and shelving to house various radios. The unit is not hermetically sealed and should be mounted in a suitable enclosure when dust, moisture, and/or a corrosive atmosphere are anticipated.

The Base Station is designed for easy installation and configuration. It features two external buttons. However, all operating parameters may be set by connecting to the Base Station via Ethernet and using a web browser.

1.2.1 LED PANEL

Figure 3 - Standard Base Station LED Panel

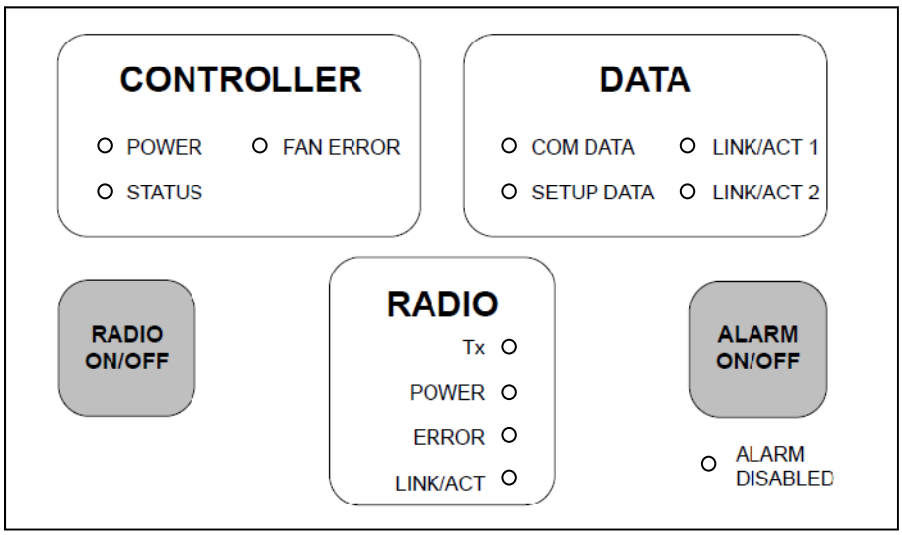
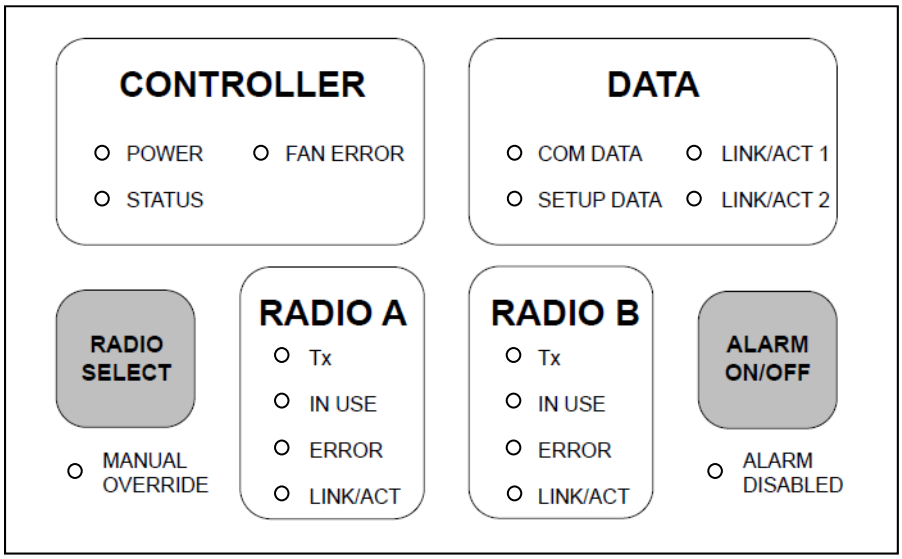


Figure 4 - Redundant Base Station LED Panel



As shown in Figure 3, the front panel of a Standard Base Station has the following buttons:

- Radio On/Off
- Alarm On/Off

As shown in Figure 4, the front panels of a Redundant Base Station have the following buttons:

- Radio Select
- Alarm On/Off

The LED panel has up to seventeen Tri-Color LEDs. The functionality of each LED is described in Section 5.2.

1.2.2 ETHERNET LAN PORTS

The Phantom II Base Station has two external Ethernet LAN Ports. The two external Ethernet Ports are connected to each other and to the radios inside the Base Station with an embedded Ethernet Switch.

The Ethernet LAN ports consist of an RJ-45 receptacle with a 10/100 BaseT Ethernet connection and Auto-MDIX feature. Table 1 shows pin-out descriptions for the RJ-45 port.

Table 1 - Pin-out for IEEE-802.3 RJ-45 Receptacle Contacts

Contact	10/100 Base-T Signal
1	TXP(1)
2	TXN(1)
3	RXP(1)
4	SPARE
5	SPARE
6	RXN(1)
7	SPARE
8	SPARE
SHELL	Shield
(1) The name shows the default function. Given the Auto-MDIX capability of the Ethernet transceiver, TX and RX function could be swapped.	

1.2.3 DIAGNOSTIC AND DATA PORTS

The Diagnostic and Data serial connections are RS-232 compliant. Serial port considerations:

- Base Station Diagnostic and Data ports are Data Communication Equipment (DCE) devices
- In general, equipment connected to the Base Station's Diagnostic/Data serial port is Data Terminal Equipment (DTE) and a straight-through cable is recommended.

Note: If a DCE device is connected to the Base Station's Diagnostic/Data port, a null modem cable/adapter is required.

In a Standard Base Station with one radio, the external serial ports are always connected to the Diagnostic and Data ports of the radio inside the Base Station.

In a two radio Redundant Base Station, the two serial ports are connected to whichever radio is currently in use. When the active radio changes, an internal multiplexer will switch both serial port connections to the second radio.

The pin outs for the serial connections can be found in the radio's user manual.

1.2.4 ALARM PORT

The Alarm Port is an 8 pin header that has two relays and a general purpose input/output pin. In the Redundant Base Station, one relay can be configured to indicate if an error has been detected with either radio and the other relay can be configured to indicate which radio is currently being used. For a full description of this port see Section 6.8 in this user manual.

1.2.5 RADIO I/O PORT

The Radio I/O port is an 8 pin header that provides access to the Base Station's radio's digital or analog I/O lines. These 8 lines are routed to whichever radio is currently in use (Radio A or Radio B). In the Phantom II Base Station, 4 of the 8 lines connected to the Phantom II's RS485/422 communication lines. The pin out is shown in the table below:

Table 2 - Pin-out for Radio I/O Port (RS485/RS422)

Contact	RS485/422 Signal	Input or Output
1	RxA (R-)	I
2	TxA (D-)	O
3	RxB (R+)	I
4	TxB (D+)	O
5	Unused (NC)	
6	Unused (NC)	
7	Unused (NC)	
8	Unused (NC)	

Figure 5 - Radio I/O Port pin out

1.2.6 POWER CONNECTOR

The Phantom II Base Station is supplied with a right-angle power connector (11-30 VDC) and 60" of cable. When installing the power cable, trim the cable as short as possible to reduce the voltage drop through the wire.

The power connector has four pins. Only pins 2 and 3 need to be connected for normal operation (Main Power and Ground). Pins 1 and 4 are auxiliary power connections and do not normally need to be connected. These pins are wired directly to an internal power connector and provide an easy way to power a user's custom PC board, RTU, or other equipment that may be mounted inside the Base Station.

Figure 6 - Power Connector

Table 3 - Pin-out of the power connector

Contact # (Left to Right)	Color	Description
4	Not Connected	Auxiliary Power A
3	Black	Ground
2	Red	Positive (11-30) VDC
1	Not Connected	Auxiliary Power B

1.2.7 ANTENNA CONNECTOR

The Standard and Redundant Base Stations have a single 50-ohm N female antenna connector. This connection functions for both transmit and receive. In the Redundant Base Station, an internal RF relay will automatically switch the antenna connection to whichever radio is currently in use.

To reduce potential interference, the antenna type and its gain should be chosen to ensure the effective isotropic radiated power (EIRP) is not more than required for successful communication.

1.2.8 RESET BUTTON

Directly above the Base Station's power connector is a small hole that allows access to the reset button. Place a paper clip or other narrow object into the hole to press and hold the reset button for five seconds. After 5 seconds, a short chirp will be heard and the settings of the Base Station will be set back to the factory defaults. After the settings are reset, the Base Station will automatically reboot.

Note: This operation will set the IP address of the Phantom II Base Station back to its default value of 192.168.1.1.

1.2.9 CHASSIS DIMENSIONS

Figure 7 shows the physical dimensions of the Base Station.

Figure 7 - Base Station Dimensions (units are in inches)

1.3 PART NUMBERS AND AVAILABILITY

1.3.1 BASE STATION

Table 4 lists the orderable part numbers and frequency ranges of the Phantom II Base Station. The radios that are installed inside the 19" Rack Mount Chassis are included with the Phantom II Base Station and do not need to be ordered separately.

Table 4 - Orderable Part Number Breakdown

DESCRIPTION	BASE STATION PART NUMBER	FREQUENCY	RADIO PART NUMBER
Standard Base Station	242-5199-200	902 – 928 MHz	Phantom II 260-5099-200
Redundant Base Station	242-5399-200	902 – 928 MHz	Two Phantom II 260-5099-200

1.3.2 ACCESSORIES AND OPTIONS

Table 5 and Table 6 list standard accessories (including antenna, feedline, and connectors) that have been tested and approved for use with the Base Station.

Table 5 - Antenna Kits

ITEM	PART NUMBER
890-960 MHz, 6.4 dBd Antenna Kit	250-5099-011
890-960 MHz, 10 dBd Antenna Kit	250-5099-021

Antenna kits include a premium antenna, antenna mounting bracket, surge protector, grounding kit, cable ties, and weather kit. UHF/900 kits include 25 feet of LMR400 antenna feedline. Feedline is available for VHF kits in 25 or 50 feet lengths (see below).

Table 6 - Feedline and Connectors

ITEM	PART NUMBER
25 feet antenna feedline (LMR400), N-Male	250-0200-025
50 feet antenna feedline (LMR400), N-Male	250-0200-055
Barrel Connector, RF1 N type, Female	250-0200-100

1.4 PRODUCT WARRANTY

It is our guarantee that every Phantom II Base Station will be free from physical defects in material and workmanship for one year from the date of purchase when used within the limits set forth in Appendix A: Specifications.

The manufacturer's warranty statement is available in Appendix B. If the product proves defective during the warranty period, contact our Customer Service Department to obtain a Return Material Authorization (RMA). BE SURE TO HAVE THE EQUIPMENT MODEL, SERIAL NUMBER, AND BILLING & SHIPPING ADDRESSES AVAILABLE WHEN CALLING. You may also request an RMA online at www.calamp.com.

FACTORY AND TECHNICAL SUPPORT

M-F 7:30-4:30 CST

CalAmp
299 Johnson Ave., Ste 110, Waseca, MN 56093
Tel 507.833.8819; Fax 507.833.6758
Email imcsupport@calamp.com

1.5 RMA REQUEST

When returning a product, mark the RMA number clearly on the outside of the package. Include a complete description of the problem and the name and telephone number of a contact person. RETURN REQUESTS WILL NOT BE PROCESSED WITHOUT THIS INFORMATION.

Contact Customer Service:

CalAmp
299 Johnson Ave., Ste 110
Waseca, MN 56093
Tel 1.507.833.8819

BE SURE TO HAVE THE EQUIPMENT MODEL AND SERIAL NUMBER, AND BILLING AND SHIPPING ADDRESSES ON HAND WHEN CALLING.

For units in warranty, customers are responsible for shipping charges to CalAmp. For units returned out of warranty, customers are responsible for all shipping charges. Return shipping instructions are the responsibility of the customer.

1.6 DOCUMENTATION AND DOWNLOADS

CalAmp reserves the right to update its products, software, or documentation without obligation to notify any individual or entity. Product updates may result in differences between the information provided in this manual and the product shipped. For access to the most current product documentation and application notes, visit www.calamp.com.

2.0 SYSTEM ARCHITECTURE AND PLANNING

2.1 SELECTING ANTENNA AND FEEDLINE

The Phantom II Base Station can be used with a variety of antenna types. The exact style used depends on the physical size and layout of a system.

2.1.1 ANTENNA GAIN

Antenna gain is usually measured in comparison to a dipole. A dipole acts much like the filament of a flashlight bulb: it radiates energy in almost all directions. One bulb like this would provide very dim room lighting. Add a reflector capable of concentrating all the energy into a narrow angle of radiation and you have a flashlight. Within that bright spot on the wall, the light might be a thousand times greater than it would be without the reflector. The resulting bulb-reflector combination has a gain of 1000, or 30 dB, compared to the bulb alone. Gain can be achieved by concentrating the energy both vertically and horizontally, as in the case of the flashlight and Yagi antenna. Gain can be also be achieved by reducing the vertical angle of radiation, leaving the horizontal alone. In this case, the antenna will radiate equally in all horizontal directions, but will take energy that otherwise would have gone skywards and use it to increase the horizontal radiation.

The required antenna impedance is 50 ohms. To reduce potential radio interference, the antenna type and its gain should be chosen to ensure the effective isotropic radiated power (EIRP) is not more than required for successful communication.

See Table 5 for a list of tested antenna recommendations. Similar antenna types from other manufacturers are equally acceptable. It is important to follow the manufacturer's recommended installation procedures and instructions when mounting any antenna.

2.1.2 OMNI DIRECTIONAL ANTENNA

In general, an omni directional antenna should be used at a master station and at relay points. This allows equal coverage to all of the remote locations. Omni directional antennas are designed to radiate the RF signal in a 360-degree pattern around the antenna. Short range antennas such as folded dipoles and ground independent whips are used to radiate the signal in a ball shaped pattern while high gain omni antennas, such as a collinear antenna, compress the RF radiation sphere into the horizontal plane to provide a relatively flat disc shaped pattern that travels further because more of the energy is radiated in the horizontal plane.

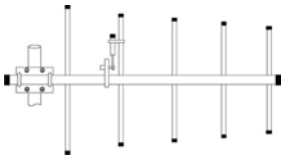
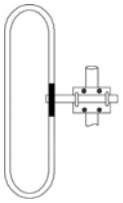
2.1.3 YAGI ANTENNA

At remote locations (not used as a relay point), a directional Yagi is generally recommended to minimize interference to and from other users.

2.1.4 VERTICAL DIPOLES

Vertical dipoles are very often mounted in pairs, or sometimes groups of 3 or 4, to achieve even coverage and to increase gain. The vertical collinear antenna usually consists of several elements stacked one above the other to achieve similar results.

Figure 8 - Antenna Types

Omni (Vertical Collinear)	Yagi	Vertical Dipole
		

2.1.5 RF EXPOSURE COMPLIANCE REQUIREMENTS

The Phantom II Base Station is intended for use in the Industrial Monitoring and Control and SCADA markets. The Phantom II Base Station must be professionally installed and must ensure a minimum separation distance between the radiating structure and any person. See the individual radio user manuals for a listing of the minimum safety distance.

Figure 9 - RF Exposure Compliance Minimum Safety Distances Reference

Radio	User Manual Part Number
Phantom II	001-5199-200

The Phantom II Base Station uses a low power radio frequency transmitter. The concentrated energy from an antenna may pose a health hazard. People should not be in front of the antenna when the transmitter is operating.

The installer of this equipment must ensure the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population. Recommended safety guidelines for the human exposure to radio frequency electromagnetic energy are contained in the Canadian Safety Code 6 (available from Health Canada) and the Federal Communications Commission (FCC) Bulletin 65.

Any changes or modifications not expressly approved by the party responsible for compliance (in the country where used) could void the user's authority to operate the equipment.

MAXIMUM EIRP

FCC Regulations allow up to 36dBm Effective Isotropic Radiated Power (EIRP). Therefore, the sum of the transmitted power (in dBm), the cabling loss and the antenna gain cannot exceed 36dBm.

3.0 BASE STATION QUICK START

3.1 CONNECTING TO THE PHANTOM II BASE STATION AND RADIOS

3.1.1 SETUP AND CONFIGURATION

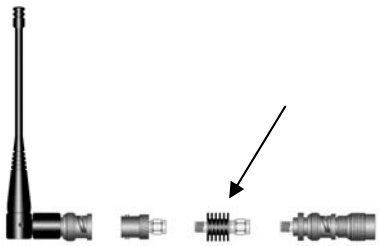
It is easy to set up a Base Station network to verify basic unit operation and experiment with network designs and configurations.

It is important to use a network IP address different from others currently in use in your test area. This will eliminate unnecessary disruption of traffic on the existing network while you become familiar with the Base Station.

3.1.2 INSTALL THE ANTENNA

An RX/TX antenna is required for basic operation. For demo units only, connect the antenna as shown in Figure 10 to provide stable radio communications between demo devices.

Figure 10 - Demo Antenna Assembly



Note: It is important to use attenuation between all demo units in the test network to reduce the amount of signal strength in the test environment.

3.1.3 CONNECT PRIMARY POWER

Primary power for the Phantom II Base Station must be within 11-30 VDC and be capable of providing a minimum of 30 watt supply for Tx @ 1W. A power connector with 60” of wire is provided with each unit. Observe proper polarity when connecting the cables to the power supply.

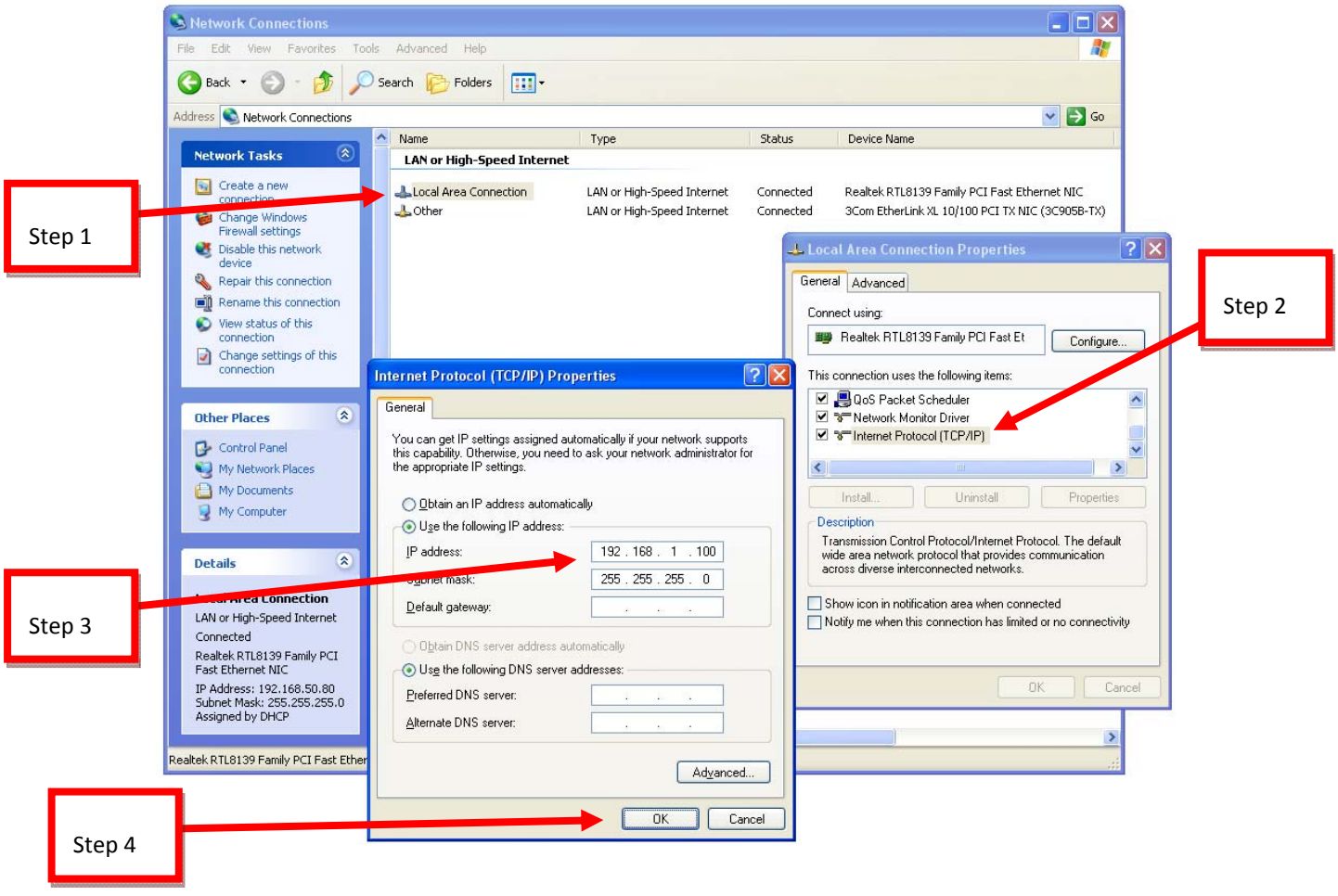
3.1.4 CONNECT BASE STATION TO PROGRAMMING PC

Connect a PC’s Ethernet port to the LAN port using a CAT 5 Ethernet cable. The LINK/ACT LED in the DATA box should light on the front panel of the Base Station.

3.1.5 LAN SETUP

STEP 1	From the Start menu on your PC, select Control Panel ⇨ Network Connections
STEP 2	Right click the Local Area Connection icon to open the Properties box. Scroll through the list and highlight Internet Protocol (TCP/IP). Click Properties to open the TCP/IP Properties box.
STEP 3	Enter the following values for USE THE FOLLOWING IP ADDRESS: IP Address: 192.168.1.100 Subnet Mask: 255.255.255.0 Default Gateway: (leave empty)
STEP 4	Click OK to apply your changes and complete the connection process.

Figure 11 - Computer IP Address Setup



3.1.6 NETWORK LOGIN

Base Station: On your Internet browser address line, type the Phantom II Base Station factory-default IP address: 192.168.1.1. Press Enter to open the Network Password screen.

Phantom II Radio: With a separate Internet browser window, type the Phantom II factory-default IP address: 192.168.1.254. Press Enter to open the Network Password screen.

3.1.7 INITIAL INSTALLATION LOGIN

Base Station: For an initial installation, enter a User Name "***admin***" and the default password "***admin***". Click OK. The web interface screen opens.

Phantom II Radio: For an initial installation, enter a User Name "***admin***" and the default password "***admin***". Click OK. The web interface screen opens.

3.2 CONFIGURE A PHANTOM II STANDARD BASE STATION

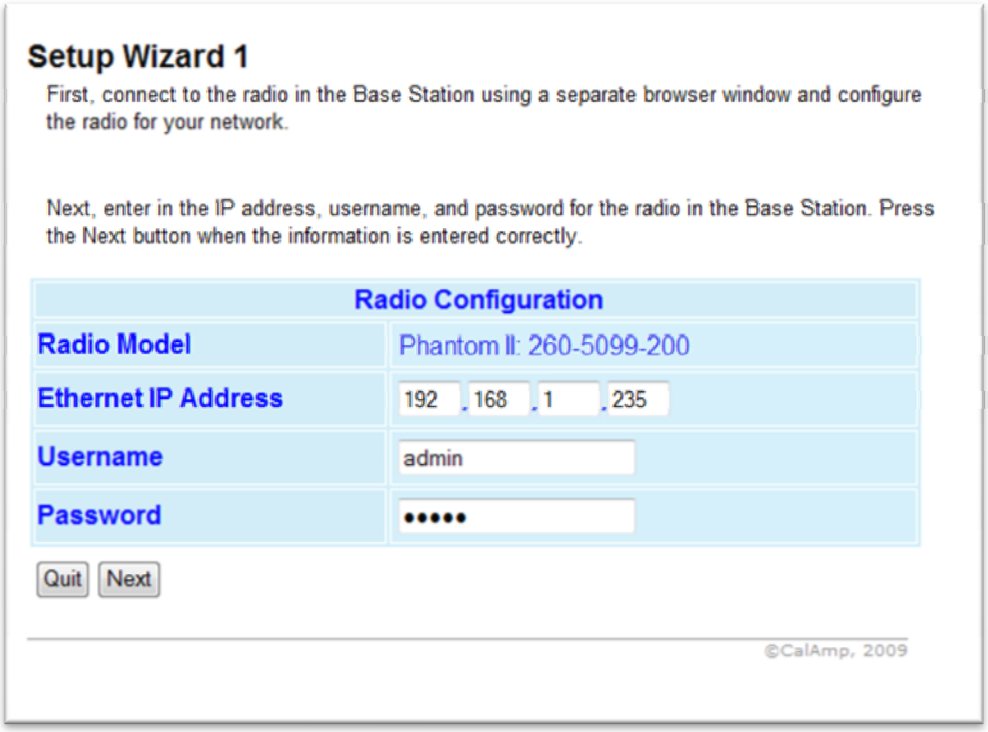
Base Station units must be programmed using the web interface. The following instructions describe how to configure the **Standard Base Station**.

Step 1: Program the Phantom II by logging into the Phantom II's web pages using the default IP address 192.168.1.254, username: "***admin***" password: "***admin***". Setup the Phantom II using the Phantom II's web pages. See the Phantom II user manual for additional information.

Step 2: Login to Phantom II Base Station Controller Board's web pages by logging into the default IP address 192.168.1.1, username: "***admin***" password: "***admin***".

Step 3: Select "Setup Wizard" from the menu on the left hand side of the web page. Enter the IP addresses, user names, and passwords of the Phantom II inside the Base Station. The Base Station Controller Board uses these settings to talk to the radio and receive diagnostic information. When the information is entered correctly click the "**Next**" button at the bottom of the web page.

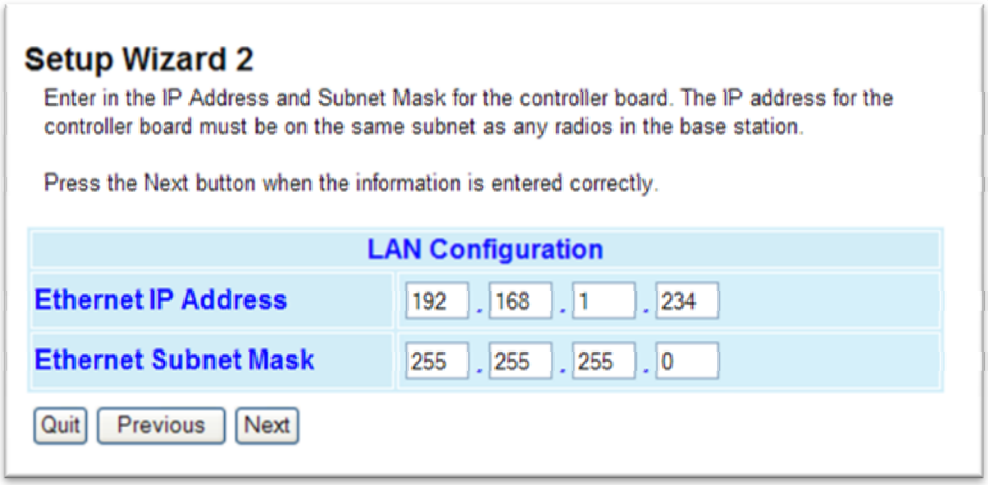
Figure 12 - Standard Base Station Setup Wizard 1



Step 4: If you do not want to change the IP address of the Base Station, click "**Next**" now. If desired, enter in a new IP address and subnet mask for the Base Station Controller. **The IP address of the Base Station Controller must be different than the Phantom II's IP address but must be on the same IP subnet as the radio inside the Base Station.**

When the IP address is entered correctly click the "**Next**" button at the bottom of the web page. The IP address of the Base Station Controller will update immediately. A new browser window will open taking you to the third setup wizard page. You will need to re-enter the login credentials.

Figure 13 - Standard Base Station Setup Wizard 2



Step 5: Setup is now complete, click "**Finish**".

Figure 14 - Standard Base Station Setup Wizard 3

3.3 CONFIGURE A PHANTOM II REDUNDANT BASE STATION

Base Station units must be programmed using the web interface. The following instructions described how to configure the **Redundant Base Station**.

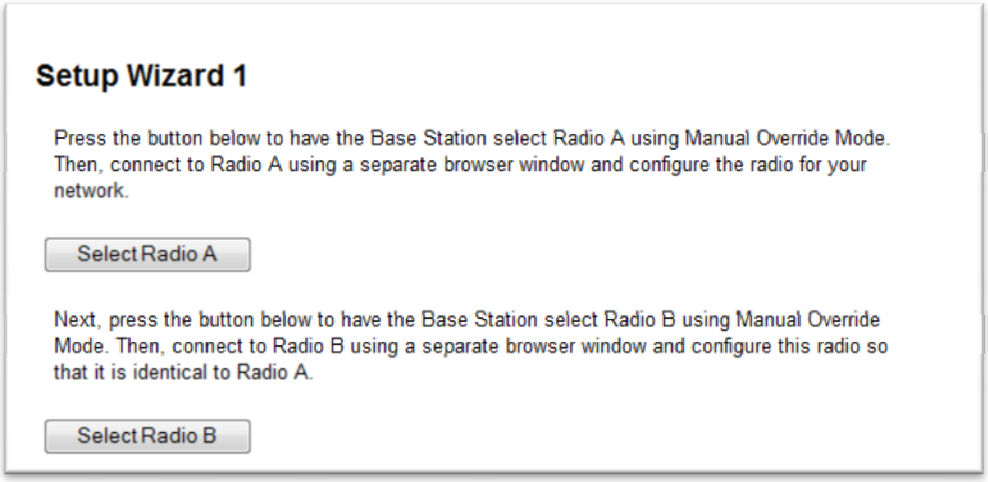
Step 1: Login to the Base Station Controller Board's web pages using the default IP address 192.168.1.1, username: "***admin***" password: "***admin***".

Step 2: Select "Setup Wizard" from the menu on the left hand side of the web page. Press the "Select Radio A" button. Program the first Phantom II by opening a new web browser window and logging into the Phantom II's web page using the default IP address 192.168.1.254, username: "***admin***" password: "***admin***". Setup the Phantom II using its web pages. See the Phantom II user manual for additional information.

When configuration is complete, press the "Select Radio B" button, on the Base Station Controller's web page, to configure the next radio. Program the second Phantom II by logging into its web pages using the default IP address 192.168.1.254, username: "***admin***" password: "***admin***". Program the second Phantom II radio identical to the first radio.

Important: The second Phantom II must be programmed with the same IP Address as the first Phantom II.

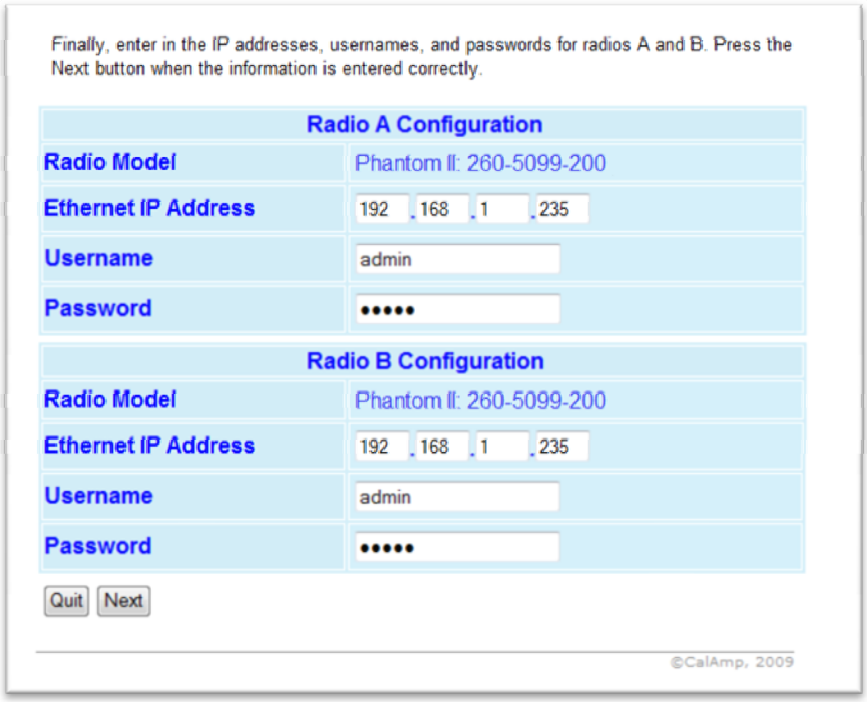
Figure 15 - Redundant Base Station Setup Wizard 1 Select Radios



Enter the IP addresses, user names, and passwords of the Phantom IIs inside the Base Station. The Base Station Controller Board uses these settings to talk to the radios and receive diagnostic information.

When the information is entered correctly click the "**Next**" button at the bottom of the web page.

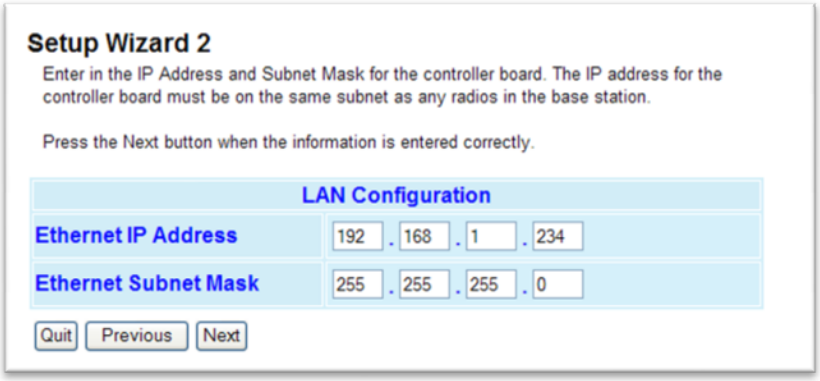
Figure 16 - Redundant Base Station Setup Wizard 1 Enter IP Addresses



Step 3: If you do not want to change the IP address of the Base Station, click "**Next**" now. If desired, enter in a new IP address and subnet mask for the Base Station Controller. **The IP address of the Base Station Controller must be different than the Phantom II's IP address but must be on the same IP subnet as the radios inside the Base Station.**

When the IP address is entered correctly click the "**Next**" button at the bottom of the web page. The IP address of the Base Station Controller will update immediately. A new browser window will open taking you to the third setup wizard page. You will need to re-enter the login credentials.

Figure 17 - Redundant Base Station Setup Wizard 2



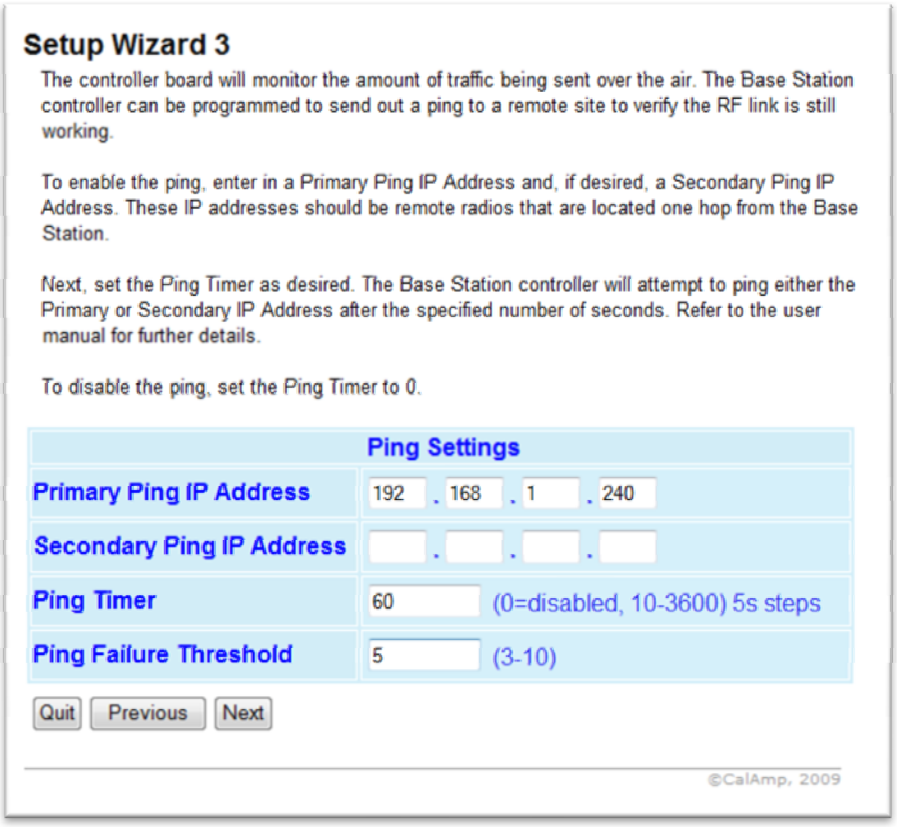
Step 4: The Controller Board can be programmed to periodically send out a ping to a remote site to verify the RF link is still working. To enable the ping utility, enter a Primary Ping IP Address and, if desired, a Secondary Ping IP Address. These IP addresses should be remote radios that are located one hop from the Base Station.

Next, set the Ping Timer as desired. When the Ping Timer expires the Base Station Controller will attempt to ping either the Primary or Secondary IP Address. If the ping is unsuccessful, the base station will switch to the back-up radio.

To disable the ping, set the Ping Timer to 0.

When satisfied with the changes, click "**Next**".

Figure 18 - Redundant Base Station Setup Wizard 3



Step 5: If the Phantom IIs are setup in Bridge Mode, click "**Next**". If the Phantom IIs are setup in Router mode and the Ping Timer is enabled, you must program in static IP routes in order for the Base Station Ping Utility to work correctly. Program in static routes for the Primary and Secondary IP Ping Addresses entered on the previous page.

When all of the routes have been entered, click "**Next**".

Figure 19 - Redundant Base Station Setup Wizard 4

Step 6: The Setup Wizard is complete and the Base Station is ready to use. Click "**Finish**".

Figure 20 - Redundant Base Station Setup Wizard Finish

4.0 BASE STATION OVERVIEW

4.1 PHANTOM II STANDARD BASE STATION OVERVIEW

The Standard Base Station consists of one Phantom II in a 19" rack mount enclosure. The Standard Base Station features two 10/100 BaseT Auto-MDIX Ethernet connections and an I/O Port which can be controlled or monitored from the Base Station Controller's web pages. Both external Ethernet connections are connected with an embedded Ethernet switch to the radio. The Standard Base Station provides access to the Diagnostic, Data, and RS485/422 ports of the Phantom II.

4.2 PHANTOM II REDUNDANT BASE STATION OVERVIEW

The Redundant Base Station has two Phantom IIs with identical RF and Ethernet MAC addresses, a Controller board, and an RF antenna relay inside the 19" rack mount chassis.

The Redundant Base Station features two 10/100 BaseT Auto-MDIX Ethernet connections and an I/O Port which can be controlled or monitored from the Base Station Controller's web pages. Both external Ethernet connections are connected with an embedded Ethernet switch to the radios. The Base Station provides connections to the Diagnostic port, Data port, and the RS485/422 port of the active Phantom II. The Ethernet, Diagnostic, Data, and RS485/422 ports are automatically routed by the Controller Board to whichever Phantom II is currently in use.

4.2.1 PHANTOM II FAILURE DETECTION

The Controller Board has a microprocessor that is continually monitoring the status of the active Phantom II via an Ethernet connection. If enabled, the Controller Board also has the ability to send out a ping to a remote unit periodically to verify the active Phantom II is still capable of transmitting and receiving data.

4.2.1.1 MONITOR PHANTOM II WITH ETHERNET CONNECTION

The Controller Board will attempt to establish a telnet connection to the Phantom II currently in use. The user must tell the Controller Board the correct IP address, user name and password of the Phantom II so the Controller Board can establish a telnet connection. This information must be entered into the Base Station Controller Board's Radio Settings web page.

Once the telnet connection has been established the Controller Board will periodically monitor the temperature in the Phantom II and flag an error is temperature exceeds the maximum threshold as listed in the Table 7 below. The Controller Board will also verify the radio's Ethernet interface is still operational.

If a telnet connection cannot be established or the Phantom II fails to respond to a diagnostic query, the Base Station will flag an error and switch to the backup radio.

Table 7 - Phantom II Error Conditions

Phantom II Parameter	Error Condition
Radio Temperature	Temperature is greater than 80C
Ethernet Connection	Telnet connection cannot be established Phantom II does not respond to diagnostic query

4.2.1.2 PING UTILITY

When the ping timer expires the Controller Board will send a ping to a remote IP address to verify the Phantom II can both send and receive data. If the ping succeeds, the ping timer is reset and no errors are generated. If the ping response is not received within 5 seconds the Controller Board will attempt to ping the secondary IP. When the max number of retries has been reached for both the primary and secondary IP addresses the Controller Board will mark the Phantom II as bad and will switch to the backup radio. If any of the pings succeed the ping timer will be reset and no radio errors will be reported.

The primary and secondary IP addresses, the ping timer, and the max number of retries can be programmed on the System Monitor -> Redundant Setup web page. The Controller Board will attempt to ping the primary IP address for the max number of retries and the secondary IP addresses for the max number of retries before flagging an error.

4.2.2 WHEN A FAILURE IS DETECTED

When a failure is detected and the Redundant Base Station is set to Automatic Mode, the first radio will be powered off and the backup radio will be powered on. The backup Phantom II radio requires approximately 60 seconds to boot up before being able to send and receive data. The Controller Board will immediately switch the Ethernet, SETUP, and COM connections to the newly activated Phantom II.

When an error is detected, the red Error LED on the Base Station's front panel will turn on indicating which radio (Radio A or Radio B) the fault was detected with. The Controller's Diagnostic web page will report an error message reporting which fault occurred. If the alarm is enabled, the buzzer will sound two short chirps every 5 seconds indicating there is a failure. If programmed for automatic mode, the relays on the Alarm Port will switch indicating an error has been detected.

Since both the Phantom IIs in the Base Station have identical Ethernet MAC addresses, when the radios are switched the Local Area will not notice that the Base Station has switched to the backup Phantom II. If the Base Station radio is configured for Master mode, the remote Phantom IIs will resync to the new Master quickly and data will be allowed to flow over the air, just as before.

If errors are detected with both the primary and secondary radios, the Base Station Controller will try using each radio a maximum of 5 times each. After the maximum number or switches has occurred, the Base Station Controller will flash the error LED of both radios. Then the Controller will no longer attempt to switch radios. It will leave one radio powered on and will let that radio try its best to continue to transmit and receive data.

4.2.3 RADIO SETUP FOR A REDUNDANT SYSTEM

In a redundant Phantom II system both Radio A and Radio B must be setup identically. The user must set all the parameters in the two radios identically. The two radios must have identical local Ethernet IP and wireless IP addresses (if used). Both radios must have the same Operation Mode and Network Name. If desired, the Radio Description in the two radios may be different.

5.0 FRONT PANEL LEDS AND BUTTONS

The front panel of the Base Station has an LED panel with 2 push buttons and up to 17 LEDs. Figure 21 below shows the LED Panel of a Standard Base Station. Figure 22 show the LED Panel of a Redundant Base Station.

Figure 21 - Standard Base Station LED Panel

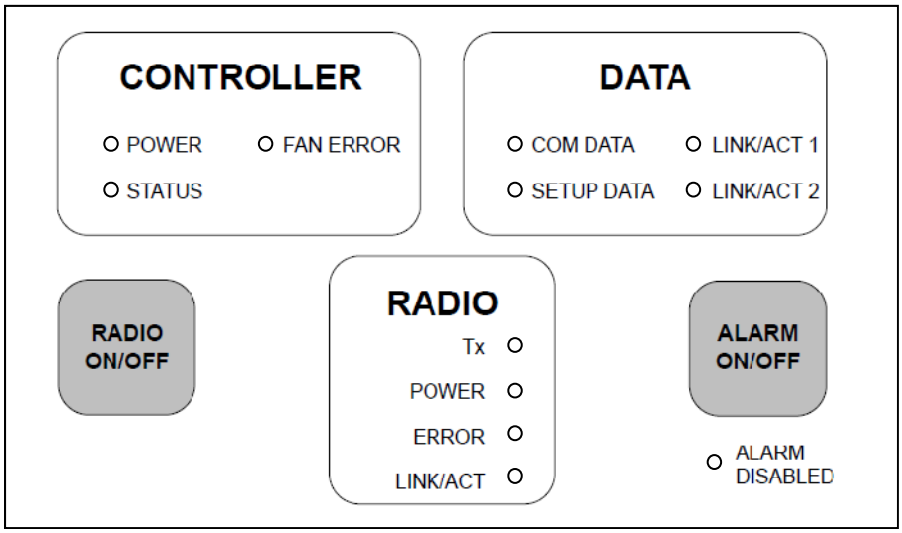
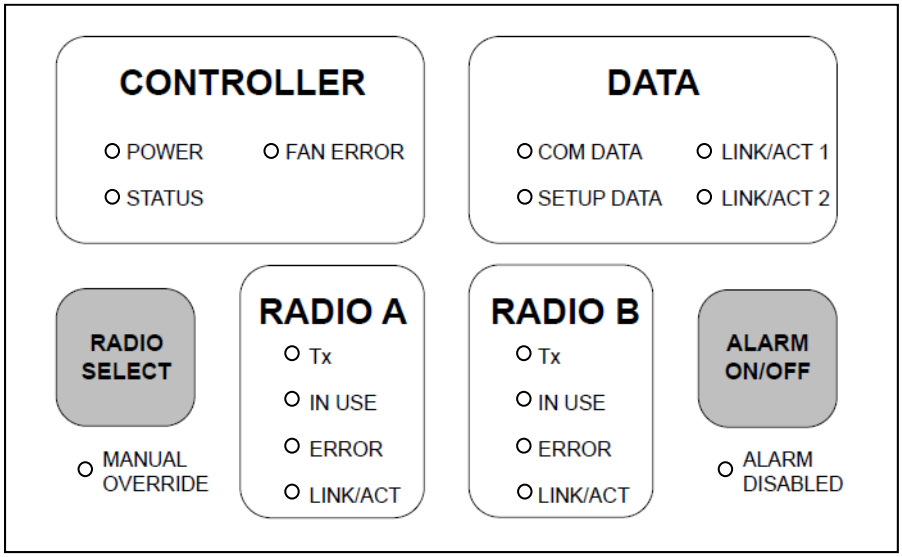


Figure 22 - Redundant Base Station LED Panel



5.1 FRONT PANEL BUTTONS

The Standard Base Station has two buttons: Radio On/Off and Alarm On/Off. The Redundant Base Station also has two buttons: Radio Select and Alarm On/Off. The button functions are listed in Table 8 below.

Table 8 - Base Station LED Functionality

Base Station Version	Button Name	Button Function
Standard Base Station	Radio On/Off	Toggles the power to the radio on and off.
	Alarm On/Off	If an error with the radio is detected a buzzer on the Base Station Controller will sound. This button disables or enables the alarm buzzer. Hold button down for 5 seconds to clear any radio errors. You will hear two long beeps as errors are cleared.
Redundant Base Station	Radio Select	Cycles through the modes listed below to turn power on and off to the radios and to select Auto or Manual Mode. 1) Radio A In Use, Auto Mode 2) Radio A In Use, Manual Mode 3) Radio B In Use, Auto Mode 4) Radio B In Use, Manual Mode
	Alarm On/Off	If an error with the radio is detected a buzzer on the Base Station Controller will sound. This button disables or enables the alarm buzzer. Hold button down for 5 seconds to clear any radio errors. You will hear two long beeps as errors are cleared.

5.2 LED FUNCTIONS

The LED panel has seventeen Tri-Color LEDs. The functionality of each LED is shown in Table 9.

Table 9 - Base Station LED Functionality

LED	Color	Definition
Power	Green Off	Base Station ready, normal operations Base Station hardware fault or power is not applied
Status	Green Red	Base Station has no faults, normal operations Base Station has a fault condition, check unit status
Fan Error	Red Off	Indicates a problem with the fans Fans are operational
COM/SETUP Data	Blinking Red Blinking Green	Data is transmitting on one of the Ports Data is being received on one of the Ports
LINK/ACT 1/2	Solid Red Flashing Red Solid Green Flashing Green	Link at 10Mbit/s Activity at 10Mbit/s Link at 100Mbit/s Activity at 100Mbit/s
Radio A/B Tx	Always Off	In the Phantom II base station this LED is not connected. It will always be off, even if the radio is transmitting successfully.
Radio A/B In Use	Green	Radio is in use
Radio A/B Error	Off Red Flashing Red	No errors have been detected with the radio(s) An error has been detected with the radio(s) The maximum number of failures has been reached. The Controller will no longer attempt to switch radios.
Radio A/B Link/Act	Solid Red Flashing Red Solid Green Flashing Green	Link at 10Mbit/s Activity at 10Mbit/s Link at 100Mbit/s Activity at 100Mbit/s
Manual Override *(redundant version)*	Red Off	Radio selection is done manually Radio selection is done automatically by the Base Station Controller
Alarm Disabled	Red Off	The onboard buzzer alarm is currently disabled The buzzer is enabled

6.0 BASE STATION WEB MANAGEMENT

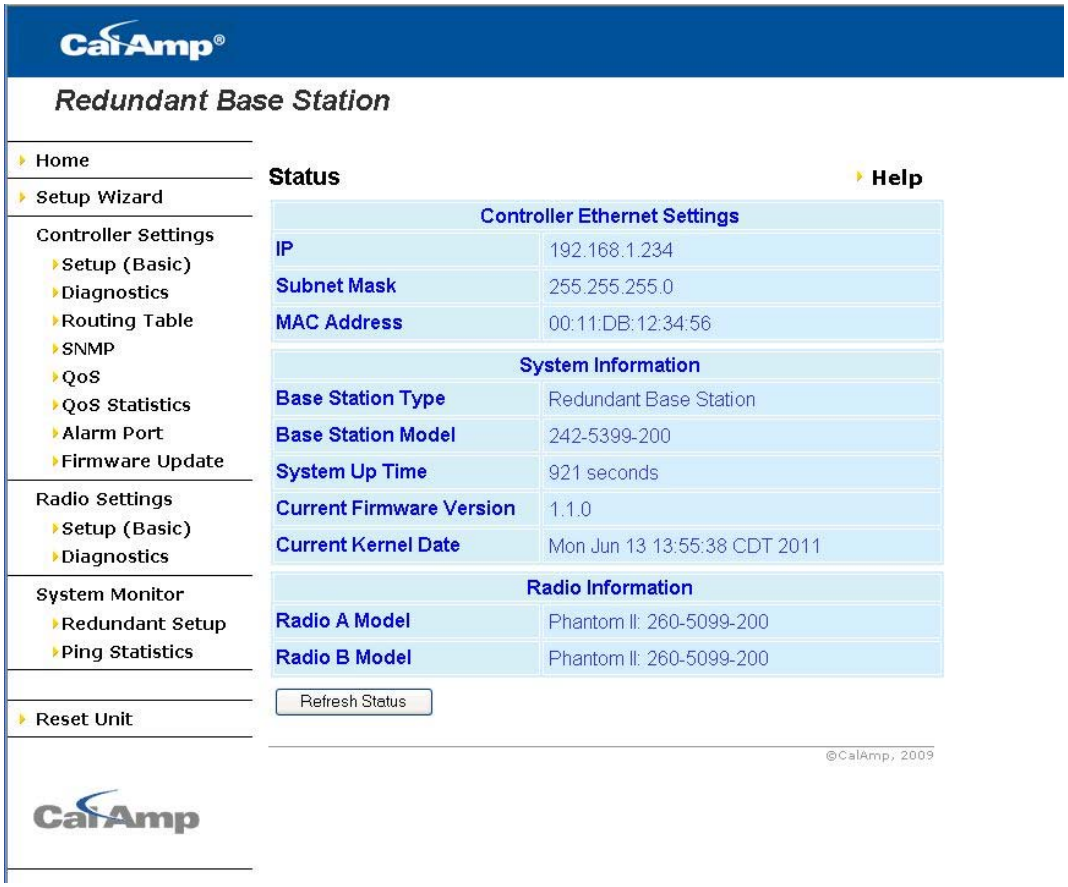
A built-in web server makes configuration and status monitoring possible from any browser-equipped computer, either locally or remotely. Status, configuration, and online help are available without requiring special client software. Setup is password protected to avoid tampering or unauthorized changes.

Both the configuration parameters and operating firmware can be updated remotely, even over the RF network itself, using the web pages.

6.1 NAVIGATING THE NETWORK MANAGEMENT SYSTEM

The web interface is subdivided in two frames: the left frame allows the user to navigate the main menu, while the right main frame displays the selected page.

Figure 23 - Redundant Base Station Homepage



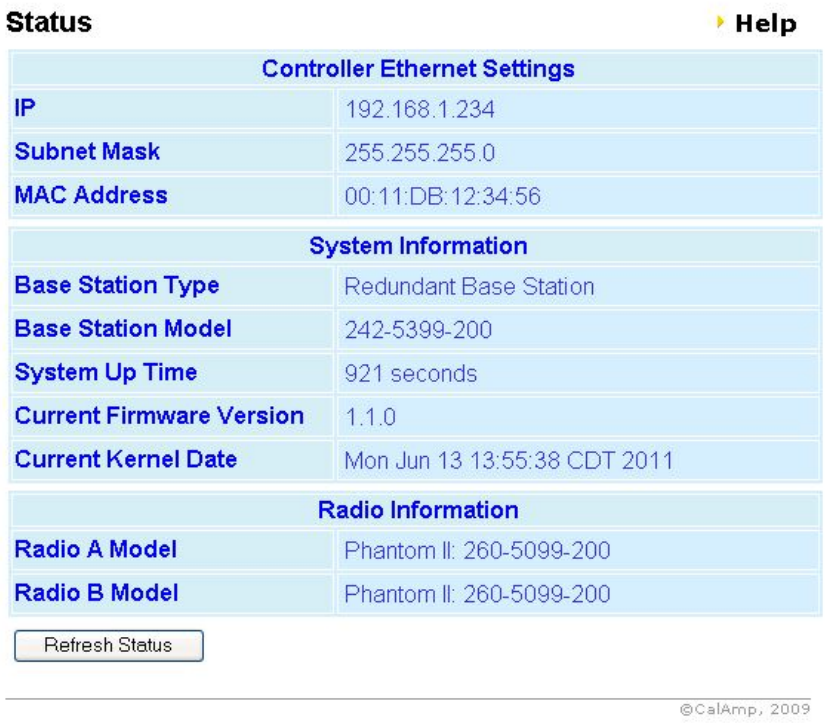
6.2 MAIN MENU

The Base Station's main menu grants the user access to a variety of web pages as shown in Figure 23 above. The Reset Unit link on the lower left of the screen allows the user to reset the Base Station Controller. As the Base Station Controller resets, it will power cycle all of the radios in the Base Station.

6.3 HOME

The Home window displays the Base Station's general and diagnostic information.

Figure 24 - Redundant Base Station Homepage Status Screen



6.3.1 CONTROLLER ETHERNET SETTINGS

6.3.1.1 IP

This field displays the Ethernet IP address for the Base Station Controller. The IP address of the Base Station Controller can be changed on the Controller Settings -> Setup (Basic) web page.

6.3.1.2 SUBNET MASK

This field displays the Ethernet subnet mask for the Base Station Controller. The subnet mask of the Base Station Controller can be changed on the Controller Settings -> Setup (Basic) web page.

6.3.1.3 MAC ADDRESS

Media Access Control Address. Every Ethernet device (i.e. LAN cards) has a unique hardware serial number or MAC address to identify each Network Device from all others. This number is programmed at the factory and cannot be changed.

6.3.2 SYSTEM INFORMATION

6.3.2.1 BASE STATION TYPE

This field displays the type of Base Station configuration. This setting is programmed at the factory. Possible values include: Standard Base Station or Redundant Base Station.

6.3.2.2 BASE STATION MODEL

This field displays the current part number / model number of the Base Station being used.

6.3.2.3 SYSTEM UP TIME

This timer is listed in seconds and shows the time since the last reboot. 1 minute = 60 seconds of up time, 1 hour = 3600 seconds, 1 day = 86400 seconds, 1 year = 31,536,000 seconds

6.3.2.4 CURRENT FIRMWARE VERSION

This field displays the current firmware version loaded in the Base Station Controller.

6.3.2.5 CURRENT KERNEL DATE

This field displays the date of the operating system kernel the Base Station Controller is running.

6.3.3 RADIO INFORMATION

This field displays the model number of the radio(s) installed in the Base Station. "N/A" will be listed when a radio is not installed in the slot. For example, a Standard Base Station will only have one radio installed, while a Redundant Base Station will have radios installed in both slots.

6.3.3.1 RADIO A/B MODEL

This field displays the model number and type of radio(s) installed in the Base Station.

6.3.3.2 REFRESH STATUS

This button refreshes the current page.

6.4 SETUP WIZARD

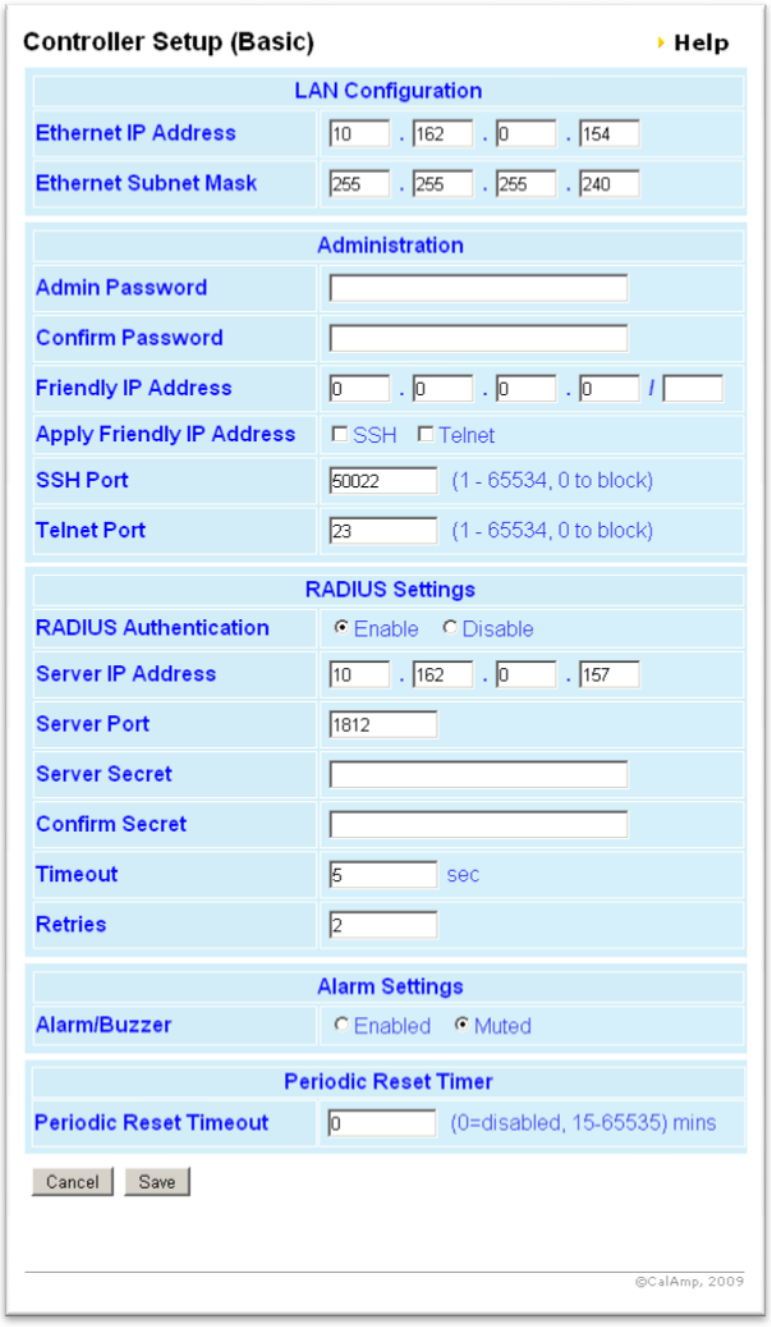
The Setup Wizard will guide the user through the steps required to configure the Base Station. The Setup Wizard consists of 3 web pages for the Standard Base Station. The Setup Wizard for the Redundant Base Station consists of 5 web pages.

Each web page in the Setup Wizard contains instructions for filling out the required information. All parameters that are entered through the Setup Wizard can be directly accessed later by loading the applicable web page from the main menu.

6.5 CONTROLLER SETUP (BASIC)

These settings pertain to various settings of the Base Station's Controller.

Figure 25 - Controller Setup (Basic) Web Page



6.5.1 LAN CONFIGURATION

These settings can be modified to change the IP address and subnet mask of the Base Station's Controller Board.

6.5.1.1 ETHERNET IP ADDRESS

This setting can be changed to alter the IP address of the Base Station. The default IP address is 192.168.205.254. When a new IP address is entered, it will take effect immediately upon clicking the Save button. Reconfigure the network card in your PC to access the new subnet, if needed, then enter the new IP address in the address bar of the web browser.

6.5.1.2 ETHERNET SUBNET MASK

This setting can be changed to alter the subnet mask of the Base Station. The default is 255.255.255.0.

6.5.2 ADMINISTRATION

These settings affect the Base Station's security and how a user is allowed to connect to the Base Station.

6.5.2.1 ADMIN PASSWORD/CONFIRM PASSWORD

This setting can be used to change the user's password. The default password is "admin". It is recommended that this be changed immediately upon installation. The confirm password field is used to ensure correct spelling.

6.5.2.2 FRIENDLY IP ADDRESS

Specifies the IP address from which remote administration is permitted. Entering 0.0.0.0 will allow any IP address. Leave the fifth box blank (after the /) if specifying a specific IP, or 0.0.0.0. A subnet mask may be entered in the fifth box. The mask indicates how many bits of the IP address to match. This can be a value from 1 to 32.

6.5.2.3 APPLY FRIENDLY IP ADDRESS

Check the box next to a service to allow access to the service only from the friendly IP address. Unchecking the box will allow access from a computer with any IP address.

6.5.2.4 SSH PORT/TELNET PORTS

Enter the port number that will be used for access to the service. Entering zero for the port number will block access to the service.

6.5.3 RADIUS SETTINGS

6.5.3.1 RADIUS AUTHENTICATION

Enable or disable RADIUS authentication for webpage access.

6.5.3.2 SERVER IP ADDRESS

The IP address of the RADIUS server.

6.5.3.3 SERVER PORT

The port of the server.

6.5.3.4 SERVER SECRET

Sets the secret phrase to use with the server.

6.5.3.5 CONFIRM SECRET

Re-type the Server Secret to confirm spelling.

6.5.3.6 TIMEOUT

Specify the number of the seconds to wait before a retry.

6.5.3.7 RETRIES

Specify the number of attempts at authenticating with the server before giving up.

6.5.4 ALARM SETTINGS

6.5.4.1 ALARM/BUZZER

This setting will enable or disabled the audible buzzer located on the Controller Board. Typically, the buzzer will beep when an error is detected with the Controller Board or an error is detected with a radio installed in the Base Station.

6.5.5 PERIODIC RESET TIMER

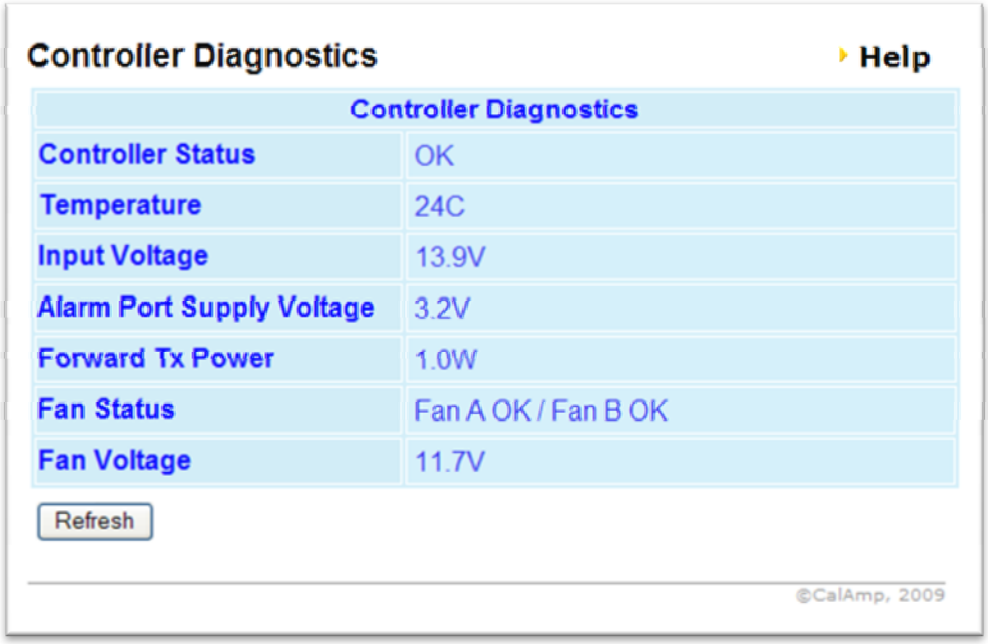
6.5.5.1 PERIODIC RESET TIMEOUT

This field sets the Periodic Base Station Reset time from 15 to 65,535 minutes. The Periodic Reset is disabled when set to 0. When this timer expires, the Reset Module will automatically power down the Base Station Controller and the radios, and then the entire system will be rebooted.

6.6 CONTROLLER DIAGNOSTICS

Local Controller diagnostics can be accessed by loading the Controller Diagnostics webpage from the main menu of the Base Station's homepage.

Figure 26 - Controller Diagnostics Web Page



6.6.1.1 CONTROLLER STATUS

Displays the current status of the Controller Board and is used to report any errors detected with the Controller Board.

6.6.1.2 TEMPERATURE

This field displays the current temperature inside the Base Station in degrees Celsius.

6.6.1.3 INPUT VOLTAGE

This field displays the current input voltage to the Base Station.

6.6.1.4 ALARM PORT SUPPLY VOLTAGE

This field displays the supply voltage to the Alarm Port logic circuits. The supply voltage is user selectable and can be set to either 1.8V or 3.3V. Click on Alarm Port on the main menu to access the Alarm Port settings.

6.6.1.5 FORWARD TX POWER

This field displays the forward transmit power of the radio in use. This value is read from the Phantom II radio.

6.6.1.6 FAN STATUS

This field displays the status of the two 12VDC fans located in the Base Station.

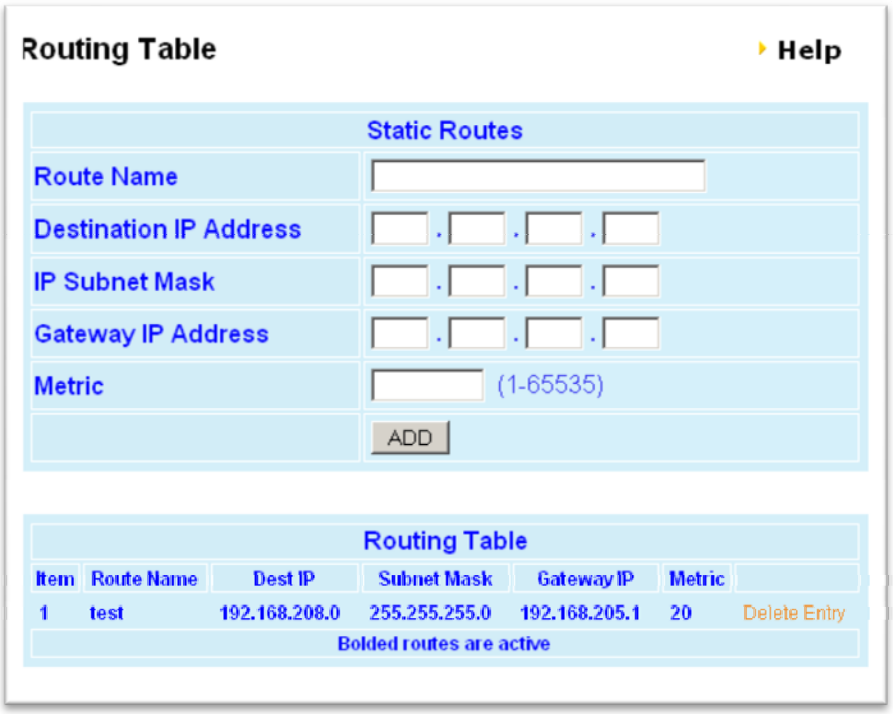
6.6.1.7 FAN VOLTAGE

This field displays the supply voltage to the two 12V DC fans. If the input voltage to the Base Station drops to 13V or lower, the fan voltage will slump below 12V. This is normal due to the voltage drop through the buck switching power supply on the Controller Board. The fans may spin slower but they will not be harmed by the lower voltage.

6.7 ROUTING TABLE

Static routes may be created from the Routing Table webpage. The static routes will appear in the table at the bottom of the screen. Static Routing refers to a manual method used to set up routing between networks.

Figure 27 - Routing Table Web Page



6.7.1 STATIC ROUTES

6.7.1.1 ROUTE NAME

This field sets the alphanumeric identifier of the static route in the Routing Table.

6.7.1.2 DESTINATION IP ADDRESS

This field sets the IP address of the destination network.

6.7.1.3 IP SUBNET MASK

This field sets the subnet mask of the destination network.

6.7.1.4 GATEWAY IP ADDRESS

This field sets the local network IP address for the gateway to the destination network. Enter the address of the local gateway.

6.7.1.5 METRIC

Number ranging from 1 to 65,535. The lower the metric value the higher the route priority.

6.7.1.6 ADD BUTTON

This button must be pressed to add the configured route to the table.

6.7.1.7 DELETE ENTRY

When clicked, this button deletes the route to the immediate left of the link.

6.8 SNMP

The Simple Network Management Protocol (SNMP) is used in network management systems to monitor network-attached devices for conditions that warrant administrative attention. The base station controller supports SNMP version v2c.

Figure 28 - SNMP Web Page

6.8.1 SNMP CONFIGURATION

6.8.1.1 SNMP

Selecting Enable will allow the SNMP functionality. Selecting Disable will shut off SNMP functionality.

6.8.1.2 READ-ONLY COMMUNITY NAME

This field sets the community string used for accessing the read-only Management Information Bases (MIBs).

6.8.1.3 READ-WRITE COMMUNITY NAME

This field sets the community string used for accessing all Management Information Bases (MIBs) including writable MIBs.

6.8.1.4 TRAP COMMUNITY NAME

This field sets the community string used when sending traps.

6.8.1.5 MIBS

Right-click the “Download mibs.zip” link and select "Save Target As..." to save a zip file of the controller-specific MIBs. Once the zip file is downloaded onto your computer, extract the files. Then, the base station controller specific MIBs can be loaded into any third party MIB browser.

6.8.2 SNMP TRAPS CONFIGURATION

Check the box next to a trap to enable it. Uncheck the box to disable that trap. The traps listed in the table below are available in the base station controller.

Table 10 – SNMP Trap Descriptions

SNMP Trap Name	Description
Board Alive	A trap is generated whenever the Controller board boots up.
Board Error Detected	A trap is generated whenever an error is detected with the Controller board.
Board Error Cleared	A trap is generated whenever errors are cleared from the Controller board.
Radio A Error Detected	A trap is generated whenever an error is detected with Radio A.
Radio A Error Cleared	A trap is generated whenever Radio A errors are cleared. Errors are cleared when the “Clear Errors” button on the Radio Settings -> Diagnostics webpage is pressed, or when the Alarm On/Off button on the Base Station’s front panel is held for 5 seconds.
Radio B Error Detected	A trap is generated whenever an error is detected with Radio B.

Radio B Error Cleared	A trap is generated whenever Radio B errors are cleared. Errors are cleared when the "Clear Errors" button on the Radio Settings -> Diagnostics webpage is pressed, or when the Alarm On/Off button on the Base Station's front panel is held for 5 seconds.
Fan Error Detected	A trap is generated when the Controller detects that either of the two fans have stopped spinning.
Fan Error Cleared	A trap is generated when the Controller detects that both fans are operating normally again after an error condition had occurred.
Alarm Pin 1 Low to High	A trap is generated whenever a low to high transition is detected on Pin 1 of the Alarm Port.
Alarm Pin 1 High to Low	A trap is generated whenever a high to low transition is detected on Pin 1 of the Alarm Port.
Alarm Pin 5 Low to High	A trap is generated whenever a low to high transition is detected on Pin 5 of the Alarm Port.
Alarm Pin 5 High to Low	A trap is generated whenever a high to low transition is detected on Pin 5 of the Alarm Port.
Alarm Pin 7 Low to High	A trap is generated whenever a low to high transition is detected on Pin 7 of the Alarm Port.
Alarm Pin 7 High to Low	A trap is generated whenever a high to low transition is detected on Pin 7 of the Alarm Port.
Alarm Pin 7 Analog Voltage High	A trap is generated whenever the Analog Voltage on Pin 7 of the Alarm Port exceeds the upper voltage threshold programmed by the user.
Alarm Pin 7 Analog Voltage Low	A trap is generated whenever the Analog Voltage on Pin 7 of the Alarm Port falls below the lower voltage threshold programmed by the user.
Alarm Pin 7 Analog Voltage In Range	A trap is generated whenever the Analog Voltage on Pin 7 of the Alarm Port returns to a value between the lower and upper voltage threshold programmed by the user.

6.8.2.1 PIN 7 VOLTAGE RANGE

Enter the voltage thresholds (low and high) that will be used to generate the Alarm Pin 7 Analog Voltage traps. The analog to digital converter can report voltages from 0V up to the I/O Supply Voltage. The I/O Supply Voltage is user selectable, and can be set to either 1.8V or 3.3V. See appendix A for Alarm Port electrical specifications.

6.8.3 SNMP TRAP SINK

6.8.3.1 TRAP SINK IP

The Trap Sink IP allows the user to enter in the IP address of the computer(s) that are configured to receive SNMP traps.

6.8.3.2 TRAP SINK PORT

Enter in the port number that the SNMP traps will be sent to. Most MIB browsers are set to listen for traps on port 162.

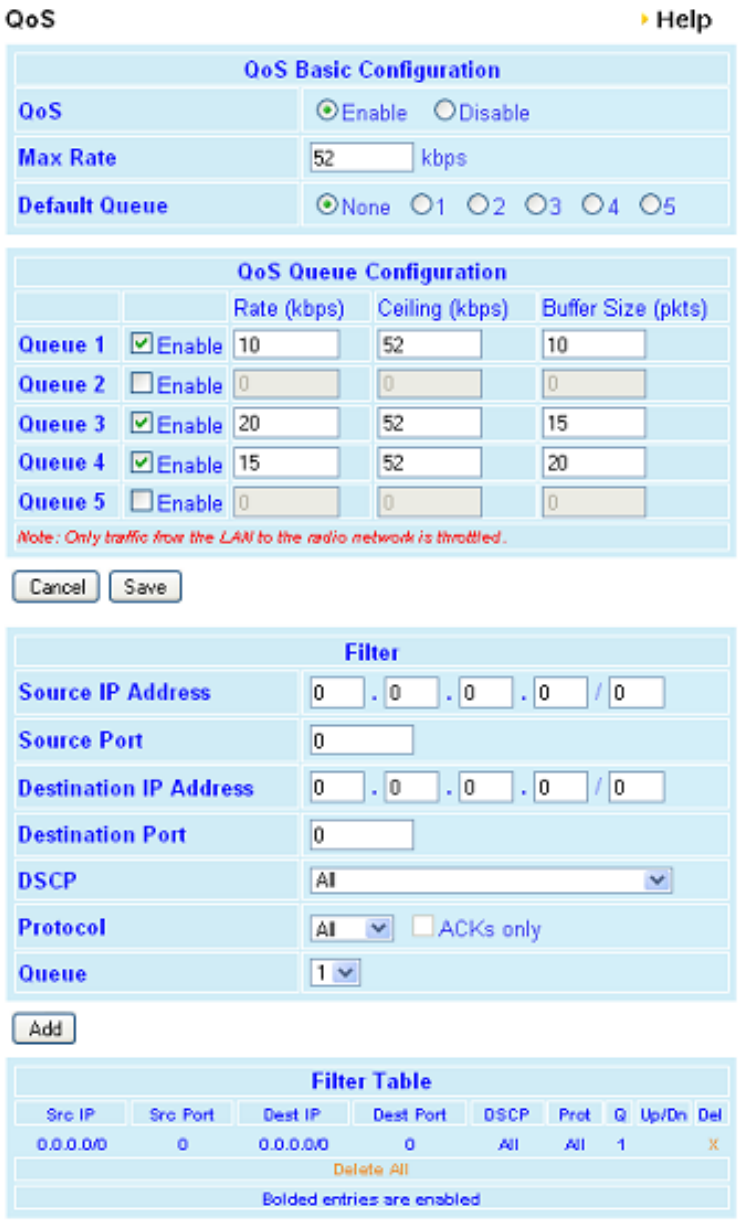
6.8.3.3 ADD/DELETE

Click the Add button to add the Trap Sink IP and the Trap Sink Port to the SNMP Trap Sink List. After an entry has been added to the list a “Delete” link is displayed next to the entry. Click the delete link to remove an individual entry from the list.

6.9 QOS

The Quality of Service (QoS) module throttles IP traffic sent to the radio network. Note that only traffic from the LAN to the radio network will be throttled. Traffic can be filtered and throttled at different rates using the QoS filters.

Figure 29 – QoS Web Page



6.9.1 QOS BASIC CONFIGURATION

QoS: Select "Enable" to use the QoS module. Select "Disable" to turn it off.

Max Rate: Sets the maximum data rate allowed by the QoS module (in kilobits per second).

Default Queue: Sets the queue through which all traffic will flow unless otherwise filtered. If no queue is selected, then unfiltered traffic will bypass the QoS module.

When changes are made to the QoS Basic Configuration, the Save button must be pressed for the changes to take effect.

6.9.2 QOS QUEUE CONFIGURATION

The QoS contains five queues, which can each be configured independently to throttle traffic to different rates.

Enable: Check "Enable" to use the queue.

Rate: Sets the guaranteed rate at which traffic flows through the queue. The sum of this value for all enabled queues cannot exceed the Max Rate set in the QoS Basic Configuration.

Ceiling: Sets the maximum rate that traffic can flow through the queue. This value cannot be set higher than the Max Rate set in the QoS Basic Configuration for any individual queue.

Buffer Size: Sets how many packets can be queued up in the queue. If this buffer is exceeded the packets will be dropped.

When changes are made to the QoS Queue Configuration, the Save button must be pressed for the changes to take effect.

6.9.3 FILTER

Filters can be configured to route traffic to specific queues. Filters can be created that match on one or more of the following parameters.

Source IP Address: Enter the source IP address to match. The Net Mask can be specified to match on a either a rnage of IP addresses or on an individual address. Leave as 0.0.0.0/0 to ignore the source IP address.

Example:

10.1.1.0/24 *This filter matches all IP addresses from 10.1.1.0 to 10.1.1.255*

10.1.1.43/32 *This filter matches on ly one IP address: 10.1.1.43*

Source Port: Enter the source port to match. Leave as 0 to ignore the source port.

Destination IP Address: Enter the destination IP address to match. Leave as 0.0.0.0/0 to ignore the destination IP address.

Destination Port: Enter the destination port to match. Leave as 0 to ignore the destination port.

DSCP: Select the differentiated services code point to match.

Protocol: IP traffic can be filtered by protocol. Select the protocol to match: TCP, UDP, ICMP, or all protocols. If TCP is selected the ACKs checkbox is enabled. Checking this box creates a filter that matches TCP Acks only. Unchecking this box creates a filter that matches all types of TCP traffic.

Queue: Sets the queue that traffic matching the filter will go into.

6.9.4 FILTER TABLE

The filter table displays a list of all filters that have been created. Filters that are currently enabled will be shown in bold. A filter is disabled if it is associated with a disabled queue. Traffic will be checked against each filter in this table starting at the top and working towards the bottom. Once a packet is found to match a given filter, the packet is placed into the specified queue. When a packet is found to match a given filter, filter comparison stops and filters further down the table are ignored. When the next packet is received the process starts over from the top of the table.

Click the up or down arrows to move a filter in the list. Click "X" to delete a filter or Delete All to remove all the filters. New filters will be added to the bottom of this list.

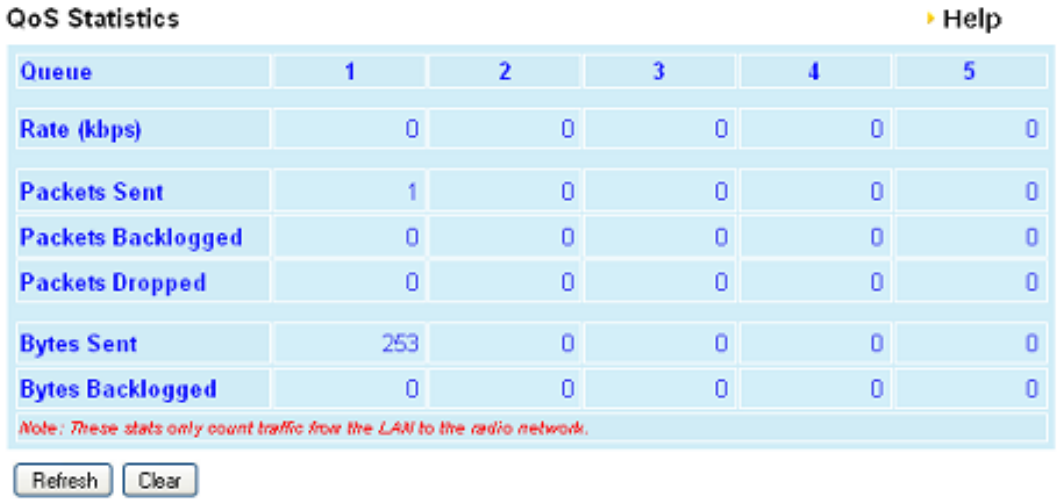
SETUP TIPS

- Only traffic from the LAN to the radio network will be throttled.
- Packets are prioritized and buffered in the Base Station controller, not in the radio. When packets are released from the QoS module they are sent to the radio.
- In order to properly throttle traffic, the QoS module must be the slowest point in your system. When the QoS rates are set too high, the radio system may not be able to keep up. In this scenario traffic will be backed up at the radio interface, waiting for the RF channel to free up.
- When a waiting line of packets forms at the radio's RF interface, the user's high priority traffic will not be allowed to jump to the front of the line and will be delayed. To ensure that high priority traffic is in fact given a high priority, the rates set in the QoS module must be the limiting point in the network.
- Many factors, such as packet size, network topology, radio collision avoidance settings, very low RF signal levels and over the air data rate, will have an effect on the overall throughput of your system. The outgoing throughput of your system can be measured by setting up the desired filters and setting all the QoS rates very high. Next, allow the system to run for a while. The QoS module will not throttle traffic since the rates are set very high.
- After enough time has elapsed to build a representative traffic profile, check the QoS Statistics web page (detailed below) and observe the unthrottled Rate reported for each queue. This can be helpful information to have when setting up the QoS rules for the initial trials. For example, to increase the amount of bandwidth available for high priority traffic, low priority traffic must be throttled to rates slower than those measured during this initial test.

Actual radio throughput can sometimes be optimized depending on the network topology and characteristics of traffic being transmitted over the air. Collision avoidance techniques, RF back off algorithms, RF Acks/RF retries are not needed in all networks. While all of these features have definite benefits in certain situations they can also slow throughput. These settings can sometimes be optimized to yield a greater throughput. See the radio's user manual or contact CalAmp technical services for more details.

6.10 QOS STATISTICS

Figure 30 – QoS Statistics Web Page



6.10.1 OVERVIEW

The QoS Statistics page gives information on how the current QoS is performing, so that in can be adjusted with greater precision. The Refresh button will update the QoS Statistics page to the most current statistics. The Clear button will reset the statistics; changing any QoS setting will also reset the statistics.

6.10.2 STATISTICS

Rate: The rate of traffic flowing through the queue. The rate is calculated using a time weighted average over the past several minutes. The Clear button does not reset the rate.

Packets Sent: The number of packets that have passed through the queue since the last clear or setting change.

Packets Backlogged: The number of packets currently queued up and waiting for transmission. The Clear button will not reset this.

Packets Dropped: The number of packets dropped, due to exceeding the buffer size for the queue, since the last clear or setting change.

Bytes Sent: The number of bytes that have passed through the queue.

Bytes Backlogged: The number of bytes currently queued up and waiting for transmission. The Clear button will not reset this.

6.11 ALARM PORT

This section describes the function of the ALARM port. The Alarm port is connected to two relays, the Alarm Relay (Relay 1) and the Radio In Use Relay (Relay 2). Either of these two relays may be controlled automatically by the Base Station (Redundant Base Station only) or may be switched manually by the user using the Base Station's web page interface.

Alternatively, the connections to Relay 2 can also be used as digital inputs when the Relay function is disabled. Pin 7 is not connected to any relays and can be used as a digital input, digital output or an analog input. These options can be set using the web page interface.

6.11.1 OVERVIEW

Figure 31 and Figure 32 provide a pin out of the Alarm I/O connector and a block diagram of the internal circuitry.

Pin	Function
1	Relay 2 (Normally Open) Digital Input 1
2	Relay 1 (Normally Open)
3	Relay 2 (Common)
4	Relay 1 (Common)
5	Relay 2 (Normally Closed) Digital Input 5
6	Relay 1 (Normally Closed)
7	Digital Input or Output 7 Analog Input 7
8	Ground

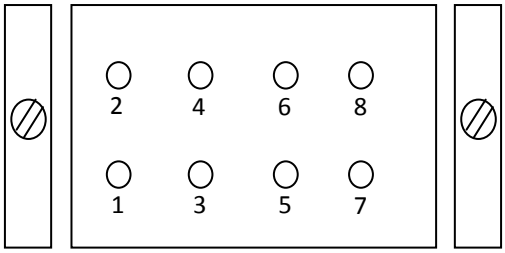
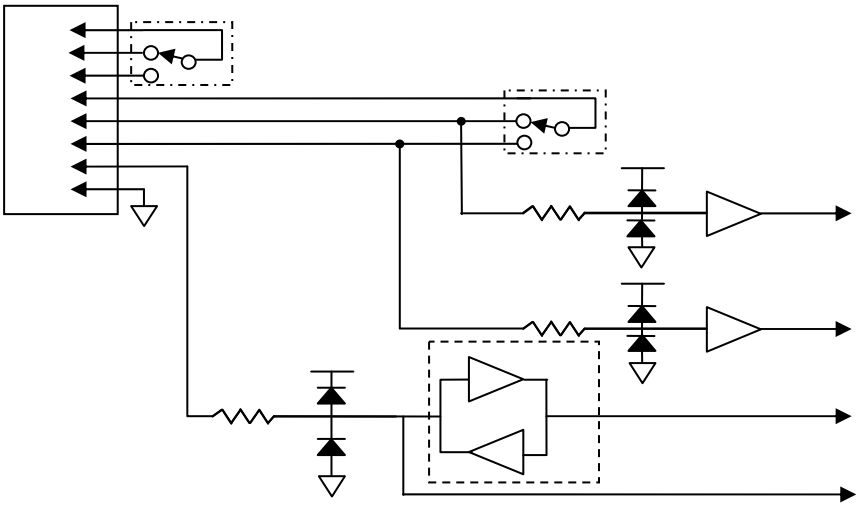


Figure 31 - Alarm Port pin out

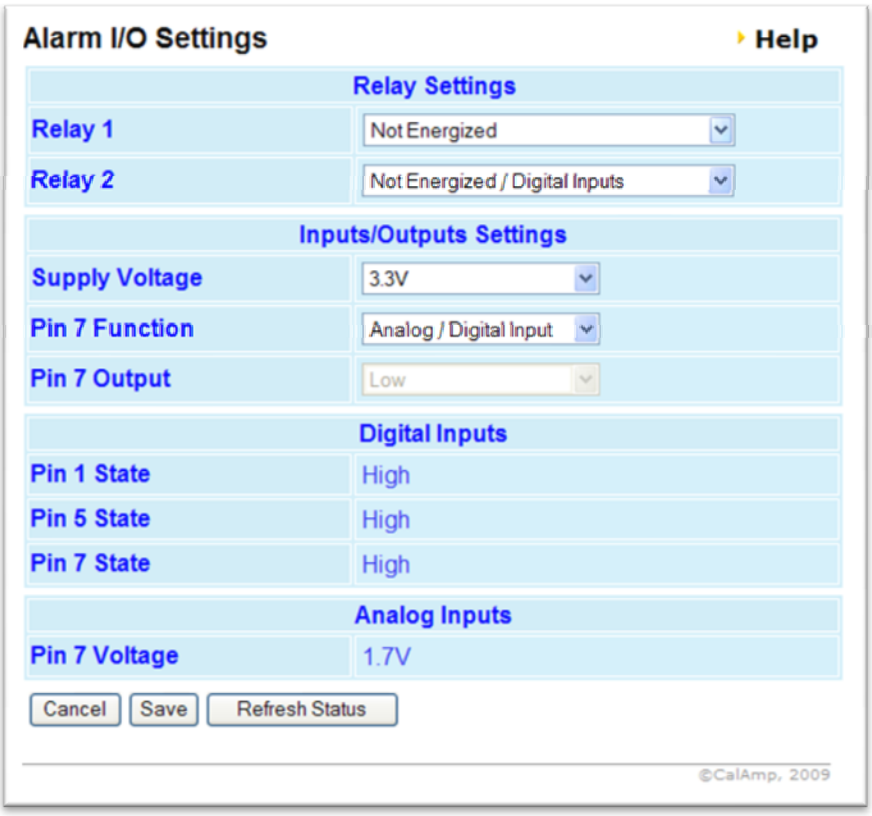
Figure 32 - Simplified Block Diagram of Alarm Port Circuitry



6.11.2 CONFIGURING THE ALARM PORT

The web page is used to configure the Alarm Port pins and to monitor the status of input lines.

Figure 33 - Alarm Port web page



6.11.3 RELAY SETTINGS

To adjust the options for the relays, use the pull down menus under the Relay Settings section. Depending upon which type of Base Station you are using, there will be either two or three options available for the relays. A summary of the options is listed in the table below.

Table 11 - Relay Setting Options

Relay 1	Description
Not Energized	Shorts pins 4 and 6
Energized	Shorts pins 4 and 2
Auto: Indicates Error Status *(Redundant Base Station only)*	Indicates if an error has been detected. Not Energized = Error Detected with radio(s) Energized = No Errors Detected
Relay 2	**Description**
Not Energized/Digital Input	Shorts pins 3 and 5 Select this mode when using Pins 1 and 5 as Digital Inputs
Energized	Shorts pins 3 and 1
Auto: Indicates Active Radio *(Redundant Base Station only)*	Indicates which radio is currently in use. Not Energized = Radio A is in use Energized = Radio B is in use

6.11.4 INPUT/OUTPUT SETTINGS

6.11.4.1 SUPPLY VOLTAGE

The user can select the supply voltage for the digital and analog logic on the Alarm Port. The supply voltage may be set to either 1.8V or 3.3V. The voltage source supplies voltage to the following:

- Digital Inputs on Pins 1, 5, and 7
- Digital Output on Pin 7
- Analog Input on Pin 7

The analog-to-digital converter (ADC) supply is fixed at 3.3V, but the analog input on Pin 7 will be clamped 0.6V above the user settable supply voltage.

Changing this supply voltage will not affect the operation of the relays.

6.11.4.2 PIN 7 FUNCTION

This setting determines the function of pin 7: Digital/Analog Input or Digital Output. When this pin is configured as an input, both the analog voltage and the digital state of the pin will be reported on the web page.

6.11.4.3 PIN 7 OUTPUT

When the Pin 7 function is set to "Digital Output", the user can set the output voltage level of Pin 7 as High or Low. The digital output is connected to the Alarm Port through a 100 ohm resistor.

6.11.5 DIGITAL INPUTS

This section displays the state of the digital inputs as read by the Controller Board.

The digital inputs on pins 1 and 5 feed through a series 150kΩ resistor, through a buffer, to the microprocessor. The digital input on pin 7 feeds through a series 100Ω resistor, through a buffer, to the microprocessor. The input voltages are clamped between 0.6V below ground and 0.6V above the I/O supply voltage.

The I/O Supply Voltage level will affect the decision threshold between a high and low state on the digital inputs. Select the I/O Supply voltage level corresponding to the digital logic levels in use. See Appendix A for a complete list of Alarm Port specification.

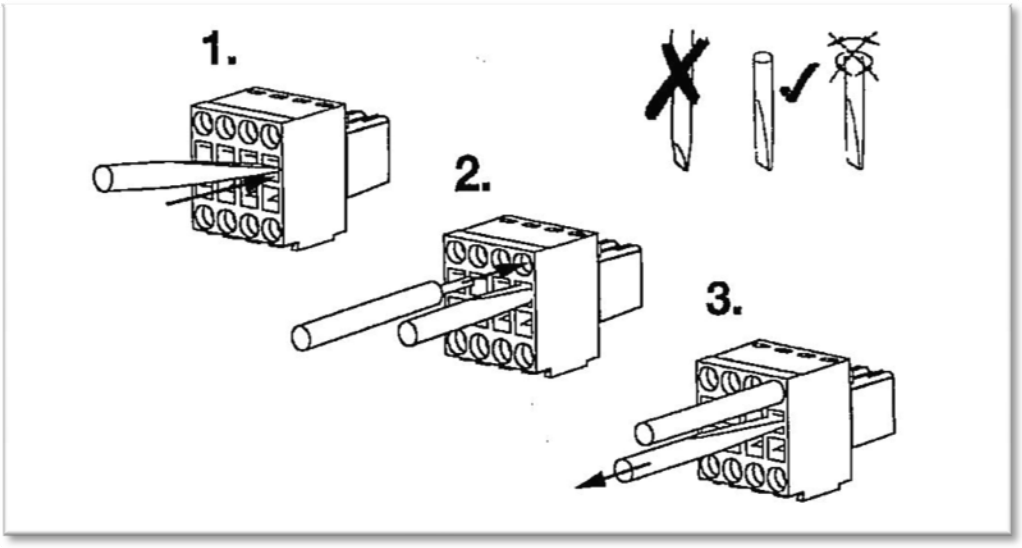
6.11.6 ANALOG INPUTS

This section displays the analog voltage read by the analog-to-digital converter input from Pin 7 of the Alarm Port. The analog input on pin 7 feeds through a series 100Ω resistor before being read by the ADC. The input voltages are clamped between 0.6V below ground and 0.6V above the I/O supply voltage.

6.11.7 CONNECTING WIRE TO THE SPRING LOADED CONNECTOR

The Base Station is supplied with an 8 pin plug that will mate to the 8 pin header on the Alarm Port. The plug features a spring loaded retention clamp to make inserting and removing the wire/cable as simple as possible. To connect a wire(s) to the plug follow the instructions below.

Figure 34 - Inserting wire into the Alarm Port Plug



Step 1: Insert a small tool into one of the square holes as shown in the figure above. This will release the spring clamp for the nearest wire to allow the wire to be inserted or removed.

Step 2: Strip the insulation off the end of the wire and insert it into the round hole as shown in the figure above.

Step 3: Remove the tool. The spring loaded clamp will hold the wire firmly in place.

6.12 FIRMWARE UPDATE

When newer versions of the Base Station Controller firmware become available, the user can manually update the unit by uploading the new firmware. The update file name must have the following name: **upgradebase.tar.gz**

Figure 35 - Firmware Update web page

6.12.1 CURRENT FIRMWARE VERSION

6.12.1.1 VERSION

Displays the firmware version currently loaded in the Base Station Controller.

6.12.1.2 CURRENT KERNEL DATE

Displays the date of the operating system kernel the Base Station Controller is running.

6.12.2 UPLOAD NEW FIRMWARE

6.12.2.1 FILE

This field specifies the path for the new firmware file to be uploaded to the Base Station Controller. The Browse button can be used to locate the file on your computer. The update file name must be the following: **upgradebase.tar.gz**

6.12.2.2 PROGRESS

The field displays the update progress after the "Upload Firmware to Base Station" button has been pressed.

6.12.3 CONFIGURATION FILE

6.12.3.1 UPLOAD CONFIG FILE

In this field, enter the configuration file to be uploaded to the Base Station Controller. The Browse button can be used to locate the file on your computer. The file to be uploaded must be named **config.xml**. Select the Upload Config File radio button. Then, click Proceed to upload a new configuration file.

6.12.3.2 DOWNLOAD CONFIG FILE

Select the Download Config File radio button. Then, click Proceed to return a link to the configuration file on the Base Station. Right-click the link and select "Save Target As..." to save the file. The link page refreshes after 15 seconds. It is recommended to use the default filename to save the file. If multiple files need to be maintained, it is recommended to use directory paths to separate the files.

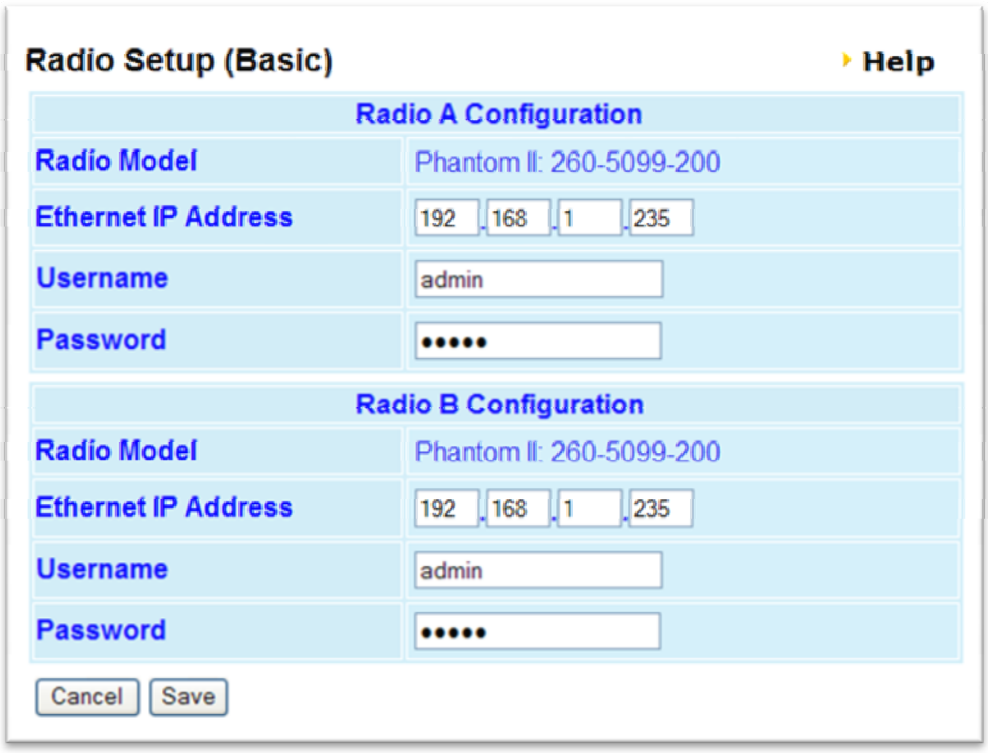
6.12.3.3 RESTORE FACTORY DEFAULTS

Select the Restore Factory Defaults radio button. Then, click Proceed to set the Base Station settings back to their original factory defaults. **The IP address of the Controller Board will be set back to 192.168.1.1.**

6.13 RADIO SETTINGS

This configuration screen lists the settings for each radio in the Base Station. The information entered here will be used by the Controller Board to access the radio(s) to control and monitor their status.

Figure 36 - Radio Settings web page



6.13.1 RADIO CONFIGURATION

This configuration screen lists the settings for each radio in the Base Station. The information entered here will be used by the Controller Board to access the radio(s) to control and monitor their status.

6.13.1.1 RADIO MODEL

This setting is pre-programmed at the factory and displays the radio model that is present in the Base Station.

6.13.1.2 ETHERNET IP ADDRESS

Enter the IP address that is programmed into the radio. The Controller Board will use this IP address to connect to the radio.

6.13.1.3 USERNAME

Enter the username needed to connect to the radio.

6.13.1.4 PASSWORD

Enter the password needed to connect to the radio.

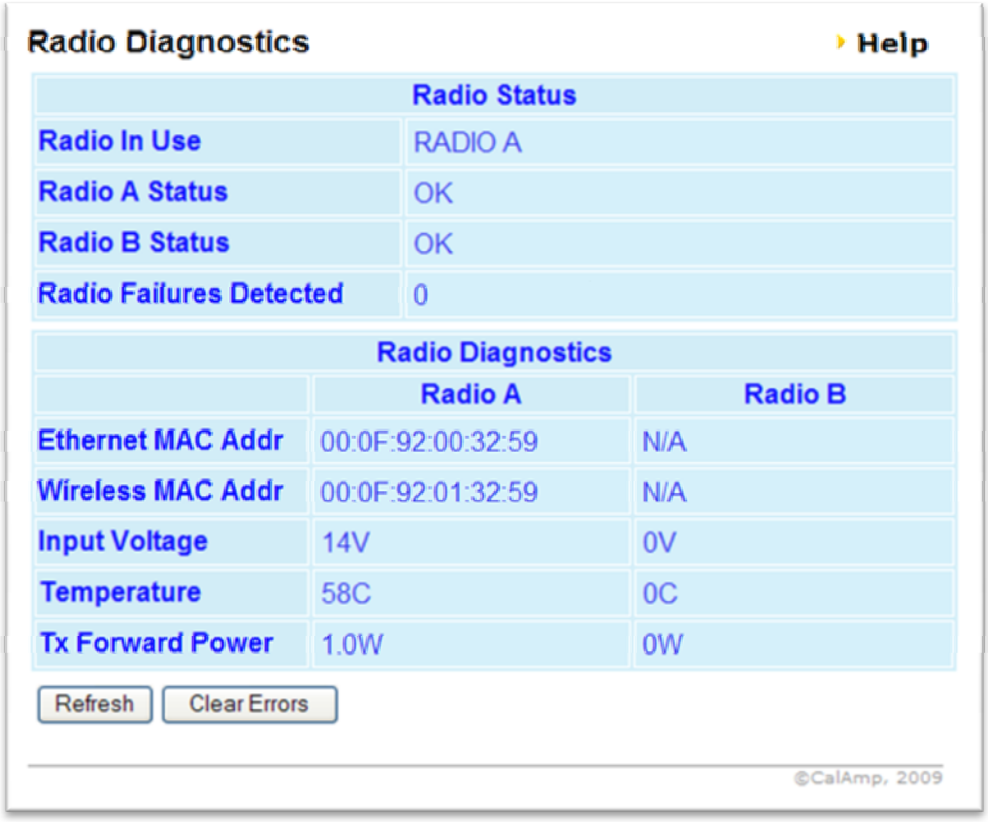
6.13.1.5 RADIO POWER (STANDARD BASE STATION ONLY)

This setting turns the power on or off to the radio. This option is only available on the Standard Base Station. For the Redundant Base Station, go to the "Redundant Setup" web page to control which radio is used.

6.14 RADIO DIAGNOSTICS

The Base Station Controller connects to the radios to monitor the radio's diagnostics and overall health. The radio's diagnostics are reported on this webpage.

Figure 37 - Radio Diagnostics web page



6.14.1 RADIO STATUS

6.14.1.1 RADIO IN USE

This field displays which radio is currently in use.

6.14.1.2 RADIO STATUS (A AND B):

These fields display the status of Radio A and B. If an error is detected with either radio it will be reported on these lines.

6.14.1.3 RADIO FAILURES DETECTED

Displays the number of times a failure was detected with the radios.

6.14.2 RADIO DIAGNOSTICS

The statistics reported in this section are measured and reported by the individual radio(s).

6.14.2.1 MAC ADDRESS

This field displays the MAC Address of the radio(s).

6.14.2.2 WIRELESS MAC ADDRESS

This field displays the wireless MAC Address of the radio(s).

6.14.2.3 INPUT VOLTAGE

This field displays the voltage level supplied to the radios from the Base Station Controller.

6.14.2.4 TEMPERATURE

This field displays the current temperature being read from within the radio.

6.14.2.5 TX FORWARD POWER

This field displays the transmitter power level as programmed by the user.

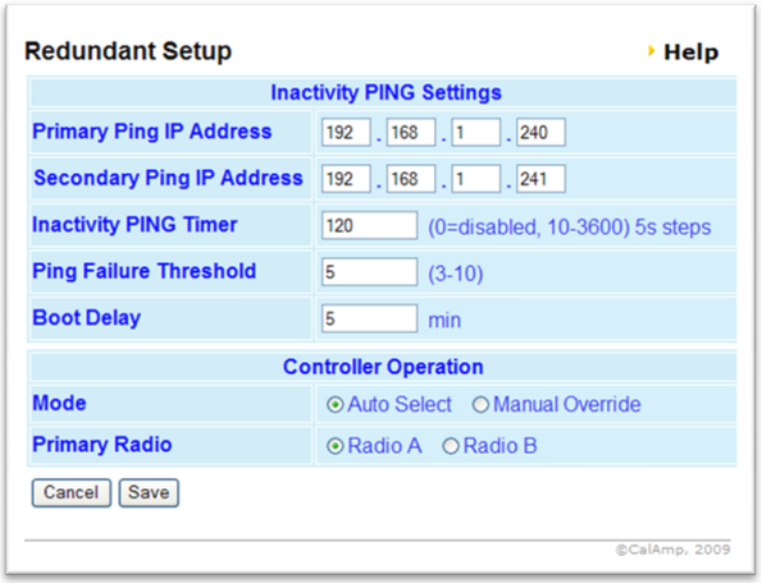
6.14.2.6 REFRESH

The button will update the web page to reflect the most recent changes.

6.15 REDUNDANT SETUP

This web page is only available with Redundant versions of the Base Station. The link will not appear in the Standard versions of the Base Station. The Redundant Setup web page allows the user to program a remote IP address that the Base Station Controller will ping to determine if the RF link is working. This page also allows the user to select Auto or Manual Override mode and switch between radios A and B.

Figure 38 - Redundant Setup web page



6.15.1 PING SETTINGS

6.15.1.1 PRIMARY PING IP ADDRESS

Enter the IP address of a remote radio. The Base Station will generate a ping request to the IP address specified after X number of seconds as specified by the Ping Timer. The primary and secondary IP ping address should be remote radios that are located one RF hop from the Base Station.

Note: If the primary and secondary IP addresses are on separate subnets from the Base Station Controller, static routes must be programmed into the Routing Table of the Base Station Controller. If the routes are not programmed in, the Base Station Controller will be unable to ping the remote addresses and the pings will fail.

6.15.1.2 SECONDARY PING IP ADDRESS

If pings to the Primary IP address fail, the Base Station will attempt to ping the secondary IP address. The secondary ping IP address is not required for the ping utility to function and may be left blank, if desired.

6.15.1.3 PING TIMER

This field specifies a ping interval in increments of 5 seconds. The Base Station will ping the primary or secondary IP addresses after the specified period. Enter 0 to disable the automatic ping feature.

6.15.1.4 PING FAILURE THRESHOLD

The Base Station will switch to the back-up radio if both the primary and the secondary (if available) pings fail this number of times. The failure counter is reset each time a ping is successful.

6.15.1.5 BOOT DELAY

The Base Station Controller will wait the specified number of minutes after booting up a radio before attempting to ping. This parameter is useful to delay normal pingins, if additional time is required to allow the RF network to stabilize.

6.15.2 CONTROLLER OPERATION

6.15.2.1 MODE

The user can set the operational mode of the Base Station. Select "Auto" to allow the Base Station to automatically detect radio failures and switch to the back-up radio in the event of a failure. Select "Manual Override" to override the Base Station's error detection algorithm and force the use of either Radio A or Radio B.

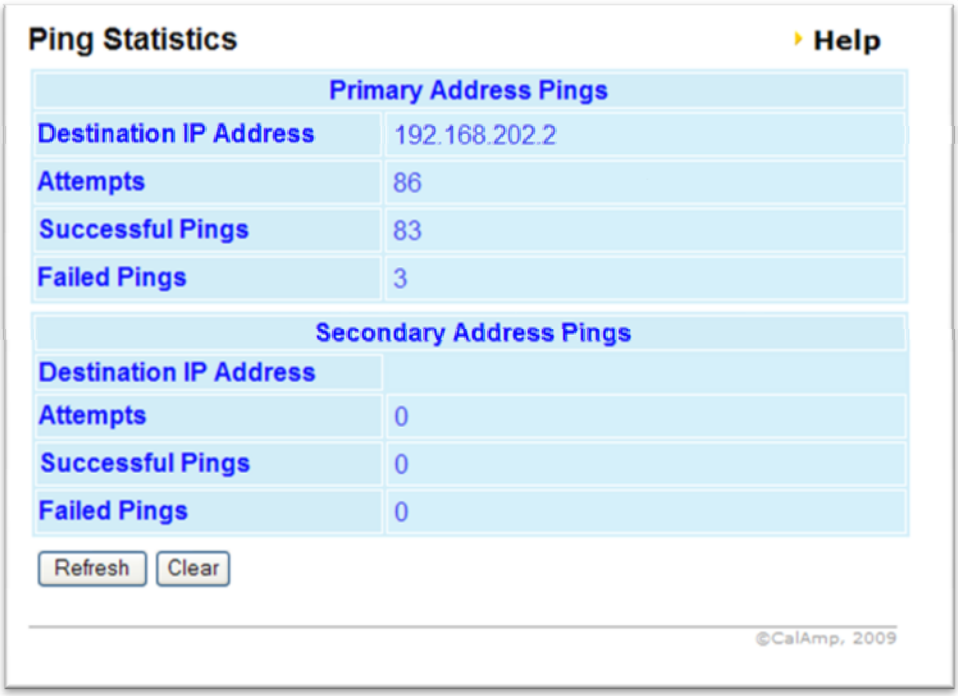
6.15.2.2 PRIMARY RADIO

In Auto mode, this setting selects which radio is the primary radio and which is the backup radio. In Manual Override mode, this setting selects which radio is currently in use.

6.16 PING STATISTICS

This web page is only available with Redundant versions of the Base Station. The link will not appear in the Standard versions of the Base Station. The Ping Statistics page show how often and with what success rate the Base Station Controller has been at pinging the primary and secondary IP addresses specified on the Redundant Setup web page.

Figure 39 - Ping Statistics web page



6.16.1 PRIMARY/SECONDARY ADDRESS PINGS

6.16.1.1 DESTINATION IP ADDRESS

This field displays the destination IP address the Controller Board is attempting to ping.

6.16.1.2 ATTEMPTS

This field displays the number of attempted pings to either the Primary or the Secondary IP address.

6.16.1.3 SUCCESSFUL PINGS

This field displays the number of successful pings to either the Primary or the Secondary IP address.

6.16.1.4 FAILED PINGS

This field displays the number of failed pings to either the Primary or the Secondary IP address.

7 APPENDIX A: BASE STATION SPECIFICATIONS

These specifications are subject to change without notice.

General				
Power Source	11-30 VDC, Negative GND			
RF Impedance	50 Ω			
Operating Temperature	-30° to + 60° C			
Storage Temperature	-40° to + 85° C			
Operating Humidity	5% to 95% non-condensing RH			
Rx Current Drain at 25°C with one radio powered.		DC Input 11V	DC Input 20V	DC Input 30V
	All Relays On All Relays Off	1.3 A (max) 1.1 A (typ) 900 A (typ)	950 A (max) 780 mA (typ) 650 mA (typ)	650 mA (max) 540 mA(typ) 430 mA(typ)
Tx Current Drain at 25°C with one radio powered.	Power Out	DC Input 11V	DC Input 20V	DC Input 30V
	Tx Pwr: 1W All Relays On All Relays Off	2.6 A (max) 2.1 A (typ) 1.9 A (typ)	1.7 A (max) 1.4 A (typ) 1.2 A (typ)	1.1 A (max) 880 mA (typ) 860 mA (typ)
Cold start	60 seconds			
Nominal Dimensions	Chassis: 16" W x 4.75" H x 11.375" D (41 x 12 x 29 cm) Front Panel: 19" x 5.22" x 0.25" (48 x 13 x 0.6 cm)			
Shipping Weight	Standard: 11.5 lbs. (5.2 kg) Redundant: 15 lbs. (6.8 kg)			
Mounting Options	19" Rack Mount			
RF Specifications	See radio specifications and user manual			
FCC / IC Certifications	See radio specifications and user manual			

Display	
11 Status LEDs (Standard) 15 Status LEDs (Redundant)	Controller LEDs: Power, Status, Fan Error Data LEDs: COM Data, Setup Data, Link/Act 1, Link/Act 2 Radio LEDs: Power, Error, Link/Act Other: Alarm Disabled, Manual Override (Redundant Models only)

Connectors		
Antenna Connector	N Female (Tx/Rx)	
Serial Setup Port	DE-9F	
Serial Com Port	DE-9F	
Ethernet RJ-45	Two 10/100 BaseT auto-MDIX (The 2 Ethernet connections are connected internally to each other and to the radio(s) with an embedded Ethernet Switch.)	
Main Power	Power Header	Power Plug
	4 Pin, 5.08mm, Power Header	4 Pin, 5.08mm Power Header Cable: 60 inches Connections: • Aux Power A • Ground

		• Power • Aux Power B
Alarm – I/O; Radio – I/O	Header	Plug
	8 Pin, 3.5mm, Header	8 Pin 3.5mm Tension Clamp Conductor Size: 18-28 AWG
Internal Auxiliary Power	Header	Plug
	4 Pin, 3.5mm, Power Header	4 Pin, 3.5mm, Power Plug Connections: • Aux Power B • Power • Ground • Aux Power A
Alarm I/O Port Specifications	Relays	
	Max Switching Current: Relay 1 or 2 (Pins 1, 2, 3, 4, 5, 6)	1 A
	Max Voltage on Relay 1 (Pins 2, 4, 6)	+/-110 V (DC) +/-125 V (AC)
	Max Voltage on Relay 2 (Pins 1, 3, 5)	+/-50 V
	Max Switching Power	30 W (DC); 37.5 VA (AC)
	Digital Inputs and Outputs	
	VIH: High Level Input Voltage (Pins: 1, 5, 7) I/O Supply Voltage = 1.8V I/O Supply Voltage = 3.3V	 1.2 V min 2.0 V min
	VIL: Low Level Input Voltage (Pins: 1, 5, 7) I/O Supply Voltage= 1.8V I/O Supply Voltage = 3.3V	 0.6 V max 0.8 V max
	Digital Inputs: Input Impedance (Pins 1, 5)	150k ohms
	Digital I/O: Input/Output Impedance (Pin 7)	100 ohms
	Min/Max Input Voltage Pins 1, 5 Pin 7 (I/O Supply = 1.8V) Pin 7 (I/O Supply = 3.3V)	 +/-50 V max -1.0 V min, +2.8 V max -1.0 V min, +4.3 V max
	Output Voltage: Pin 7 Output High: (I/O Supply = 1.8V, Isource = 1mA) (I/O Supply = 3.3V, Isource = 1mA) Output Low: (I/O Supply = 1.8V, Isink = 1mA) (I/O Supply = 3.3V, Isink = 1mA)	 1.7V (typical) 3.2V (typical) 0.1V (typical) 0.1V (typical)
	Analog Input	
	Analog Input (Pin 7) Range I/O Supply = 1.8V I/O Supply = 3.3V	 0.0 V to 1.8 V 0.0 V to 3.3 V
	Analog Input Accuracy	+/- 0.1 V

APPENDIX B: PRODUCT WARRANTY

CalAmp warrants to the original purchaser for use ("Buyer") that data telemetry products manufactured by DRL ("Products") are free from defects in material and workmanship and will conform to DRL's published technical specifications for a period of, except as noted below, one (1) year from the date of shipment to Buyer. DRL makes no warranty with respect to any equipment not manufactured by DRL, and any such equipment shall carry the original equipment manufacturer's warranty only. DRL further makes no warranty as to and specifically disclaims liability for, availability, range, coverage, grade of service or operation of the repeater system provided by the carrier or repeater operator. Any return shipping charges for third party equipment to their respective repair facilities are chargeable and will be passed on to the Buyer.

If any Product fails to meet the warranty set forth above during the applicable warranty period and is returned to a location designated by DRL. DRL, at its option, shall either repair or replace such defective Product, directly or through an authorized service agent, within thirty (30) days of receipt of same. No Products may be returned without prior authorization from DRL. Any repaired or replaced Products shall be warranted for the remainder of the original warranty period. Buyer shall pay all shipping charges, handling charges, fees and duties for returning defective Products to DRL or DRL's authorized service agent. DRL will pay the return shipping charges if the Product is repaired or replaced under warranty, exclusive of fees and duties. Repair or replacement of defective Products as set forth in this paragraph fulfills any and all warranty obligations on the part of DRL.

This warranty is void and DRL shall not be obligated to replace or repair any Products if (i) the Product has been used in other than its normal and customary manner; (ii) the Product has been subject to misuse, accident, neglect or damage or has been used other than with DRL approved accessories and equipment; (iii) unauthorized alteration or repairs have been made or unapproved parts have been used in or with the Product; or (iv) Buyer failed to notify DRL or DRL's authorized service agent of the defect during the applicable warranty period. DRL is the final arbiter of such claims.

THE AFORESAID WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED AND IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. DRL AND BUYER AGREE THAT BUYER'S EXCLUSIVE REMEDY FOR ANY BREACH OF ANY OF SAID WARRANTIES IT AS SET FORTH ABOVE. BUYER AGREES THAT IN NO EVENT SHALL DRL BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES WHETHER ON THE BASIS OF NEGLIGENCE, STRICT LIABILITY OR OTHERWISE. The purpose of the exclusive remedies set forth above shall be to provide Buyer with repair or replacement of non-complying Products in the manner provided above. These exclusive remedies shall not be deemed to have failed of their essential purpose so long as DRL is willing and able to repair or replace non-complying Products in the manner set forth above.

This warranty applies to all Products sold worldwide. Some states do not allow limitations on implied warranties so the above limitations may not be applicable. You may also have other rights, which vary from state to state.

EXCEPTIONS

THIRTY DAY: Tuning and adjustment of telemetry radios

NO WARRANTY: Fuses, lamps and other expendable parts

APPENDIX C: DEFINITIONS

Access Point: Communication hub for users to connect to a LAN. Access Points are important for providing heightened wireless security and for extending the physical range of wireless service accessibility

Airlink: Physical radio frequency connections used for communications between units

ARP: Address Resolution Protocol – Maps Internet address to physical address

Backbone: The part of a network connecting of the bulk of the systems and networks together - handling the most data

Bandwidth: The transmission capacity of a given device or network

Browser: An application program providing the interface to view and interact with all the information on the World Wide Web

COM Port: Both RS-232 serial communications ports of the Radio wireless radio modem. Configured as DCE and designed to connect directly to a DTE

Default Gateway: A device forwarding Internet traffic from your local area network

DCE (Data Communications Equipment): This designation is applied to equipment like modems. DCE is designed to connect to DTE

DHCP (Dynamic Host Configuration Protocol): A networking protocol that allows administrators to assign temporary IP addresses to network computers by "leasing" an IP address to a user for a limited amount of time, instead of assigning permanent IP addresses

DNS (Domain Name Server): Translates the domain name into an IP address

Domain: A specific name for a network of computers

DTE (Data Terminal Equipment): This designation is applied to equipment such as terminals, PCs, RTUs, PLCs, etc. DTE is designed to connect to DCE

Dynamic IP Address: A temporary IP address assigned by a DHCP server

Ethernet: IEEE standard network protocol that specifies how data is placed on and retrieved from a common transmission medium

Firewall: A set of related programs located at a network gateway server that protects the resources of a network from users on other networks

Firmware: The embedded programming code running a networking device

Fragmentation: Breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet

FTP (File Transfer Protocol): A protocol used to transfer files over a TCP/IP network

Gateway: A device interconnecting networks with different, incompatible communications protocols

HDX (Half Duplex): Data transmission occurring in two directions over a single line, using separate Tx and Rx frequencies, but only one direction at a time

HTTP (HyperText Transport Protocol): Communications protocol used to connect to servers on the World Wide Web

IPCONFIG: A Windows 2000 and XP utility that displays the IP address for a particular networking device

MAC (Media Access Control): The unique address a manufacturer assigns to each networking device

MTU (Maximum Transmission Unit): The largest TCP/IP packet hardware can carry

NAT (Network Address Translation): NAT technology translates IP addresses of a local area network to a different IP address for the Internet

Network: A series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users

Network speed: Bit rate on the RF link between units in a network

Node: A network junction or connection point, typically a computer or work station

OIP (Optimized IP): Compresses TCP and UDP headers, and filters unnecessary acknowledgments. OIP makes the most use of the available bandwidth

OTA (Over the Air): Standard for the transmission and reception of application-related information in a wireless communications system

PHY: A PHY chip (called PHYceiver) provides the interface to Ethernet transmission medium. Its purpose is digital access of the modulated link (usually used together with an MII-chip). The PHY defines data rates and transmission method parameters

Ping (Packet Internet Groper): An Internet utility used to determine whether a particular IP address is online

PLC (Programmable Logic Controller): An intelligent device that can make decisions, gather and report information, and control other devices

RIPv2: Dynamic IP routing protocol based on the distance vector algorithm

Router: A networking device connecting multiple networks

RS-232: Industry–standard interface for data transfer

RTU (Remote Terminal Unit): A SCADA device used to gather information or control other devices

SCADA (Supervisory Control and Data Acquisition): A general term referring to systems gathering data and/or performing control operations

SNTP (Simple Network Time Protocol): Protocol for synchronizing clocks of computer systems over packet-switched, variable-latency data networks. Uses UDP as its transport layer

Static IP Address: A fixed address assigned to a computer or device connected to a network

Static Routing: Forwarding data in a network via a fixed path

Subnet Mask: An Ethernet address code determining network size

Switch: A device connecting computing devices to host computers, allowing a large number of devices to share a limited number of ports

TCP (Transmission Control Protocol): A network protocol for transmitting data that requires acknowledgement from the recipient of data sent

TCP/IP (Transmission Control Protocol/Internet Protocol): A set of protocols for network communications

Telnet: User command and TCP/IP protocol used for accessing remote PCs

TFTP (Trivial File Transfer Protocol): UDP/IP based file transfer protocol

Topology: The physical layout of a network

Transparent: Device capable of transmitting all data without regard to special characters, etc

Terminal Server: Acts as a converter between Ethernet/IP and RS-232 protocols

UDP (User Datagram Protocol): Network protocol for transmitting data that does not require acknowledgement from the recipient of the sent data

Upgrade: To replace existing software or firmware with a newer version

URL (Universal Resource Locator): The address of a file located on the Internet

ABOUT CALAMP

CalAmp is a leading provider of wireless communications products that enable anytime/anywhere access to critical information, data and entertainment content. With comprehensive capabilities ranging from product design and development through volume production, CalAmp delivers cost-effective high quality solutions to a broad array of customers and end markets. CalAmp is the leading supplier of Direct Broadcast Satellite (DBS) outdoor customer premise equipment to the U.S. satellite television market. The Company also provides wireless data communication solutions for the telemetry and asset tracking markets, private wireless networks, public safety communications and critical infrastructure and process control applications. For additional information, please visit the Company's website at www.calamp.com.