Version 5.6.1

WAVES NETWORK CONFIGURATION TOOL ADMINISTRATOR MANUAL

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Cooper Notification
7565 Commerce Court
Sarasota, FL 34243
Tel.: 941.487.2300
Fax: 941.487.2387
www.coopernotification.com

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TRADEMARKS

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DISCLAIMER

This manual has been reviewed for accuracy when used in conjunction with Cooper Notification authorized administrator and/or operator training. The information contained herein was accurate for the software at the time of this manual's production. Cooper Notification assumes no liability for damages incurred directly or indirectly from errors, omissions, or discrepancies between WAVES and the manual.

DISCLAIMER - NCT WHEN USED WITH TRX OR CRLU

Changes or modifications that are not expressly approved by Cooper Notification could void the user's right to operate the equipment.

This device complies with Part 15 of the Federal Communications Commission (FCC) Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

The following table (Table FR.1) contains a list of the approved antennae for use with a TRX or CRLU. Antenna installation is limited to those listed in Table FR.1 and may only be installed by a professional.

TABLE FR.1 Antennae Approved for Use

Description	Cooper P/N	Manufacturer	Manufacturer Part Number
Antenna, 9DBI, Omnidirectional	A01-02255	Mobile Mark	OD9-2400
Antenna, Omni-directional, 15 DBI	A01-02257	Hyperlink Technologies	HG2415U-PRO
Antenna, Directional, 8DBI	A01-02259	Hyperlink Technologies	RE09P-NM
Antenna, Omnidirectional, 3DBI	A01-02260	Hyperlink Technologies	HG2403RD-NM
Antenna, Omni, 6DBI	A01-02820	Maxrad	MFB24006
Antenna, 2.4GHZ 15DBI, GRID, N-FEM CON	A01-02856	Hyperlink Technologies	HG2415G-NF
Antenna, 2.4 GHZ, 13.9 DBI, YAGI	A01-02859	Laird Technologies	PC2415N
Antenna, 2.4GHZ, 15DBI, YAGI, N-FEMALE	A01-02860	Hyperlink Technologies	HG2415Y-NF
Antenna, Fixed, 15DBI	A03-02416	Hyperlink Technologies	HG2416P

SAFETY SUMMARY

Safety Notices, Warnings, and Cautions must be applied during operation and maintenance of the equipment. If situations arise that are not covered in the General Safety Notices, Warnings, or Cautions the local authority will issue instructions as deemed necessary to resolve the situation.

GENERAL SAFETY NOTICES

The following safety notices supplement the specific Warnings and Cautions found throughout this manual.

- Equipment must be clear of all power lines, wires, and electrical obstructions at all times.
- Ensure that precautionary measures are employed to prevent applying power to equipment at any time maintenance work is in progress.
- Do not touch electronic components with wet hands.
- Do not make any unauthorized alterations to equipment or components.
- Do not wear loose clothing while working around rotating parts of machinery.
- When working near electricity do not use metal rules, flashlights, metallic pencils, or any other object having exposed conducting material.
- When possible, avoid installing equipment during severe or wet conditions. Handling equipment with wet hands may cause slippage resulting in bodily injury and/or damage to equipment.
- Ensure the area is well ventilated when using cleaning, gasoline, and oil products. Avoid prolonged breathing of fumes which may cause physical harm.
- Proper personal protective equipment (PPE) should be used when changing a battery. This equipment includes acid resistant gloves, and safety glasses, as well as proper body acid-resistance coverings and safety shoes.

Circuit boards are electrostatic sensitive. All Electrostatic Discharge (ESD) sensitive components contain solid state circuits that may become damaged when contacted with an electrostatic charge. Extreme care must be taken to protect the circuitry.

Wear a static dissipating grounding wrist strap or similar protective device grounded at the nearest available bare metal chassis or other ground point BEFORE touching the circuit board.

Always hold a components board by its edges or facing plate if available. Avoid touching the edge connectors. Never slide components over any surface.

Failure to follow correct grounding procedures may cause severe damage to the circuitry.

OPERATING RESPONSIBILITIES

It is the responsibility of the owner and/or operator of the product to ensure the following.

- The equipment is correctly and safely installed.
- When installed, the equipment fully complies with federal, state, and local codes.
- Any person operating this equipment has been properly trained.
- Any person who has not been trained on the safe use of this equipment does not have access to it.

- Any person operating this equipment has access to all documentation and information required for the safe use and operation of this equipment.
- Any person operating this equipment remains alert at all times. Never operate machinery when physically or mentally fatigued, or while under the influence of alcohol, drugs, or medication.
- The equipment is properly maintained and safety inspected at regularly scheduled intervals.

WARNINGS

Specific warnings used in this manual are summarized below and pages referenced. These warnings appear throughout the manual.

- Make sure electrical connections are secure before applying power to a unit. Failure to secure connection may cause an electrical arc resulting in physical shock or damage to equipment. (Page 74)

CAUTIONS

Specific cautions used in this manual are summarized below and pages referenced. These cautions appear throughout the manual.

- (None cited.)

MODIFICATION RECORD

The following table displays the modifications made to this manual.

TABLE FR.2 Manual Modification Record

MOD #	ECN #	Description
A	N/A	Original
B	90132	Front Matter: Updated General Safety Notices and added “Operating Responsibilities” section to stay consistent with manual template style. Preface: Changed “Customer Support” to “Customer Satisfaction” and corrected the phone number. Section 4.1.1: Added two new notes (one after the second paragraph and one at the end of the section). Sections 4.1.1.1, 4.2.1.1, and 4.2.1.2: Changed reference to section in “*WAVES Administrator Manual*” from “Audio Settings” to “WAVES Volume Settings”. Section 4.2.4.4: Rewrote end of first paragraph; rewrote step 1; rewrote paragraph before Table 4.3. Section 4.2.4.4: Edited Table 4.3 in the following rows - Battery row, RSSI row, Miss Correlations row, deleted Link Enable row, Audio CRC fail row, Speaker Tower Status row, ACU Status row.
C	100026	Front Matter: Added disclaimer pertaining to FCC rules and the NCT manual; Added list of approved antennae for TRX and CRLU.

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Preface

This manual provides a user with the information needed to install, configure, and operate the WAVES system. To better understand WAVES functionalities and features, a system overview is also provided.

An outline of each chapter's content is briefly described in the section below, as well as a list of terms and conventions used in this manual and customer support information.

About This Manual

To assist you in quickly identifying each chapter's content, a brief chapter description is provided below.

Chapter 1, "Introduction"

This chapter presents the WAVES system and its capabilities, main features, components, and principle of operation.

Chapter 2, "Using the Network Configuration Tool"

This chapter familiarizes the user with the Configuration Tool screen and its menus and toolbars.

Chapter 3, "Creating a Functional Site Tree"

This chapter describes how to build a functional site tree of elements in the WAVES network.

Chapter 4, "Configuring Site Tree Elements"

This chapter describes how to define zone, sub-zone, and unit properties for each element's on the site tree.

Chapter 5, "Setting Up Peripheral Devices"

This chapter describes procedures for configuring the peripheral devices in the WAVES network.

Appendix A, "TRX Transmitting Offset Assignments"

This appendix provides recommended transmitting offset assignment numbers for RF frequency values.

Appendix B, “TRX Firmware Update Procedures”

This appendix provides instructions for updating or reloading transceiver firmware.

Appendix C, “Configuring the RF AGC Setting”

This appendix describes how to change the AGC setting by writing a custom command and sending it to a TRX.

Appendix D, “Troubleshooting”

This appendix provides a list of problems and resolutions for problems that may occur when using the Network Configuration Tool.

Documentation Conventions

The following tables describe frequently used terms and icon conventions found in this manual. For definitions of additional words and acronyms used in this manual, see the Glossary on page 81.

TABLE PR.1 Documentation Terms

Term	Description
Base Station	The command center of the WAVES network. The term is used interchangeably with “IBS.”
Configuration Tool	Part of the WAVES application that allows administrators to configure and define global and individual transceiver settings for devices in the WAVES system. The term is used interchangeably with “Network Configuration Tool” and “NCT.”
Device	An appliance attached to a transceiver that provides input or sends messages into the WAVES system. For example a chemical detector or wireless and fixed duress activators.
Global	The entire installation site on the unit site tree. The term is used interchangeably with “Theater” or “Site.”
IBS	Integrated Base Station. The command center of the WAVES network. The term is used interchangeably with “Base Station.”
NCT	Part of the WAVES application that allows administrators to configure and define global and individual transceiver settings for devices in the WAVES system. The term is used interchangeably with “Configuration Tool” and “Network Configuration Tool.”
Network Configuration Tool	Part of the WAVES application that allows administrators to configure and define global and individual “transceiver settings for devices in the WAVES system. The term is used interchangeably with “Configuration Tool” and “NCT.”

TABLE PR.1 Documentation Terms

Term	Description
Site (Site-wide)	The entire installation site on the unit site tree. The term is used interchangeably with “Theater” and “Global.”
Theater	The entire installation site on the unit site tree. The term is used interchangeably with “Global” and “Site.”
Transceiver	An addressable node in the WAVES wireless network that receives and broadcasts messages, such as the TRX-401, CRLU-201, VHF Radio 400, and UHF Radio 500. he term is used interchangeably with “Unit”, “TRX”, or “CRLU.”
TRX	An addressable transceiver node in the WAVES wireless network that uses FHSS technology to broadcast RF signals over a wide range of frequencies. The term is used interchangeably with “Transceiver” and “Unit.”
Unit	An addressable node on the site tree that represents an individual transceiver in the WAVES network. The term is used interchangeably with 'Transceiver' or “TRX.”

TABLE PR.2 Icon Conventions

Icon	Description
	Users should not disregard information in a Note. Indicates information that emphasizes or supplements important points of the main text which, in some cases, may be essential to the completion of a task. A Note is typed in regular lower case text.
	**ALERTS THE USER TO POSSIBLE HAZARDS WHICH MAY CAUSE LOSS OF LIFE, PHYSICAL INJURY OR ILL HEALTH IN ANY FORM EITHER IMMEDIATE OR LATENT. A WARNING NOTE IS TYPED IN BOLD UPPER CASE TEXT.**
	**Alerts the user to possible hazards which may cause damage to equipment but not danger to people. A Caution note is typed in bold lower case text.**

Getting Help

For assistance, comments, or inquiries please contact Customer Satisfaction at the following:

Cooper Notification
7565 Commerce Court
Sarasota, Florida 34243
U.S.A.
Telephone:941.487.2379
Fax:941.487.2389
Email:mvsr-support@cooperindustries.com

CHAPTER 1

Introduction

The Wireless Audio Visual Emergency System (WAVES) is an integrated alerting and site protection system. It provides control of live and recorded audio and visual warnings and instructions before, during, and after emergency situations to help direct everyone to safety. This chapter provides an overview of WAVES, its features, and components.

The following sections are included in this chapter.

- What Is WAVES?
- WAVES Features
- How Does WAVES Work?
- WAVES System Components
- Peripheral Devices

1.1 WHAT IS WAVES?

WAVES is a command and control emergency notification system that broadcasts safety sirens, live and recorded voice messages, and visual notifications via secure wireless networks to alert, warn, and inform people of what to do in an emergency or disaster. Using zones and subzones, people in immediate danger areas, whether indoor or outdoor, can be alerted quickly and accurately.

Developed using secure wireless technology, WAVES is the de-facto standard for anti-terrorism/force protection systems used by the Federal Government. Single frequency, narrow band VHF/UHF communications, as well as secure digital Frequency Hopping Spread Spectrum (FHSS) technology and a redundancy backbone are incorporated, preventing jamming, interference, and eavesdropping as well as protecting the network in the event of a disaster. The WAVES network reconfigures automatically if a unit goes down, allowing alerts and messages to continue broadcasting without interruption. In the event the primary command center is destroyed, a fixed or mobile secondary station(s) can be used to control the system. To provide backup power if a grid power loss is experienced, each WAVES transceiver and base station are protected by an uninterruptible power supply (UPS). Additionally, optional solar power and backup generators can be added to the system, to ensure system operation during power loss.

From speaker sirens to indoor speakers and from strobes to LED signs, WAVES can send emergency messages in a variety of formats. An event can be programmed (scripted) to

trigger notifications without further intervention of a human operator, thereby decreasing response time and the likelihood of notification failures. For example, a scripted event can be automatically activated by an alert sensor, such as a push button at a gate, a wireless panic button or a Chemical, Biological, Radiological and Nuclear (CBRN) detector. WAVES also provides the ability to remotely access a base station and activate critical mass notification functions by using a telephone (including cellular) or a networked computer, as well as wired or wireless activators.

1.2 WAVES FEATURES

WAVES is the most reliable, field-proven secure digital wireless system available today. Its system features include the following:

1.2.1 Command and Control

WAVES provides the user a sophisticated command and control capability with an easy-to-use user interface. Its PC-controllable wireless network, highly adaptable to virtually any type and size facility or area, can operate as a standalone system or be integrated with security systems such as intrusion detection, weather systems, access control, fire alarms, and CBRN or Nuclear, Biological, Chemical (NBC) detection systems.

1.2.2 Simultaneous Messaging

In a WAVES network, the locally stored message feature enables simultaneous activation of different messages at different nodes, allowing each transceiver or HPSA at a site to play different messages simultaneously, while retaining the common-message alerting that WAVES already performs.

1.2.3 Real-Time Emergency Alerting

WAVES integration with Cooper Notification's Roam Secure Alert Network (RSAN™) is an optional feature that provides for the exchange of Common Alerting Protocol (CAP) messages by way of a TCP/IP network such as LAN, WAN, or the Internet. Through this interoperability alerts can be quickly issued to a text-enabled device, phone, fax, or computer.

1.2.4 Pre-Approved Frequencies

WAVES wireless frequencies are pre-approved for use throughout military and government facilities (JF12 #7787 and SFAF), requiring no further action nor creating any delays in use.

1.2.5 Chemical, Biological, Radiological, and Nuclear Capability

WAVES has the capability to integrate with other control systems, including CBRN systems. Cooper Notification has worked with the US Marine Corps on integration of ACADA GID-3 sensor devices with WAVES and continues to work with the U.S. military to integrate with the most advanced CBRN sensor systems.

1.2.6 Portable Field Units

WAVES portable systems, Tactical WAVES (TACWAVES™), Mobile Speaker Tower (MSPT™), and Mobile Speaker Array (MSA™), can operate as standalone or be

integrated into one system to work as field notification units for tactical operations or temporary events.

1.2.7 UFC Compliant

U.S. Army Corps of Engineers identifies Cooper Notification as fully compliant with UFC 4-021-01 Individual Building MNS. Cooper Notification is the only company that can supply all four types of mass notification systems as mentioned in the November 21, 2003 ECB, which included the Individual Building, Giant Voice, Telephone Alerting, and Installation-Wide Control System.

1.2.8 J-34 Department of Defense Anti-Terrorism Directorate

WAVES is the only wireless alerting system that meets all J-34 Department of Defense Anti-Terrorism Directorate requirements. In 1998 the Joint Chiefs of Staff established 11 requirements that any Personnel Alerting System (PAS) system must meet. U.S. Army CECOM tested available PAS systems and found that WAVES was the only system that fulfilled all 11 requirements.

1.3 HOW DOES WAVES WORK?

The WAVES system consists of a base station and up to 15,376 uniquely addressable field transceivers that create a radio frequency (RF) network of many transceivers connected together. Each transceiver has a single transmitter that it listens to and may have none, one, or multiple transceivers that it transmits to. The base station transceiver is the highest level transmitter that all other transceivers listen to, either directly or through other transceivers. All digital traffic flows from the base station transceiver in the forward channel and flows back through the backwards channel.

The RF network is controlled by firmware inside each transceiver. When a transceiver is powered up it searches for a transmitter to listen to. Upon locating a valid transmitter that has sufficient signal strength, the transceiver locks-on to the transmitter. Any loss of signal from the transmitter causes the transceiver to search for another transmitter in its table of valid transmitters. Once locked-in, communication can take place between nodes in the WAVES system.

In addition to the hardware RF path, each transceiver listens and reports to the base station computer's WAVES software. A logical address is assigned to each transceiver, based upon its location in an installation site tree. All commands to and from the transceiver reference its address. For any on-line element information to be received by the WAVES software and reflected the database, the correct address must be programmed into the transceiver. This is automatically done when you program the various properties of each transceiver. Once the transceivers are configured and the system is setup, an operator stationed at a WAVES console can monitor the system and initiate responses to notifications.

1.4 WAVES SYSTEM COMPONENTS

- Integrated Base Station (IBS)
  - Base Station Transceivers
  - Audio Data Unit (ADU-301)

  - Central Command Unit (Personal Computer)
- Field Transceivers

1.4.1 Integrated Base Station (IBS)

The IBS is the command center of the WAVES network. All sensor appliances, like Wireless Activator (WA) panic buttons and Nuclear, Biological, and Chemical (NBC) detectors send their signals through the RF network to the IBS, which is running WAVES software. The software is set up during installation to either immediately respond and alert personnel to safety through notification appliances, such as speakers, strobes, and LED text signs, or to allow the operator at the IBS to decide what action to take.

In addition to optional peripheral devices the IBS system includes a UPS, Primary/Alternate Base Station Switch, microphone, cables, antennas, and a built-in speaker. The core IBS components are described in the sections that follow.

FIGURE 1.1 Integrated Base Station

1.4.1.1 Base Station Transceivers

A base station transceiver facilitates communication between a WAVES IBS and field transceiver nodes. The IBS can contain one or both of the following base station transceivers: a CRLU-201 for TRX communication, and/or a Radio-400 (VHF)/Radio-500 (UHF) transceiver.

1.4.1.1.1 CRLU-201

The CRLU-201 is the base station transceiver unit of the WAVES system for TRX FHSS communication. It transmits multiple channels of audio and visual display messages, as well as RS-232 data and control information for wireless distribution within the WAVES system. At the same time, it receives RS-232 data and network-wide supervisory Built-in Test (BIT) diagnostic reports for subsequent transmission to the WAVES software.

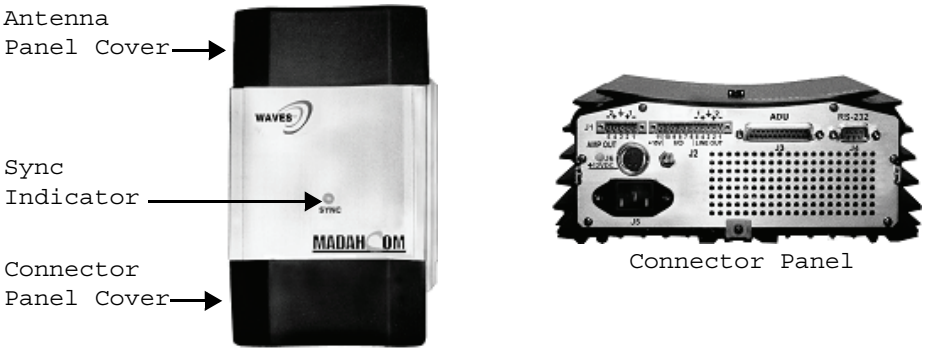


FIGURE 1.2 CRLU-201

The CRLU-201 is a fully integrated unit with an integral power supply, audio amplifiers, and antennas. It digitizes incoming analog audio streams from an ADU-301 and

communicates with the ADU-301 through a multi-pair, shielded cable terminated in a DB-25 connector. RS-232 data is communicated through a DB-9 connector. The CRLU can also be programmed to function as a TRX field transceiver.

The CRLU is powered locally from either an AC (100-240V, 47-63Hz) or DC (12-16V) power source, or remotely from the ADU-301 through a designed cable. The device can also accommodate an optional UPS-901 that can provide up to five hours of operation. The UPS-901 batteries are stackable, allowing for extended backup time.

All CRLU-201 and UPS-901 circuits have a Class 2 rating.

You can address the following functions to the CRLU: PTT, volume, discrete I/O and audio messages. You cannot address visual messages to the CRLU.

The CRLU-201 can be configured to function as a Satellite Relay Unit (SRLU) and a Backup CRLU to create an Alternate Base Station.

1.4.1.1.1.1 CRLU-201 SRLU Configuration

The SRLU is used as a relay with the added capability of being an independent audio source for local announcements, or when more than two audio sources are needed.

The following diagram is an example of an application with a SRLU.

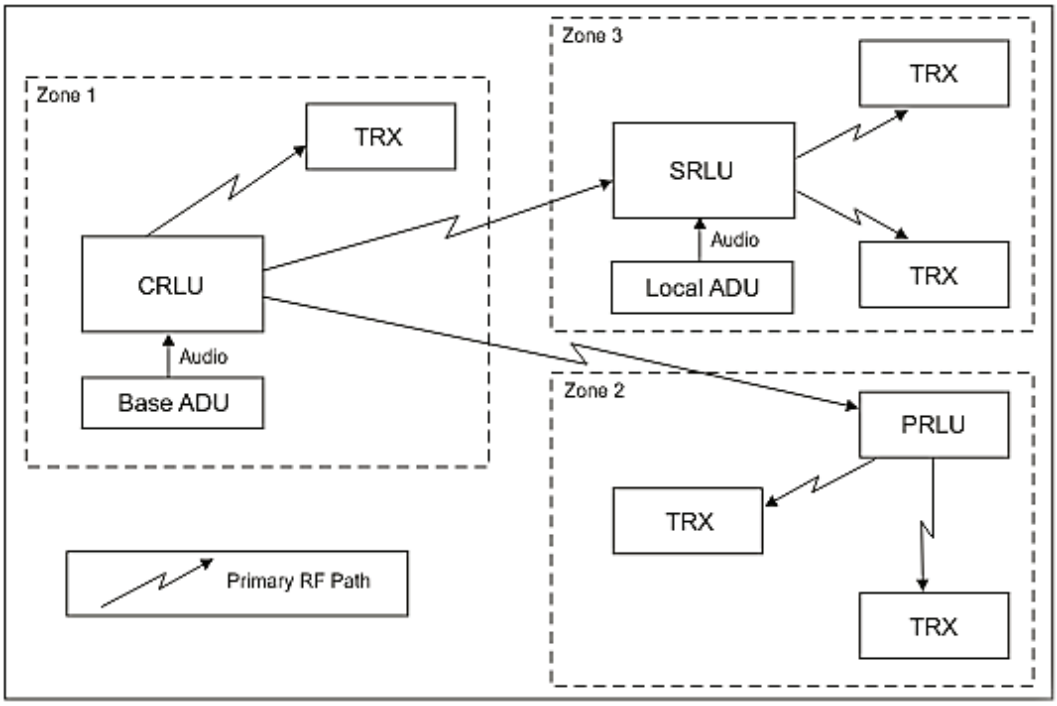


FIGURE 1.3 Example of an application with SRLU

1.4.1.1.1.2 SRLU Audio/Voice Switching Priorities

The SRLU audio channels can be configured to broadcast one of two audio sources: Local or Base. In Local mode, the local audio inputs (the output from the local ADU) are transmitted to the SRLU zone. In Base mode, only the audio channels received from the CRLU are transmitted to the SRLU zone.

The SRLU voice channels are configured to establish the relative priority of the PTT messages received from the local ADU and the CRLU. In Base mode, a PTT message

from the CRLU will override a PTT from the local ADU. In Local mode, PTT from the local ADU will override a PTT message from the CRLU.

See the "Audio Files" section in the *WAVES Administrator Manual* for instructions on setting the SRLU audio and voice configurations.

1.4.1.1.1.3 Backup CRLU-201 Configuration (Alternate Base Station)

As an Alternate Base Station, the CRLU-201functions as an SRLU until activated by turning the Primary/Alternate Base Station switch on the front of the IBS. When the switch is in Primary position, the unit acts as an SRLU. When the switch is Alternate position, the unit becomes the network CRLU.

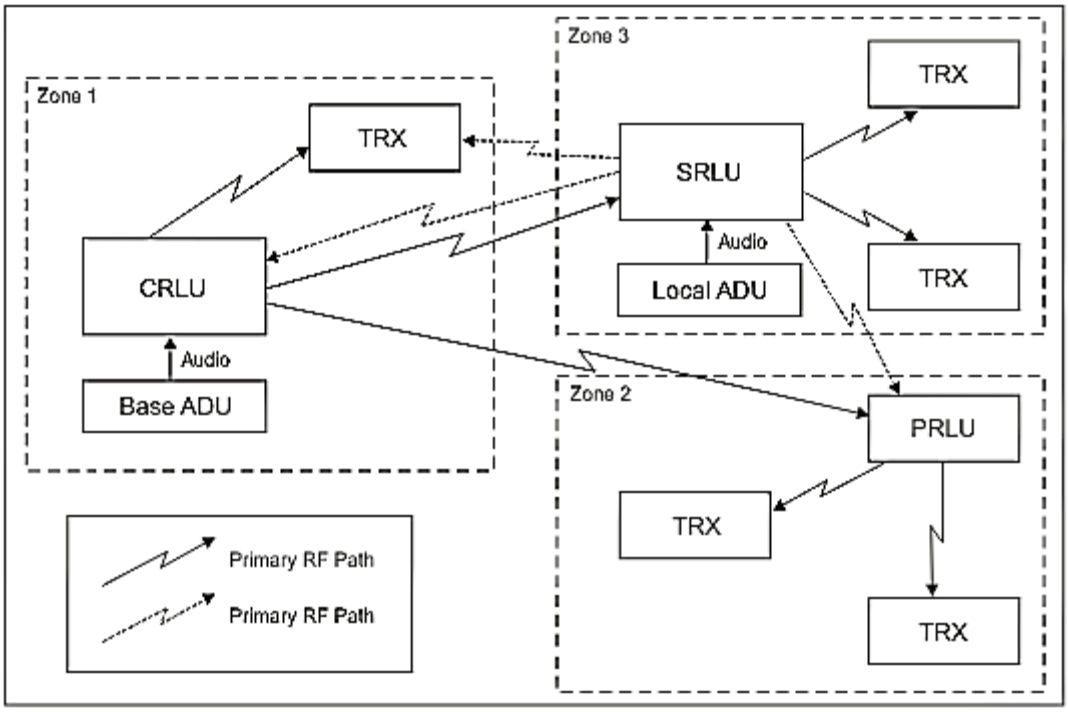


FIGURE 1.4 Example of site with Backup CRLU

All functions of the SRLU, as described in Section 1.4.1.1.1.1, "CRLU-201 SRLU Configuration", apply to the Backup CRLU configuration.

1.4.1.1.2 Radio-400 and Radio-500 (Base)

The base station Radio-400 (VHF) or 500 (UHF) are transceivers used to facilitate communication between an IBS and VHF/UHF-radio-equipped nodes. For WAVES systems using VHF/UHF radio nodes, the IBS contains a Master COTS radio controller that communicates through a Master COTS VHF/UHF radio with a network of VHF/UHF radio-enabled nodes in the WAVES network. As with the CRLU, the VHF/UHF radio transmits audio messages and control information for distribution within the WAVES system. The radio also processes supervisory diagnostic reports.

FIGURE 1.5 Radio-400 VHF base station transceiver

1.4.1.2 ADU-301

The ADU-301 is the interface between the IBS personal computer (PC) and the base station transceiver, providing an interface between its input audio and data channels and the base station transceiver. It converts data from the PC to a form usable to the transceiver and provides the interface. The base station transceiver subsequently communicates with the field transceivers.

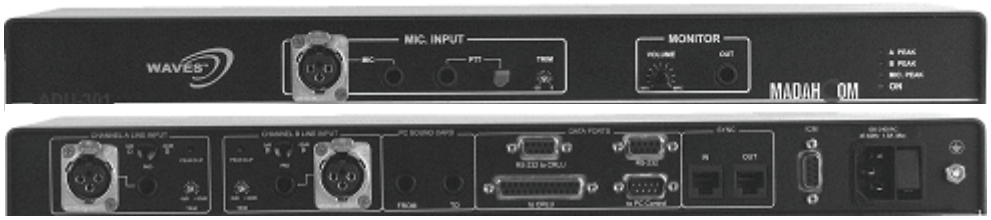


FIGURE 1.6 ADU-301 front and rear panels

The following connections can be made by way of the ports on the ADU-301.

- Two balanced or unbalanced line-level audio sources (ChA and ChB) can be connected via the XLR connector on the front panel or the ¼-inch phono jacks on the rear panel. Each channel level can be adjusted using the -20 dB pad, the +30 dB trimmer and the peak/clip LED indicators (on the front and rear panels).
- A PC sound card can be connected (TO/FROM) via stereo phono jacks provided on the rear panel.
- A microphone can be connected via the XLR connector on the front panel or the ¼-inch phono jack on the front panel. The microphone input includes a pre-amplifier and soft-limiter compressor. The microphone can be activated via the front panel PTT switch or from an external control signal connected to a ¼-inch phono jack.
- A monitor stereo speaker/headphone output with adjustable gain up to 4 watts per channel is provided via a ¼-inch phono jack on the front panel (Tip – Channel A + Voice and Ring – Channel B + Voice).
- A bridge can be set up between a data device and the CRLU-201 RS-232 connector via the ADU-301 DATA Ports: RS-232 TO CRLU and RS-232 connectors.
- RS-232 to RS-422 conversion can be made through an interface between the optional PC (RS-232 via its DATA PORTS: TO PC CONTROL connector) and the CRLU-201 (RS-422 via its DATA PORTS: To CRLU connector).
- Power is provided locally from an AC (100-240V, 47-63Hz) power source. It can also provide power to, or receive power from the CRLU-201 through the CAB-ADU-25-CRLU-4 cable.

All ADU-301 circuits have a Class 2 rating.

The ADU voice output depends on one of the two voice inputs and on the following priorities:

- **Top Priority –** Microphone + PTT. When pressing the PTT button, the microphone is enabled, and any other voice signal is disabled.
- **Second Priority –** Sound card. When activating a message through the computer (by the Scheduler or audio/visual message), the audio output is transmitted.

1.4.1.3 IBS Personal Computer

The IBS contains a custom personal computer that is the heart of the system and controls the network through the WAVES software application. The network database, all messages, and scheduled events are stored in and controlled from the PC.

Using the WAVES software, transceivers can be monitored from the base station and grouped into zones and sub-zones to facilitate real-time control of audio, voice and data messages, prerecorded and saved messages, and scheduled message broadcasts.

1.4.2 Field Transceivers

Field transceivers are addressable nodes in the wireless network that receive and broadcast messages sent to them. The transceivers can independently process information selectively transmitted to them from the base station or from local sensors. They then amplify audio signals for speakers and send data to visual display signs and other connected output appliances. This enables WAVES installers to adapt each transceiver to its immediate acoustic environment and the WAVES operators to adapt each transceiver to changing conditions. In this way, acoustic quality and transceiver integrity can be maintained.

1.4.2.1 TRX-401

The TRX-401 is an addressable transceiver node in the WAVES network that uses FHSS technology to broadcast RF signals over a wide range of frequencies. Frequency offsets are used to spread RF signals. Receiving stations use their frequency offset settings to recognize and retrieve RF signals directed to them. Each transmitter receiver pair hops in synchronization across 76 channels in a pseudo-random pattern. Spreading the frequency like this makes the signal hard to interfere with and hard to eavesdrop into.

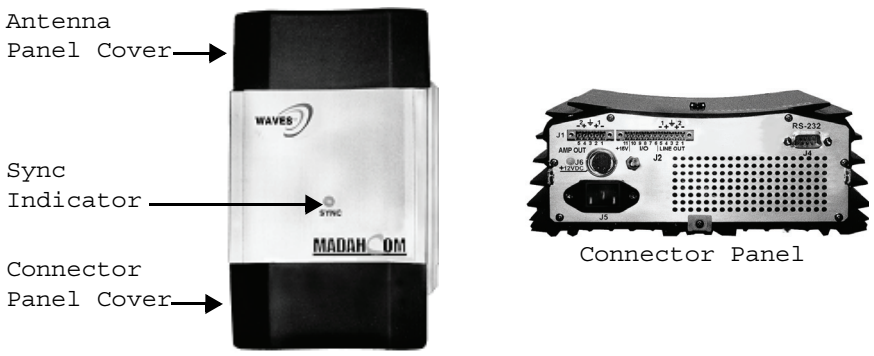


FIGURE 1.7 TRX-401

From the base station, WAVES can transmit two high-fidelity audio channels multiplexed with a full-duplex data channel that receives and transmits signals to on-site control and monitoring appliances. This enables the WAVES operator to transmit an audio broadcast and a voice announcement at any given time and synchronize them with a display message sent on the data channel.

Each TRX is programmed to receive communication from up to nine other TRXs. This provides increased reliability and survivability. In the event that the primary source TRX fails, the signal is automatically rerouted through secondary TRXs. Finally, the WAVES operator at the base station has full real-time control of each TRX's audio and data parameter settings, enabling the operator not only control of the audio and data settings but also ability to monitor each transceiver's operating parameters and status.

1.4.2.2 Radio-400 and Radio-500 (Field)

Radio-400 and Radio-500 units are VHF and UHF off-the-shelf radios, respectively, used as transceiver nodes operating on a single-frequency narrow band. Radio frequency settings are preprogrammed in manufacturing to customer specifications. Commands sent from the WAVES Base Station are received by the radio and played through configured devices. The radio also transmits messages and status reports upstream to the IBS.

FIGURE 1.8 Radio-400 VHF field transceiver

1.5 PERIPHERAL DEVICES

In WAVES, peripheral devices are any appliances that provide input or send messages into the WAVES system. For example, chemical detectors can be programmed to alert the fire department response team to what chemical agent type is dispersing and where it appears. Teams can don appropriate gear before arriving at the site and down-wind buildings can be immediately alerted to evacuate. In the event of a systematic intrusion, patterns of sensors show up immediately on the WAVES satellite map for the command unit to make appropriate responses to save lives. WAVES is also capable of activating other appliances, such as access-control bollards using custom-built interfaces.

Sensor appliances configured in the WAVES network are capable of triggering assigned WACOL scripts that send messages to notification appliances. For example, when activated, a script can play prerecorded messages to speakers, cause strobes to flash or display a preset message on an LED sign. The scripts can be activated as needed or scheduled to play automatically to assigned sensor appliance. For information on creating scripts, refer to the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system.

Examples of peripheral devices include the following:

- **Wireless and Fixed Duress Activators** - Sense input from users at remote locations.
- **Intrusion Detection Systems (IDS)** - Sends detection status messages to WAVES.
- **NBC/CBRN Detectors** - Sends status and alarm messages to WAVES.
- **WAVES Microphone** - Sends live audio and command PTT messages to WAVES.

Figure 1.9 displays some of the peripheral appliances that can be connected to the WAVES network.

FIGURE 1.9 WAVES peripheral devices

CHAPTER 2

Using the Network Configuration Tool

The Network Configuration Tool provides access to administrator tasks that are essential in setting up unit parameters in the WAVES network. This chapter describes how to open the application and familiarizes the user with the screen components.

The following sections are included in this chapter.

- What is the Network Configuration Tool?
- Exploring the Screen Components

2.1 WHAT IS THE NETWORK CONFIGURATION TOOL?

The Network Configuration Tool allows the administrator to configure and define global and individual transceiver settings for devices in the WAVES system.

- Global settings affect the entire installation site and include parameters internal to the WAVES application, as well as several parameters that are uniformly loaded into all transceivers.
- Transceiver settings affect an individual unit and its behavior in the WAVES system.

When an administrator opens the Network Configuration Tool, WAVES 7 remains open in the background, and, if there are any scripts in the scripts queue, asks the operator if it is OK to delete the currently queued scripts before opening the Configuration Tool. After the Network Configuration Tool opens, WAVES 7 is disconnected from the hardware network devices so that any 'inbound' messages from devices and any 'outbound', AreaAlert, or scheduled messages are discarded until the Configuration Tool is closed.

When the administrator closes the Configuration Tool, WAVES 7 automatically restarts the connection to the hardware network devices and a change to the database is noted on the WAVES Event List in the Status panel. In addition, the Event log will continue to log any scripts that attempted to play when the Configuration Tool was active.

You CANNOT send prerecorded audio or visual messages, or make live PTT announcements using the Network Configuration tool. Only global and unit properties settings and verification actions are permitted.

2.1.1 Launching the Application

For an existing base station, the NCT automatically opens the last launched database, which should be the same one that is open in WAVES 7. For a new base station database, you must identify the *.wvs file.

2.1.1.1 Opening the Configuration Tool for the First Time

1. From the **WAVES 7** screen, login as **Administrator**.
2. From the **Administration** menu, select **Network Configuration**. The WAVES 7 Off-Line dialog box appears advising you that the CRLU Service will be stopped while the Configuration Tool is open.

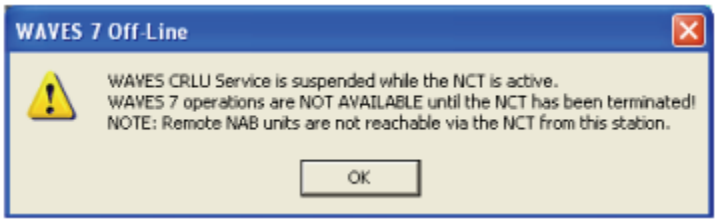


FIGURE 2.1 WAVES 7 Off-Line caution

3. Click **OK**. The Network Configuration Tool opens displaying a blank WVS database.

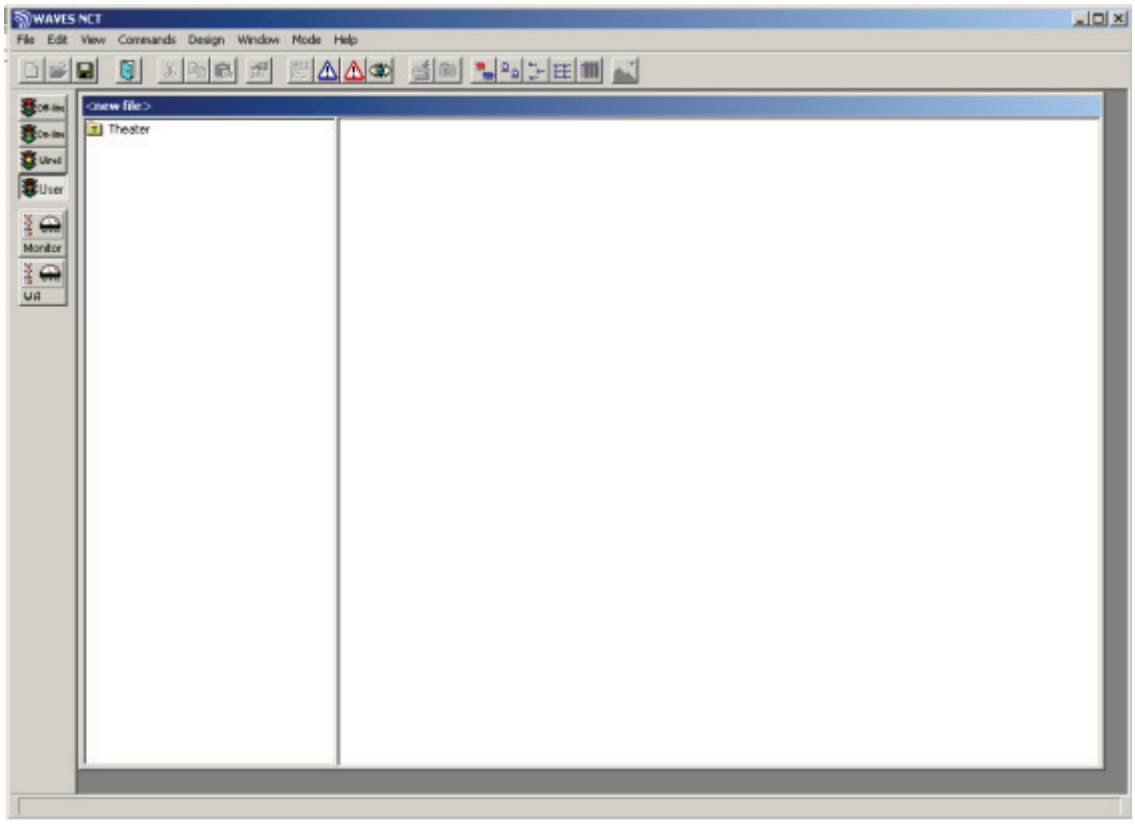


FIGURE 2.2 Blank Configuration Tool WVS database window

4. From the **NCT** screen, set the mode to **On-line** or **Off-line** and log in.
5. From the **File** menu, select **Open**. The Open a File dialog box appears.

6. From the **Look In** list, open the **C:\Waves\Data** directory and open the same **WVS** database that is open in WAVES 7. (For example, C:\Waves\Data\StationAnywhere.wvs.) The database opens.

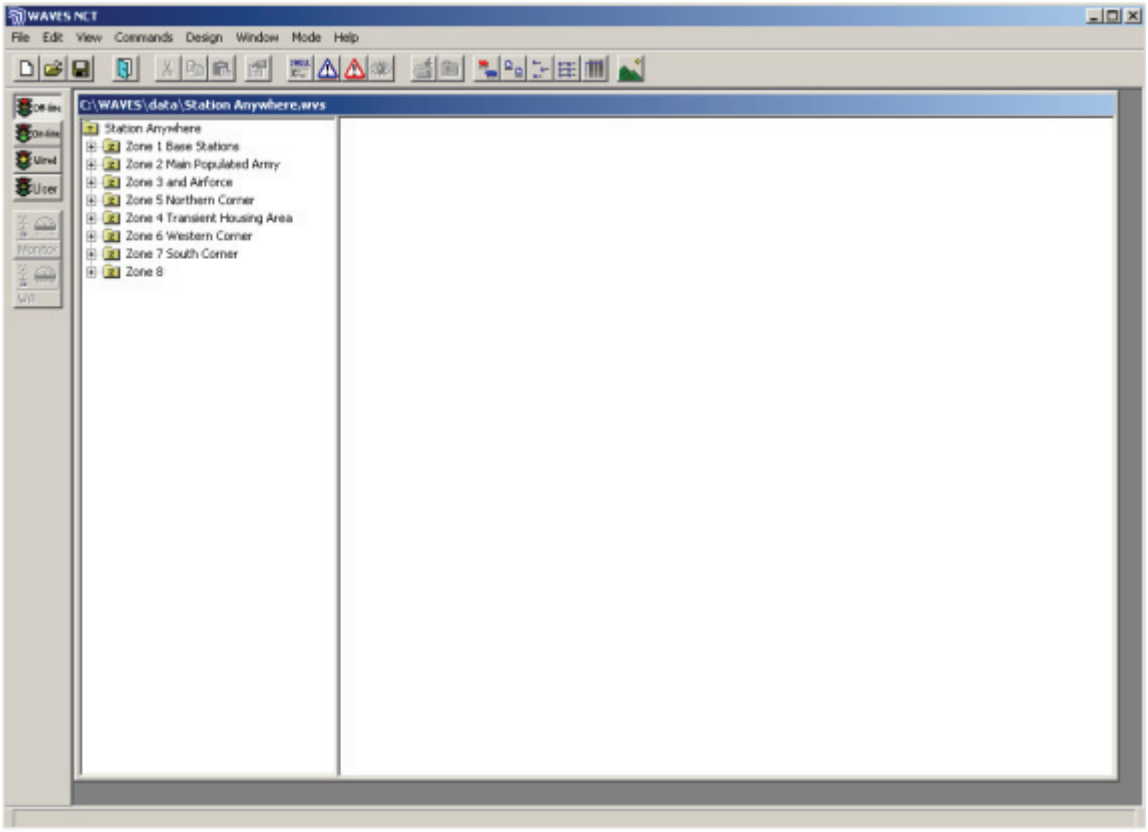


FIGURE 2.3 Open WVS database in Configuration Tool window

7. From the **File** menu, select **Save**.

   The next time you launch the Network Configuration Tool, the application will recognize the last database you saved and automatically open it.

2.1.1.2 Opening a Different Base Station WVS File

1. From the **WAVES 7** screen, login as **Administrator**.
2. From the **Administration** menu, select **Network Configuration**. The WAVES 7 Off-Line dialog box appears advising you that the CRLU Service will be stopped while the Configuration Tool is open.
3. Click **OK**. The Network Configuration Tool opens.
4. From the **NCT** screen, set the mode to **On-line** or **Off-line** and log in.
5. From the **File** menu, select **Open**. The Open a File dialog box appears.
6. From the **Look In** list, open the **C:\Waves\Data** directory and the desired **WVS** file.

2.1.2 Closing the Application

1. From the **File** menu, select **Save** if any changes have been made.

2. Do one of the following:

   – Click the  icon on the toolbar.

   OR

   – From the **File** menu, select **Exit**.

   The application closes.

   The WAVES screen maximizes and any changes to the network configuration will be reflected in WAVES within seconds as it automatically restarts the network routing process. In addition, an event saying "WVS database changed" is added to the WAVES Event List in the Status panel.

2.2 EXPLORING THE SCREEN COMPONENTS

When the Configuration Tool opens it automatically opens the last saved database.

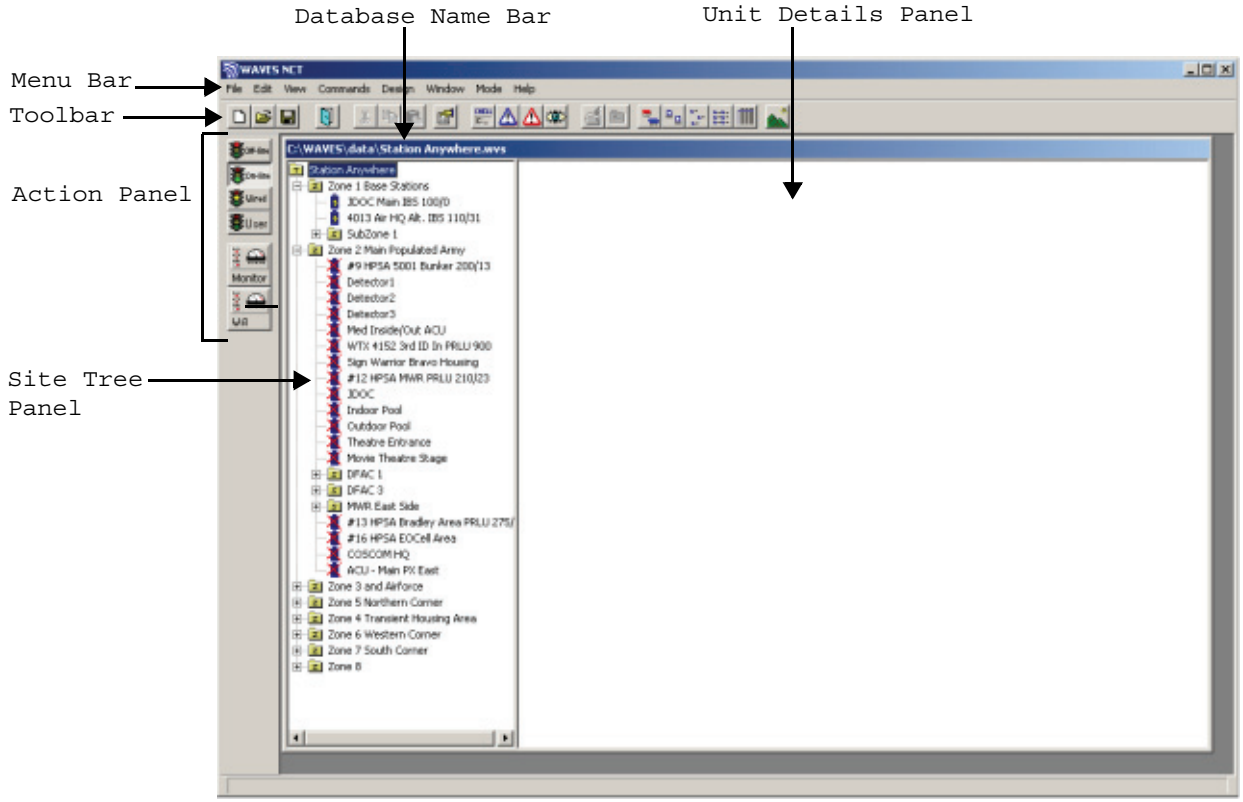


FIGURE 2.4 Network Configuration Tool screen

2.2.1 Component Descriptions

The Network Configuration Tool toolbars contain buttons that correspond to many of the menu commands. While not all buttons will be used, you can find out what each one does by pointing to it and reading its tool tip. Table 2.1 below describes the main sections of the NCT screen, as well as menu options and command buttons that you may use.

The following table identifies and describes ONLY the functional areas of the Network Configuration Tool interface that you will use. Because several tasks are performed from WAVES 7, not all NCT command buttons and menu options are discussed.

TABLE 2.1 NCT Screen Components Functions

Screen Area	Function
Database Name Bar	Displays the opened *.wvs file name and its directory path.
Unit Details Panel	Displays selected site tree element(s). Site tree elements can be displayed as icons a list, or detailed list. See the description for the View | Units option under "Menu Bar" in the Screen Area column.
Menu Bar	Provides access to the following administrative and operator functions: • **File** – **New** - Available only in Off-line, On-line, or Wired mode, allows you to open a blank window to create a new database. – **Open** - Available only in Off-line, On-line, or Wired mode, allows you to open the "Open a File" dialog box and choose an existing WVS database. – **Properties** - Available only in Off-line, On-line, or Wired mode, this option opens the 'global' site Properties dialog box from which unit parameters can be configured. – **Save** - Available in any mode, allows you to save an open file. – **Save As** - Available in any mode, allows you to save an open file with a new name and/or to a different location. – **Exit** - Available in any mode, allows you to close the Network Configuration Tool. • **Edit** – **New** - Available only in Off-line, On-line, or Wired mode, allows you to add a new zone, sub-zone, or unit to the site tree. You can also right-click a zone or sub-zone and choose "New" from the shortcut menu, or press the "Insert" key. – **Cut** - Available only in Off-line, On-line, or Wired mode, allows you to cut a selected site tree element from its location. – **Copy** - Available only in Off-line, On-line, or Wired mode, allows you to copy a selected site tree element.

TABLE 2.1 NCT Screen Components Functions

Screen Area	Function
Menu Bar (continued)	– **Paste**  - Available only in Off-line, On-line, or Wired mode, allows you to paste a cut or copied site tree element into a new location on the site tree. – **Rename** - Available only in Off-line, On-line, or Wired mode, allows you to rename a selected site tree element. You can also slowly double-click the element to change the name or right-click the element and choose "Rename" from the shortcut menu. – **Delete** - Available only in Off-line, On-line, or Wired mode, allows you to delete a selected site tree element. You can also right-click the element and choose "Delete" from the shortcut menu. – **Properties** - Available only in Off-line, On-line, or Wired mode, this option opens a selected unit's Properties dialog box. You can also right-click the unit and choose "Properties" from the shortcut menu. • **View** – **WACOL Shell**  - Available only in Off-line, On-line, or Wired mode, allows you to open the "WACOL Shell" dialog box. From the dialog box, you can enter or select a WACOL command to execute to a selected site tree element. – **Speaker Towers** - Available in any mode, allows you to open the "Speaker Tower" dialog box. From the dialog box you can send prerecorded alarms or Built-in Audio Messages, initiate a self-test, and temporarily set the speaker tower volume. – **Volume Mute** - Available in any mode, allows you to open the "Volume/Mute" dialog box. From the dialog box, you can adjust volume and mute settings for a site, zone, sub-zone, or unit. – **Toolbars** - Available in any mode, allows you to hide or display toolbar elements and the Action Panel. – **Units** - Available in any mode, allows you to display unit information in the Unit Details panel as: ◦ Large icons  ◦ Small icons  ◦ Vertical list  ◦ Vertical list with BIT details  • **Commands** – **Monitor**  - Available only in On-line and User mode, allows you monitor site conditions for a configured TRX.

TABLE 2.1 NCT Screen Components Functions

Screen Area	Function
Menu Bar (continued)	– **Bit Result** - Available in any mode when a "Request BIT" command has been issued, allows you to open the "BIT Results" window. From the window you can view the results of the BIT test. – **Peep Unit Info**  - Available only in On-line, Wired, and User mode, allows you to open the "Monitor unit" window to peep a unit's parameters. – **Verify** - Available only in On-line, Wired, and User mode, allows you to open the "Verify Settings" window for a selected site tree element. – **DB to Unit** - This option is currently not used. NOTE: The "DB to Unit" command is obsolete and not compatible with the current database version. using the command will cause undesirable results in the database. – **Update All** - This option is no longer in use. – **Version Update** -Available only in Wired mode, allows you to open the "Version Update" dialog box. From the dialog box you can update a transceiver's firmware version. – **Wireless Update** - Available only in On-line mode, allows you to open the "Wireless Firmware Update" dialog box. From the dialog box you can to update or reload a transceiver's firmware. – **Change Password** - Available only in Off-line, On-line, and Wired mode, allows you to change a user password. – **Change COM** - Available only in Off-line, On-line, and Wired mode, allows you to open the "Select COM port" dialog box and select from a list of available communication ports. – **Export Data Base** - Available in any mode, allows you to export the database file to a user specified file directory. • **Window** – **Cascade**, **Tile vertical**, **Tile horizontal**, **Arrange icons** - Available in any mode, allows you to arrange open dialog boxes on the screen. • **Mode** – **Off-line**, **On-line**, **Wired**, **User**  - Allows you to select and switch between user modes. • **Help** – **Help** - Allows you to open the PDF version of the Network Configuration Tool Administrator Manual. – **About** - Available in any mode, allows you to open an information screen that contains Configuration Tool information.

TABLE 2.1 NCT Screen Components Functions

Screen Area	Function
Toolbar	Contains shortcut buttons to common administrator functions. For button descriptions other than those shown below, see the Menu Bar descriptions. • Available only when a unit in the Unit Details panel is selected. Selecting a unit in the Unit Details panel and then clicking the arrow-up folder button navigates the selected unit to the next lower folder or units inside its parent folder on the site tree. • Available only in Off-line, On-line, and Wired mode, and when a unit in the Unit Details panel is selected. Selecting a unit in the Unit Details panel and then clicking the arrow-down folder button navigates the selected unit into its parent folder on the site tree.
Site Tree Panel	Contains a graphical representation of the site database in an organized hierarchical tree format.

CHAPTER 3

Creating a Functional Site Tree

The Network Configuration Tool's site tree depicts a functional system view and a graphical representation of units in the WAVES network. This chapter describes how to build and organize the site tree.

The following sections are included in this chapter.

- Understanding the Site Tree Structure
- Navigating the Site Tree
- Selecting the Operating Mode
- Building the Site Tree
- Saving Database Files
- Backing Up the Database File
- Upgrading a WVS Database File

All configuration procedures described in this chapter are normally carried out in Off-line mode by a WAVES Administrator.

3.1 UNDERSTANDING THE SITE TREE STRUCTURE

The site tree is organized in a hierarchical tree format, in which the higher branches of the tree represent general areas and the lower branches are more specific. The site tree is presented on the left side of the Network Configuration Tool window. This same site tree and element names are referenced and seen in the WAVES 7 application.

The highest branch of the site tree represents the entire/global site. The default global name for a new database site is “Theater”; however, you can change it to a more descriptive name. For example, in Figure 3.1 the site name has been changed to “Convention Center”. The different areas of the site are represented by the site elements: zones (z), sub-zones (s), and units (u).

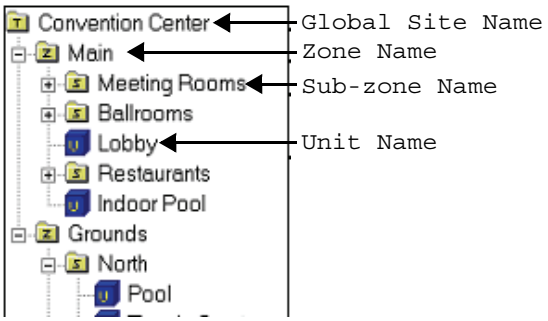


FIGURE 3.1 Network Configuration Tool site tree

Zone and sub-zone branches appear below the site branch. For example, in Figure 3.1, “Main” is a zone and “Meeting Rooms”, “Ballrooms”, and “Restaurants” are its sub-zones.

Units are the lowest branches on the site tree. Unit branches can appear under a zone or sub-zone branch. For example, in Figure 3.1, “Lobby” is in the “Main” zone and “Ballroom” sub-zone.

3.2 NAVIGATING THE SITE TREE

You can use the site tree to display the entire site or focus on one specific area of the site.

When you open a WVS file, the Network Configuration Tool displays the site and zone branches. An icon appears next to each branch to assist you in identifying the branch level.

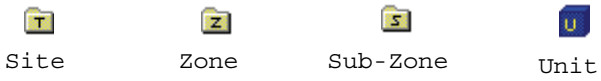


FIGURE 3.2 Site tree branch icons

If you are working with a large site that contains many site elements, you may need to expand or collapse branches to obtain a general view of the site tree or focus on a specific branch. For example, you can view all the zones on the site tree by collapsing the branches under them or you can open all the branches under a specific zone.

A “+” sign to the left of a branch icon indicates that the branch contains collapsed branches. A “-” sign indicates that the branch has sub-branches and all the branches immediately under it are open. For example, all branches immediately under the “Main” branch in Figure 3.3 are open but branches under the “Meeting Rooms”, “Ballroom”, and “Restaurant” branches are hidden. “Lobby” and “Indoor Pool” do not have branches under them.

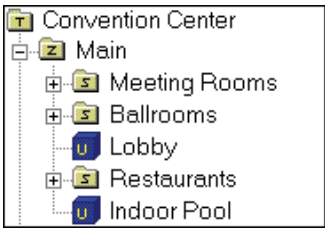


FIGURE 3.3 Expanded and collapsed site tree branches

3.2.1 Expanding a Branch

- Double-click the branch name.

  OR

- Click the "+" sign to the left of the branch icon.

3.2.2 Collapsing a Branch

- Double-click the branch name.

  OR

- Click the "-" sign to the left of the branch icon.

3.2.3 Viewing Branch Details

You can view the details of a branch and the branches immediately under it in a table format in the Unit Details panel. The available details categories are selected on the Monitor BIT tab of the global Properties window. See Section 4.1.2, "Defining BIT Monitoring Parameters" on page 36 for instructions on configuring Monitor BIT tab options.

1. From the **site tree**, click a branch element.
2. Do one of the following:
   - From the **View** menu, select **Units**, choose **Icons**, and then point to **Details**.

     OR

   - Click the  icon located on the toolbar.

   The branch details appear in table format in Unit Details panel.

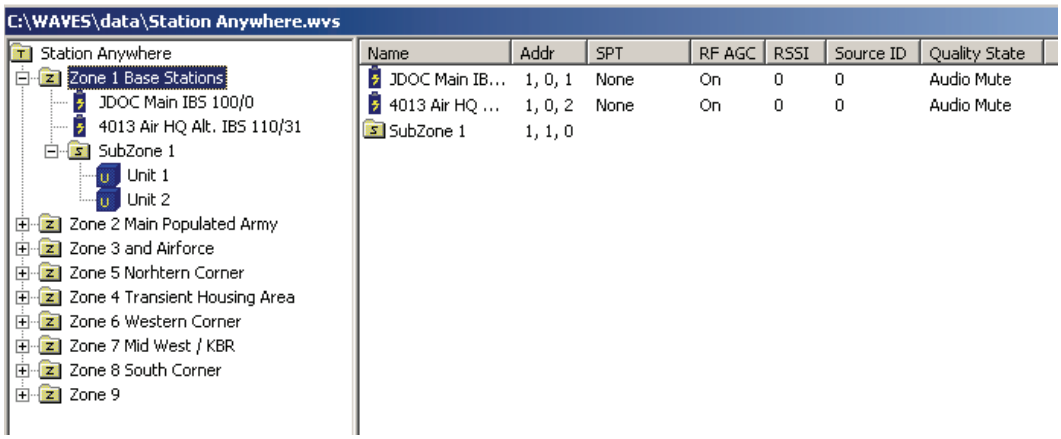


FIGURE 3.4 Branch element details

3.3 SELECTING THE OPERATING MODE

You can work with the Configuration Tool in one of four operating modes:

- User
- Off-line
- On-line
- Wired

Table 3.1, “Operating Modes Permissions” provides a task list and what mode is authorized to perform the task.

When you start the Network Configuration Tool application, User mode is active. The other three operating modes are password protected and allow access to administrative tasks.

User Mode - User mode allows you to view database statuses and perform general operational tasks, but no database operations (see Table 3.1, “Operating Modes Permissions”).

Off-line Mode - Off-line mode allows you to work off-line to design a site tree and make changes to the design of existing site trees. You can also adjust the property settings of the base and field transceivers.

On-line Mode - On-line mode allows you to control on-line operation of the Configuration Tool through the connection between the computer at the base station and the base station transceiver. In this mode, you can receive BIT reports, design or make changes to the design of a site tree, adjust the property settings of the base and field transceivers, refresh the current operating parameters and reconfigure an entire site. To ensure the integrity of the site tree, it is recommended that you redesign the site tree off-line and only update the site tree after you are satisfied with the new design.

Wired Mode - Wired mode allows you to initialize the base and field transceivers. It is the only mode in which you can set Unit IDs and update a transceiver’s software version. Wired mode requires a direct cable connection between the PC and the transceiver being configured. The On-line and Wired modes operate at 19,200 bps.

TABLE 3.1 Operating Modes Permissions

Operation	User Mode	Off-line Mode	On-line Mode	Wired Mode
Peep unit internal parameters	Yes	No	Yes	Yes
Verify database parameters with actual unit parameters	Yes	No	Yes	Yes
Save current settings	Yes	Yes	Yes	Yes
Open a file	No	Yes	Yes	Yes
Create a new file	No	Yes	Yes	Yes
Exit program	Yes	Yes	Yes	Yes
Copy unit	No	Yes	Yes	Yes
Cut unit	No	Yes	Yes	Yes
Paste unit	No	Yes	Yes	Yes
View/change unit properties (except for ID)	No	Yes	Yes	Yes

TABLE 3.1 Operating Modes Permissions (continued)

Operation	User Mode	Off-line Mode	On-line Mode	Wired Mode
Change unit ID	No	Yes*	No	Yes
Change unit view	Yes	Yes	Yes	Yes
Rename unit	No	Yes	Yes	Yes
Change window view options	Yes	Yes	Yes	Yes
Send database to unit	No	No	Yes	Yes
Update version	No	No	No	Yes**

* In the database only.

** Updates only the directly connected unit.

3.3.1 Changing the Operating Mode

1. From the **Mode** menu, select **Off-line**, **On-line**, **Wired**, or **User** or click the desired mode's icon from the **Action** panel.

   When changing from User Mode, the "Enter a password" dialog box may appear.

FIGURE 3.5 Action panel operating mode icons

2. If the **Enter a password** dialog box appears, enter the **Password** and click **OK**.

3.3.2 Changing the Password

1. Set the mode to **Off-line**, **On-line**, or **Wired**.
2. From the **Commands** menu, select **Change Password**. The Change Password dialog box appears.

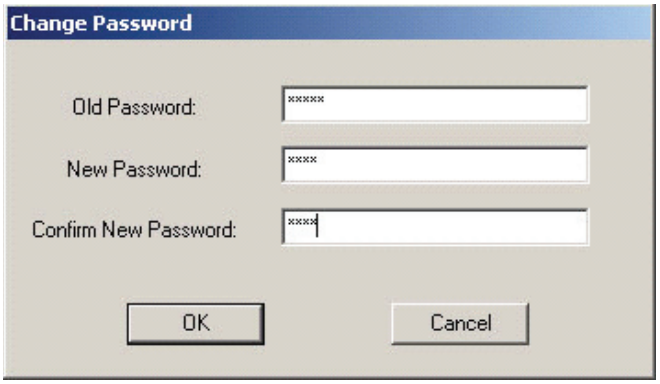


FIGURE 3.6 Change Password dialog box

3. Enter the **Old Password**.
4. Enter the **New Password**.
5. Re-enter the **New Password** and click **OK**.

3.4 BUILDING THE SITE TREE

The site database is stored in a WVS file. To build the site tree, you must first create a new WVS database file.

> All operations defined in this section can be performed in any mode except User mode.

3.4.1 Creating a New Configuration Tool Database File

> When working in Off-line or Wired mode, the Unit icon appears as a green block with a black question mark.

1. From the **WAVES 7** screen, login as **Administrator**.
2. From the **Administration** menu, select **Network Configuration**. The WAVES 7 Off-Line dialog box appears advising you that the CRLU Service will be stopped while the Configuration Tool is open.
3. Click **OK**. The application opens displaying information for the database that was open in WAVES 7.
4. Set the mode to **Wired (**  **)**, **On-line (**  **)**, or **Off-line (**  **)**.
5. From the **File** menu, select **New** or click the  icon on the toolbar. The Close File dialog box appears.

6. Click **Yes** to save the file. A <new file> window opens.

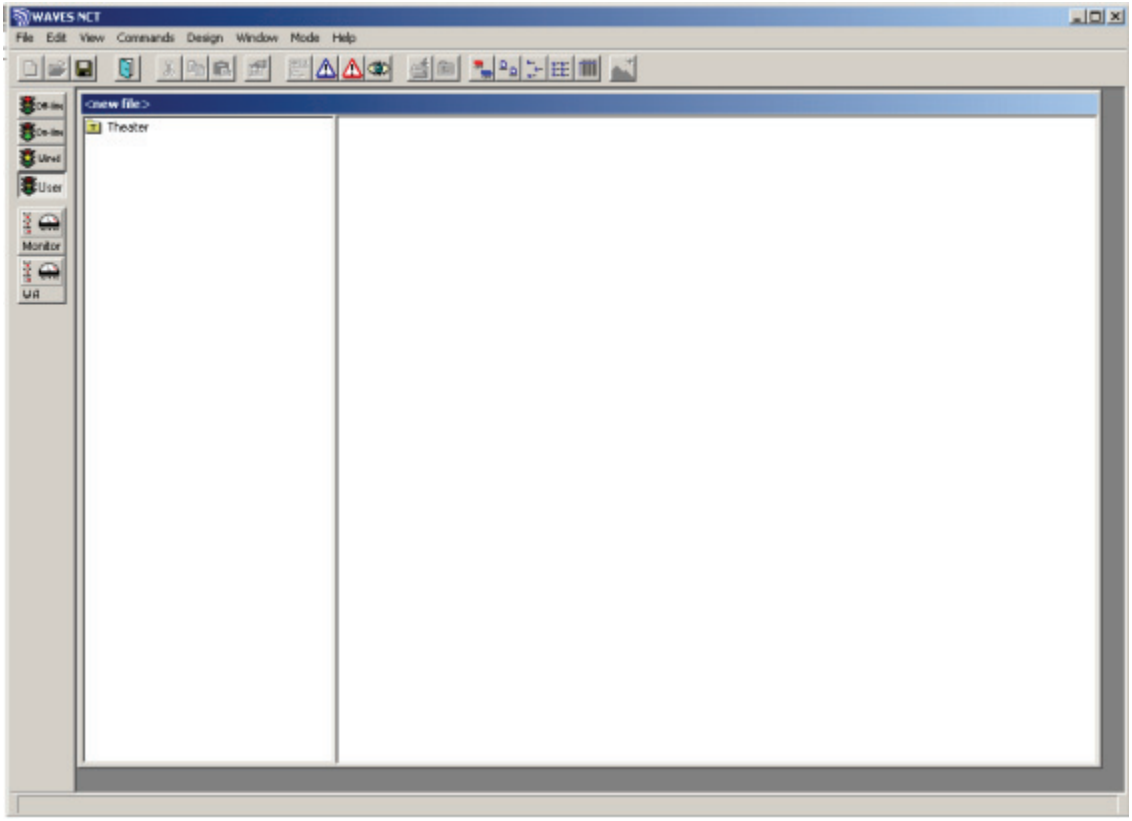


FIGURE 3.7 New File window

An empty site tree appears on the left side of the window. The Configuration Tool assigns it the default site name, “Theater”. You can change the site name to a more appropriate name, especially if you have more than one site, as described in Section 3.4.3.

3.4.2 Defining Site Tree Elements

Zones, sub-zones, and units are site elements that represent the different branches of the site tree. The elements include the following:

- **Zones** - Zones appear on the level just below the site name. You can define up to 31 zones.
- **Sub-zones** - Sub-zones appear immediately below zones. You can define up to 15 sub-zones under each zone.
- **Units** - Units appear on the lowest level of the site tree. If you do not need a sub-zone, you can insert the unit directly under the zone. You can define up to 31 units under a zone or sub-zone.

3.4.2.1 Element Addresses

When you define a site tree element, the Configuration Tool automatically assigns it a numeric address according to a strict numeric hierarchy. The hierarchy numbering is described below.

- The address for a zone, sub-zone, or unit consists of three (3) numbers separated by commas (x,y,z) (where *x* is the zone number, *y* is the sub-zone number, and *z* is the unit number).
- The address number assigned to the first *zone* in a site is 1, and so on**.**
- The address number assigned to the first *sub-zone* of a zone is 1, and so on.
- The address number assigned to the first *unit* of a sub-zone is 1, and so on.

Examples of addresses for site tree elements shown in Figure 3.8 and described below.

- The top level address is 0,0,0 for the whole site (Theater), which is the root of the site tree.
- The address of the first zone is 1,0,0.
- The address of the first sub-zone is 1,1,0 when it is added under the first zone.
- The address of the first unit is 1,1,1 when it is added under the first sub-zone.
- The address of the second unit is 1.1.2 when it is added under the first sub-zone.

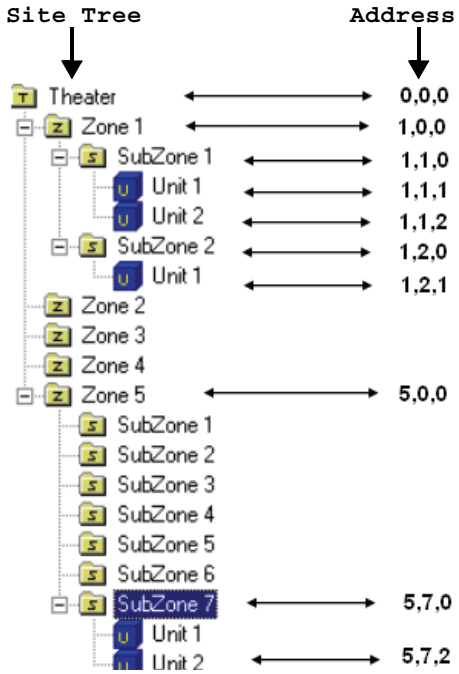


FIGURE 3.8 Element addressing scheme

3.4.2.2 Adding a Zone

1. Set mode to **Wired**, **On-line**, or **Off-line**.
2. Click the site name. For example, the site name in Figure 3.8 is “Theater”.
3. Do one of the following:
   – Press the **Insert** key and then the **Enter** key.

   OR

   – Right-click the site name and select **New** from the shortcut menu. The new zone appears at the bottom of the site tree and an address is assigned to it. You can rename the Zone as described in Section 3.4.3.

See Chapter 4, “Configuring Site Tree Elements” for information on defining the element parameters.

3.4.2.3 Adding a Sub-Zone or Unit

You can place up to 15,376 units (15,872 elements) in a tree structure.

1. Set mode to **Wired**, **On-line**, or **Off-line**.
2. Click a zone or sub-zone and do one of the following:
   – Press the **Insert** key.

   OR

   – Right-click the zone or sub-zone and select **New** from the shortcut menu. The Select Type dialog box opens.

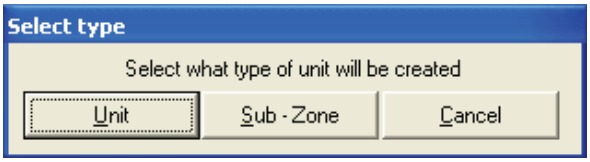


FIGURE 3.9 Select Type dialog box

3. Click **Unit** or **Sub-Zone**. The new unit or sub-zone appears and an address is assigned to it. You can rename the element as described in Section 3.4.3.

See Chapter 4, “Configuring Site Tree Elements” for information on defining the element parameters.

3.4.3 Renaming the Site and Elements

When you create a new site or site element, the Network Configuration Tool automatically assigns default names. You can change the default names to more appropriate ones at any time.

1. Set mode to **Wired**, **On-line**, or **Off-line**.

2. Select the site or a site element.
3. Do one of the following:
   - From the **Edit** menu, select **Rename**.

     OR
   - Press the **F2** key.

     OR
   - Right-click the element and select **Rename** from the **shortcut menu**.

DO NOT use apostrophes or quotation marks in unit or group names.

4. Type the new name and press the **Enter** key.

3.4.4 Deleting Site Tree Elements

3.4.4.1 Deleting a Zone, Sub-Zone, or Unit

When you delete a zone or sub-zone element, you also delete all the site elements under it. For example, if you delete “North” in Figure 3.1, you also delete “Pool” and “Tennis Courts”.

1. Set mode to **Wired**, **On-line**, or **Off-line**.
2. On the site tree, click the site element you want to delete.

Deleting a zone or sub-zone also deletes the elements subordinate to it.

3. Do one of the following:
   - On the **Edit** menu, click **Delete**.

     OR
   - Right-click the element and then select **Delete** from the shortcut menu.

     OR
   - Press the **Delete** key.

   The Delete Site dialog box opens.
4. Click **Yes** to delete the element or No to cancel the action. The element is deleted.

3.4.4.2 Deleting a Site

- Delete the file from your hard disk. For example, open the C:\Waves\Data directory, locate the file and delete it.

3.4.5 Reorganizing the Site Tree

You can easily reorganize unit groupings on your site tree and add new site elements by moving or copying sub-zones and units.

If you reorganize the site tree in Off-line mode and save the new addresses, you must later update the field transceivers in On-line mode to maintain the integrity of the site tree. See Chapter 4, "Configuring Site Tree Elements" for detailed instructions on setting and updating unit parameters.

3.4.5.1 Moving a Sub-Zone or Unit

Changing the location of a sub-zone or unit on the site tree changes unit addresses. When you move a sub-zone or unit the Configuration Tool automatically assigns new addresses based on the site tree hierarchy.

1. Set mode to **On-line**.
2. Select the sub-zone or unit you want to move.
3. Drag the sub-zone or unit to the desired new location. The Move Site dialog box opens.
4. Click **Yes** to move the element or No to cancel the action. The sub-zone or unit appears in the new location and the Configuration Tool assigns new addresses to the relocated site element and all its subordinate branches.
5. Update the moved unit's transceiver as described in Section 3.4.6, "Updating a Unit's TRX".

3.4.5.2 Copying a Unit

When you copy a unit, the parameters of the unit are duplicated but the address is different.

1. Set mode to **Wired**, **On-line**, or **Off-line**.
2. Select the unit you want to copy.
3. From the **Edit** menu, select **Copy** or click the  icon on the toolbar.
4. Select the zone or sub-zone under which you want to place the duplicate element.
5. From the **Edit** menu, select **Paste** or click the  icon on the toolbar**.** The Copy Site dialog box opens.
6. Click **Yes** to paste the element or No to cancel the action. The copied unit appears in the new location and the Configuration Tool assigns it a new address.
7. Update the copied unit's transceiver as described in Section 3.4.6, "Updating a Unit's TRX".

3.4.6 Updating a Unit's TRX

When elements are moved or copied, you must update the unit's TRX with its new address.

1. Set mode to **On-line** or **Wired**.
2. From the site tree, select the unit to be updated and right-click.
3. From the shortcut menu, select **Properties**. The unit's Properties dialog box appears.

4. For each tab in the Properties dialog box, select a tab and click **Update the Unit**.
5. When finished, click **OK** to close the dialog box.

3.5 SAVING DATABASE FILES

After building the site tree, save the file for use at a later time.

1. Set mode to **Wired**, **On-line**, or **Off-line**.
2. From the **File** menu select **Save** or click the  icon on the toolbar.
   If this is the first time the file is saved, the Save a File dialog box opens. Do the following:
   a. From the **Save In** box, locate the **C:\Waves\Data** directory.
   b. Type a name for the file.
   c. Click **Save**. The database is saved with a .wvs file extension.

3.5.1 Maintaining Different Unit Settings

You can maintain different sets of parameters for each unit in the site by saving them to different database files.

For example, you may be responsible for the efficient operation of a stadium, in which one day a concert may take place and the next day a sports event. Each type of event could require very different unit groupings and audio settings.You can build a site tree containing all the transceivers currently located in the stadium and save it in different database files. You can then open one of the *.wvs files and rearrange the units into different groups and configure audio settings appropriate to a concert. Later you can open the other *.wvs file and rearrange the units into groups and configure audio settings appropriate for a football game.

Make sure the internal settings and Unit ID of each unit remain the same.

3.5.2 Copying the Database to a New File

1. Set mode to **Wired**, **On-line**, or **Off-line**.
2. From the **File** menu, click **Save As**. The Save a File dialog box opens.
3. From the **Save In** box, locate the **C:\Waves\Data** directory.
4. Type a name for the new file.
5. Click **Save**. The Configuration Tool copies the contents of the original file into the new file and saves it with a .wvs extension.

3.6 BACKING UP THE DATABASE FILE

When the site design is complete, make a backup copy of the database and store it in a safe location. At a minimum, both *.wvs and *.mdb databases should be copied to a removable media such as floppy diskette or CD.

It is recommended, that you also manually record all unit and global properties in the event the removable media or database becomes corrupt.

3.6.1 Backing Up the Databases

1. From the **File** menu, select **Save** or click the  icon to save any changes to the database.
2. From the **File** menu, select **Exit** or click the  icon on the toolbar to close the Configuration Tool.
3. Open the **C:\Waves\Data** directory.
4. Hold down the **Ctrl** key and click the ***.wvs** and ***.mdb** files.
5. Right-click the highlighted files and choose **Send To** from the shortcut menu.
6. Send the files to a **3-1/2 Floppy**, **CD**, or other **removable media**. If access to an external backup device is available the entire C:\Waves directory can be backed up.
7. **Close** the C:\Waves\Data directory.
8. Label the media to indicate its contents and then store the media in a safe location.

3.6.2 Recording Unit and Global Properties

This procedure is optional but highly recommended in the event the removable media becomes corrupt. By manually recording the unit and global properties you can reconstruct the Network Configuration Tool database if necessary.

1. From the **Network Configuration Tool**, set the mode to **On-line** or **Off-line**.
2. Expand the site tree so that each unit can be seen.
3. From the site tree, select the first unit and open its properties dialog box by clicking the  (Properties) icon on the toolbar.
4. Do the following:
   a. Record the **unit name** displayed on the dialog box's title bar.
   b. From each tab, record the **properties**.
   c. When finished, click **OK** to close the dialog box.
5. Repeat **Step 4** for all site tree devices.
6. From the **File** menu, select **Properties**. The Properties dialog box for the entire site appears.
7. Do the following:
   a. Record the **site name** displayed on the dialog box's title bar.
   b. From each tab, record the **settings**.
   c. When finished, click **OK** to close the dialog box.
8. Click **OK** to close the Properties dialog box.

3.7 UPGRADING A WVS DATABASE FILE

WAVES NCT 5.6.x is fully compatible with WVS database files from WAVES NCT v5.4. No conversion is required when upgrading from that version.

To upgrade the WVS database file from WAVES v5.3 or earlier, follow the instructions outlined below.

1. Start **WAVES 7** and login as **Administrator**.
2. From the **Administration** menu, select **Network Configuration**. The WAVES 7 Off-Line dialog box appears advising you that the CRLU Service will be stopped while the Configuration Tool is open.
3. Click **OK**. The Network Configuration Tool opens.
4. Select **On-line** or **Off-line** mode, enter your **password**, and click **OK**.
5. From the **File** menu, select **Open**. The Open dialog box appears.
6. Locate the ***.wvs** file and click **Open**. The Open dialog box closes and a Close File dialog box appears.
7. From the **Close File** dialog box, click **No**.
8. From the **File** menu, select **Save As**.
9. Rename the file, saving it to the **C:\Waves\Data** directory.
10. Open the **C:\Waves\Data** directory.
11. Locate and **rename** the **MDB** file to match the newly renamed WVS file. The *.wvs and *.mdb file names must be identical for WAVES 7 to work.
12. **Save** and **close** the Network Configuration Tool.

CHAPTER 4

Configuring Site Tree Elements

General site properties must be set to address the functional requirements at a site, as well as unique properties set for each transceiver. This chapter describes how to set up the site operating parameters.

The following sections are included in this chapter.

- Configuring Global Site Properties
- Configuring Transceiver Properties
- Verifying Database Integrity
- Exporting the Database to a Text File
- Updating TRX Firmware

Configuring site elements is a administrator function, therefore all procedures in this chapter are performed in **Off-line**, **On-line**, or **Wired** mode.

4.1 CONFIGURING GLOBAL SITE PROPERTIES

Global property settings affect the whole site. These include parameters internal to the Network Configuration Tool application, as well as several parameters that are uniformly loaded into all transceivers.

The following site-wide properties should be set.

- Audio Mode
- BIT results

4.1.1 Audio Settings

Global audio settings allow you to determine how the audio channels are utilized and enable the automatic periodic refreshing of TRX volume and mute settings.

For normal WAVES operation, the 'audio' channels A and B (I and II) are muted, the 'voice' channels are not muted, and the 'audio mode' is always Mono 32. In WAVES, 'voice channels' refer to input from WAVES via the microphone or computer sound card.

By using WAVES 7 tools along with the Network Configuration Tool, volume levels can be set globally (theater), by zone or sub-zone, or for individual units. Changing the volume properties of an individual TRX at the 'unit level' changes only the settings for that TRX. Changing the volume properties of the theater, zone, or sub-zone affects the settings of all the TRXs located under their branches on the site tree.

Setting the theater, zone, or sub-zone volume levels to non-zero values will affect the volume level of all units located under their site tree branch. Whenever you add a new transceiver to an existing network, you must reapply the group volume settings (theater, zone, and sub-zone).

Because the volume of an individual TRX is affected by the site, zone, and sub-zone settings, it is recommended that you configure volume settings in the order outlined in the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system. Changing the theater, zone, or sub-zone volume after the unit volume has been set will cause a change in the unit volume. For example, if the Voice volume on a 'unit' is set to 40 dB and you change the Voice volume of the 'theater' to -5 dB, then the 'unit' will broadcast voice announcements at a volume of 35 dB (unit volume setting minus changed theater volume).

To ensure units are broadcasting at their expected levels, configure volume settings as outlined in the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system.

To ensure units are broadcasting at their expected levels, confirm that your volume settings are also consistent with the “Instruction Sheet: Configuring WAVES Volume Settings” (P/N P40-00019).

4.1.1.1 Audio Mode

Audio Mode defines the type of audio configuration supported by the transceivers.

1. Set the mode to **Off-line**, **On-line**, or **Wired**.
2. From the **File** menu, select **Properties**. The site Properties dialog box opens.
3. Select the **Audio Options** tab.
4. From the **Audio Mode** list, select **32 mono** and then click **Update**.
5. Click **OK** to close the dialog box.

For instructions on configuring audio settings, refer to the “WAVES Volume Settings” topic in the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system.

4.1.2 Defining BIT Monitoring Parameters

The global properties Monitor BIT tab allows you to define which BIT parameters will display in the Unit Details panel when in Detail mode. WAVES 7 allows you to view BIT results; however, on rare occasion you may need to see additional information.

1. Set the mode to **Off-line**, **On-line**, or **Wired**.
2. From the **File** menu, select **Properties**. The site Properties dialog box opens.
3. Select the **Monitor BIT** tab.

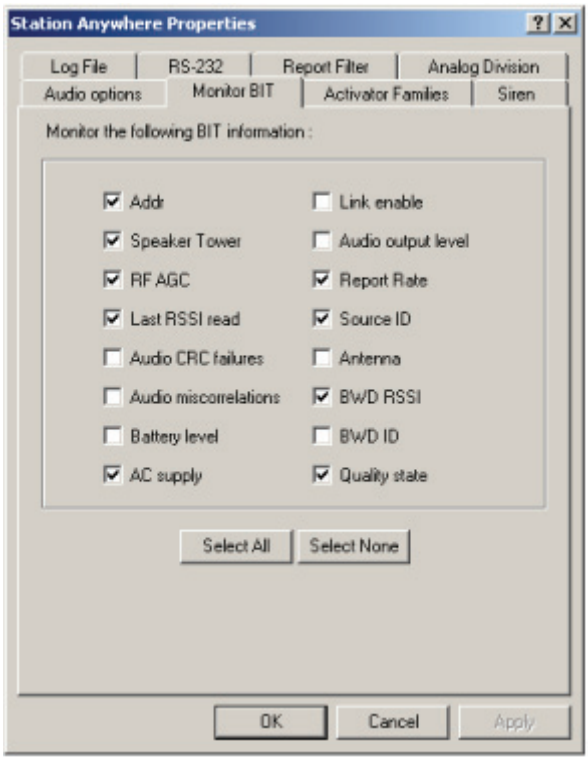


FIGURE 4.1 Monitor BIT settings tab

4. Do one of the following:
   - Click the **Select All** button to choose all options.

     OR

     a. Click the **Select None** button to clear all check boxes.

     b. Select the **Speaker Tower** check box.

     c. Select any **other** desired parameter(s).

   All selected BIT parameters will display in the Unit Details panel when in Detail mode.

   Table 4.1 provides brief descriptions of the items that can be selected on the Monitor BIT tab. See Section 4.2.4, “BIT Parameters” for further descriptions.
5. Click **Apply** to save the new parameters.
6. Click **OK** to close the site Properties dialog box.

TABLE 4.1 “Monitor BIT” Parameter Descriptions

BIT Item	Reported BIT Parameter Description
Addr	Unit address (zone, sub-zone, unit #)
Speaker Tower	Status reported from the external Speaker Tower or HPSA unit. Reports on Unit Details panel as None, OK, Fault, or Comm Fault.
RF AGC	Current state of AGC. Reports on Unit Details panel as On or Off.
Last RSSI Read	Relative signal strength of last hop packet received. Reports on Unit Details panel as 0 - 255.

TABLE 4.1 "Monitor BIT" Parameter Descriptions (continued)

BIT Item	Reported BIT Parameter Description
Audio CRC Failures	Simple 8-bit counter of CRC failures; 255 rolls over to 0. Reports on Unit Details panel as 0 - 255
Audio Miscorrelations	Simple 8-bit counter of the number of expected correlation sequences that were not detected; 255 rolls over to 0. Reports on Unit Details panel as 0 - 255.
Battery Level	Battery status. Reports on Unit Details panel as No, OK, or Low.
AC Supply	AC power status. Reports on Unit Details panel as OK or Fail.
Link Enable	RS-232 link status. Reports on Unit Details panel as Enable or Disable.
Audio Output Level	Last tested status of audio output circuit. Reports on Unit Details panel as OK or Fail.
Report Rate	Reporting rate for BIT information, in tenths of a second. Reports on Unit Details panel as 10 - up
Source ID	Unit ID of the current upstream relay. Reports on Unit Details panel as 1 - 16383.
Antenna	Relative signal strength of last packet received from downstream unit for relay to the CRLU. Reports on Unit Details panel as 0 - 100%.
BWD RSSI	Relative signal strength of last packet received from a downstream unit for relay to the CRLU. Reports on Unit Details panel as 0 - 255.
BWD ID	Low 8 bits of the Unit ID of the source of the last packet received from a downstream unit. Add multiple of 256 to this value to obtain the actual Unit ID. Reports on Unit Details panel as 0 - 255.
Quality State	Indication of the integrity of the audio data being received. Switching between states is based on the number of CRC failures received within a given time period that varies from 2 to 20 seconds. Values are listed in order of increasing quality. Reports on Unit Details panel one of the following: • After Switching - Designates that the unit just selected (switched to) a new upstream RF source. • Voice Mute Designates the unit is synchronized with the upstream RF source but is not yet determined to be ready, no audio is passed through. • Audio Mute - Designates the received signal is strong enough to attempt announcements but the reliability is not yet established. • Low, Medium, and High - Designates the signal quality assessment based on the most recent CRC error counts. When the number of CRC errors decreases during a count period, the TRX reports a better Quality State.

4.2 CONFIGURING TRANSCEIVER PROPERTIES

Transceiver properties are settings that affect an individual unit and its behavior in the system.

Transceiver properties can be sent to the unit in *Wired* mode or *On-line* mode.

4.2.1 Unit Audio Settings

Because the volume of an individual TRX is affected by the site, zone, and sub-zone settings, it is recommended that you configure volume settings in the order outlined in *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system. Changing the theater, zone, or sub-zone volume after the unit volume has been set will cause a change in the unit volume. For example, if the Voice volume on a 'unit' is set to 40 dB and you change the Voice volume of the 'theater' to -5 dB, then the 'unit' will broadcast voice announcements at a volume of 35 dB (unit volume setting minus changed theater volume).

To ensure units are broadcasting at their expected levels, configure volume settings as outlined in the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system.

Refer to Section 4.1.1, “Audio Settings” for additional information on audio settings.

4.2.1.1 Changing Unit Audio Properties

- Refer to the “**WAVES Volume Settings**” topic of the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system.

4.2.1.2 Changing Site, Zone or Sub-Zone Audio Properties

- Refer to the “**WAVES Volume Settings**” topic of the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system.

4.2.2 RS-232 Devices

The Configuration Tool allows you to set up different types of RS-232 peripheral devices such as display signs, sirens, wireless activators, individual building emergency systems, and chemical detector sensors. Refer to Chapter 5, “Setting Up Peripheral Devices” for instructions.

4.2.3 I/O SETTINGS

You can monitor and control site conditions from the base station by attaching external devices to the input and output pins of TRXs at key locations throughout your site and by configuring their digital I/O pins using the Network Configuration Tool. Each field TRX is equipped with one digital input pin and two digital I/O pins.

When an external device is attached to the digital input and ground pin of a TRX, the TRX receives a high (5 V) or low (0 V) signal from the device. Once you have configured the digital setting in the NCT you can return to WAVES 7 to configure a response that is triggered when a defined condition for the digital device exists.

4.2.3.1 Configuring Digital Pins

1. Set mode to **Wired** or **On-line**.
2. Select a unit on the site tree and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the **shortcut menu**.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
3. Select the **I/O Settings** tab.
4. Select the **Monitor I/O on this unit** check box. All digital input and I/O options become available.

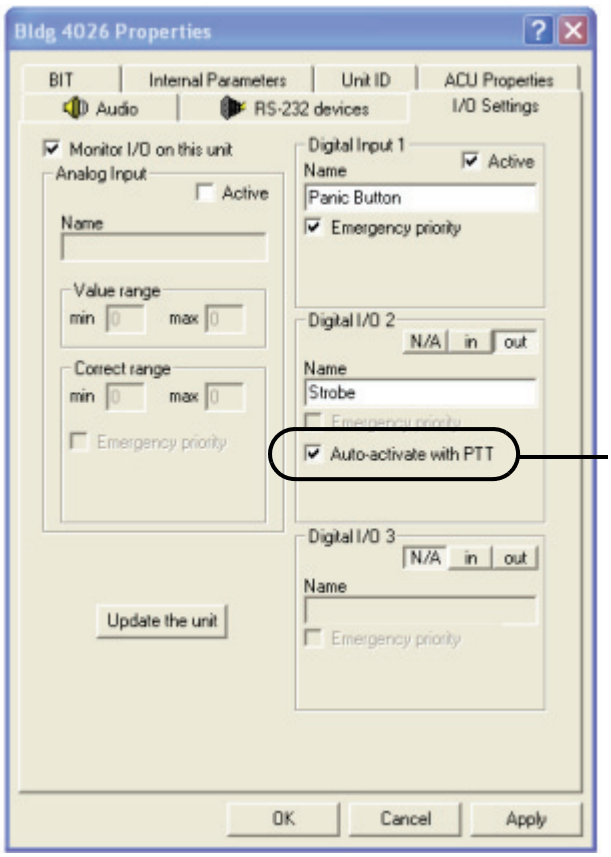


FIGURE 4.2 I/O Settings tab

To configure Digital Input (J2 Pin 10 on the TRX):

a. From the **Digital Input 1** box, select **Active** to activate the digital input pin.

b. Type a descriptive name in the **Name** box.

c. Select the **Emergency priority** check box. Emergency priority is not required, but is recommended. If not selected, the notification is not received by WAVES until the next regular BIT cycle of the TRX.

To configure Digital I/O 2 (J2 Pin 9 on the TRX):

a. From the **Digital I/O 2** box, click the **In** button to activate the digital pin as an input or the **Out** button to activate the digital pin as an output.

If Digital I/O 2 is configured as output (Out), checking the "Auto-activate with PTT" check box causes output to be asserted whenever the TRX makes a PTT announcement. For example, an attached strobe will automatically flash whenever audio is played to the unit. If the option is not checked, the strobe will only flash when an I/O ON command is issued.

b. Type a descriptive name in the **Name** box.

c. Select the **Emergency priority** check box. Emergency priority is not required, but is recommended. If not selected, the notification is not received by WAVES until the next regular BIT cycle of the TRX.

To configure Digital I/O 3 (J2 Pin 8 on the TRX):

a. From the **Digital I/O 3** box, click the **In** button to activate the digital pin as an input or the **Out** button to activate the digital pin as an output.

b. Type a descriptive name in the **Name** box.

c. Select the **Emergency priority** check box. Emergency priority is not required, but is recommended. If not selected, the notification is not received by WAVES until the next regular BIT cycle of the TRX.

5. Click **Update the Unit** to send all the settings in the Properties dialog box to the transceiver.

If you are working in On-line mode, the settings are saved in the base station computer's database after an acknowledgment is received.

If you are working in Off-line mode, a message appears informing you that the data was not sent to the field transceiver and asking if you want to save the properties in the database. If you click Yes, the new settings are stored in the database. However, later you must update the field transceiver by switching to the On-line mode and sending the properties to the unit manually.

6. Click **OK** to close the dialog box.

4.2.3.1.1 Prioritizing Digital Device Messages

A 'normal sampling rate' is based on the Report Rate defined in the BIT tab of the Properties dialog box. When an input is assigned an emergency priority status, the TRX overrides the Report Rate and sends a status message *immediately* to the CRLU. Emergency status messages also receive priority allocation of bandwidth to expedite their transmission to the base station. When configuring digital input or I/O settings, make sure to select the Emergency priority check box. Emergency priority is not required, but is recommended. If not selected, the notification is not received by WAVES until the next regular BIT cycle of the transceiver.

You can assign emergency priority to one or all of the digital inputs.

To assign emergency priority to a digital input:

1. Select the unit on the site tree and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the **shortcut menu**.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
2. Select the **I/O Settings** tab.
3. Select the **Emergency Priority** check box for the desired activated digital device(s).
4. Click **Update the Unit** to send all the settings in the Properties dialog box to the transceiver.
5. Click **OK** to close the dialog box.

4.2.3.2 Monitoring TRX Digital Inputs

If you programmed a field TRX to send status messages to the base station computer by-way-of the CRLU, you can monitor the condition of the transceiver's digital inputs from the Network Configuration Tool or WAVES screens.

To monitor inputs from the Network Configuration Tool:

1. Set mode to **User** or **On-line**.
2. From the **site tree**, select a unit to be monitored.
3. From the **Commands** menu, select **Monitor** or click the 

icon from the **Action** panel. The status monitor dialog box appears.

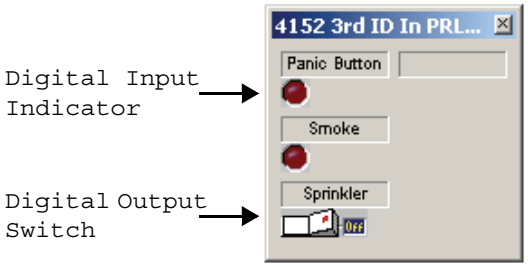


FIGURE 4.3 Status monitoring dialog box

The following transceiver statuses can be monitored on the status box. The name assigned to an active digital I/O pin appears above its graphic representation.

- **Digital Input** - A light appears below each digital input's name. If the digital input receives a signal (activated), the light below its name turns red and the Event script for the digital input is activated if configured in WAVES 7.
- **Digital Output** - A switch appears below each digital output's name. If the switch is turned ON, the output is 5 V. If the switch is turned OFF, the output is grounded.

4.2.4 BIT Parameters

Each field transceiver conducts two types of diagnostic built-in tests:

- **Power-on-BIT (POB)** - Tests the hardware configuration during power on.
- **Online BIT** - Tests the system's ongoing operation.

If the transceiver is connected to a high-power speaker array (SPT/HPSA) or ACU it also reports the results of the unit's internal BIT. Test results are reported at a defined rate or upon demand to the base station console.

When the BIT detects an unusual condition, the Configuration Tool graphically indicates the status of the field transceiver on the site tree by replacing the transceiver's normal unit icon with special icons. The condition is also indicated on the WAVES operator screen by flashing icons or status indicators. Refer to the *WAVES 7 Operator Manual* or *WAVES 7 Online Help* for more information on monitoring statuses from the WAVES 7 screen.

Table 4.2 below provides a description of the icons that display on the Network Configuration Tool site tree.

TABLE 4.2 BIT Condition Icons on the Site Tree

Icon	Description
	Red block with a yellow question mark. The base station did not receive BIT results from the unit. When the base station tried to contact the unit, it received no response.
	Yellow loudspeaker with a red "X" across it. The Speaker Tower reported an error or is not communicating.
	Red battery with a red diagonal line across it. The BIT detected that the backup battery power supply is low (has 10V or less).
	Blue battery with a yellow lightning sign. The BIT detected that the unit is using its backup battery.
	Blue battery with a red "X" across it. The BIT detected that the unit does not have a backup battery even though it is registered as having one.
	Yellow block with a black exclamation mark. A problem exists with a connected RS-232 device.
	Green block with black question mark. The system is off line and no statuses are being received.

4.2.4.1 Setting BIT Parameters

1. Set mode to **Wired, On-line**, or **Off-line**.
2. From the **site tree**, select the TRX you want to run a BIT on and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.

3. Select the **BIT** tab.

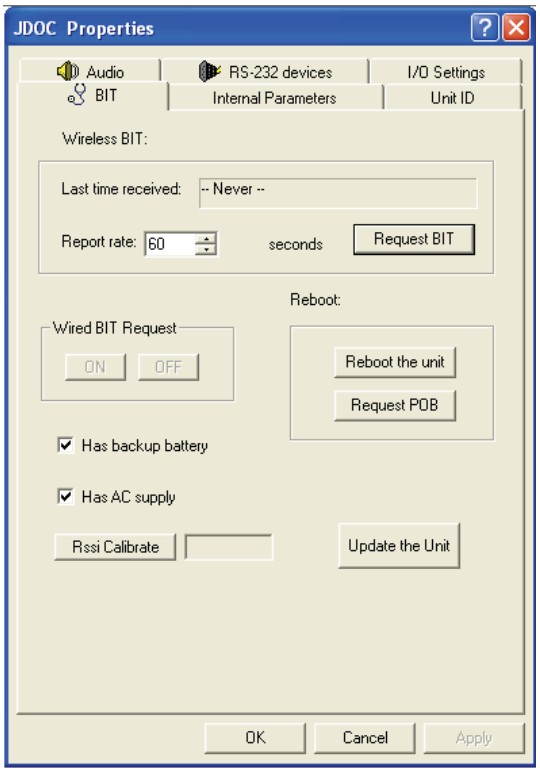


FIGURE 4.4 BIT settings tab

4. Do one of the following depending on the transceiver type:

   For a TRX transceiver:

   a. In the **Report rate** box, type or select the rate at which the TRX sends BIT messages to the CRLU. The default Report Rate is 60 seconds. Unless adding a new device, it is recommended that you leave the rate as set by the Cooper Notification Field Engineer to avoid the possibility of causing false indications.

   b. **Select** the **Has backup battery** check box, to register the TRX backup battery if the TRX is attached to a UPS-901 and to check its status.

   c. **Select** the **Has AC supply** check box, to register the TRX AC power supply if the TRX has an AC power cord attached to it and to check its status.

   d. Click **Update the Unit** to send all the settings to the TRX and then click **OK** to close the dialog box.

   For a VHF or UHF transceiver:

   a. In the **Report rate** box, type or select **60** seconds as the rate at which the transceivers sends BIT messages to the Base VHF/UHF radio.

   b. **Clear** the **Has backup battery** check box.

   c. **Clear** the **Has AC supply** check box.

   d. Click **OK** to save the settings to the NCT database and close the dialog box.

5. From the **File** menu, select **Save** to save changes to the WAVES 7 database.

4.2.4.2 Manually Requesting BIT Results

1. Set mode to **Wired, On-line**, or **Off-line**.
2. From the **site tree**, select the transceiver you want BIT results from and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
3. Select the **BIT** tab and click **Request BIT**.
4. Click **OK** to close the dialog box.
5. See Section 4.2.4.4, "Viewing BIT and POB Results" for instructions on viewing the results.

4.2.4.3 Manually Requesting POB Results

1. Set mode to **Wired, On-line**, or **Off-line**.
2. From the **site tree**, select the transceiver you want POB results from and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
3. Select the **BIT** tab and click **Request POB**.
4. Click **OK** to close the dialog box.
5. See Section 4.2.4.4, "Viewing BIT and POB Results" for instructions on viewing the results.

4.2.4.4 Viewing BIT and POB Results

The BIT Results window displays the results of a request for BIT and POB information for a transceiver. The name and address of the unit appear on the title bar. The window displays the BIT and POB results data from the transceiver.

1. With the unit from which you requested the BIT or POB report already selected, select the **Commands** menu.
2. Select **BIT Result**. The BIT Results window appears.

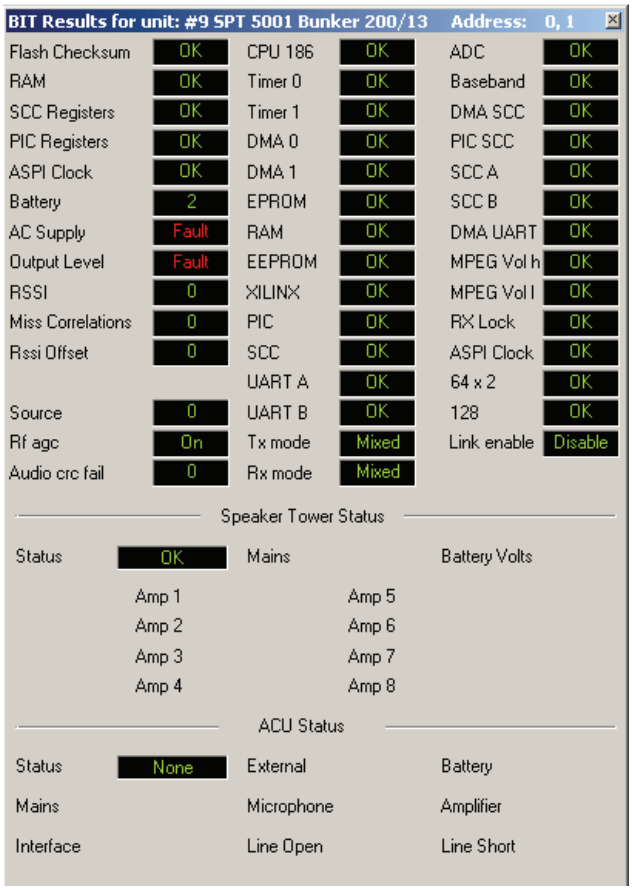


FIGURE 4.5 BIT results window

Many of the results displayed in the upper portion of the BIT Results window are used only for factory testing and may not show relevant information for the TRX operational status. These fields should not be relied upon to assess the condition of the transceiver hardware. Table 4.3 describes commonly referenced fields on the BIT Results window.

TABLE 4.3 Commonly Referenced BIT Results Descriptions

Field	Description
Battery	Reports the UPS-901 battery status as one of the following: • **0 - No battery** • **1 - Low battery level** • **2 - Medium battery level** • **3 - High battery level**
Output Level	Reports the audio output level as one of the following: • **OK** • **Fault**
RSSI	Reports the communication (receive) signal strength. In a WAVES system, a minimum of 170 is required to meet the "Acceptable" level for signal strength and greater than 180 is "Good".

TABLE 4.3 Commonly Referenced BIT Results Descriptions (continued)

Field	Description
Miss Correlations	Reports the number of packets lost by the receiver (cumulative value with rollover at 255). When packets are lost, Audio CRC fail is also incremented. When there are seven consecutive failures, the receiver starts to search for another source.
Source	Reports the Unit ID of the current RF source.
RF agc	Reports the receive attenuation status. Used for attenuation of strong signals. The following results are returned: • **On** - Receive signal is attenuated. • **Off** - Receive signal is not attenuated.
Audio CRC fail	Reports the Audio CRC failures per second (cumulative value with rollover at 255) as one of the following: • **Increments of 0-2 failures per 10 seconds** - Good reception. • **Increments of more than 20 failures per 10 seconds** (the receiver will search for another source) - Poor reception.
Speaker Tower Status	Reports the Speaker Tower statuses as follows: • **Status** - Reports the following: – **None** if no SPT is defined. – **OK** – **Fault** if any of the criteria below are also “Fault”. • **Mains** - When configured, reports the following: – **OK** – **Fault** if missing 120/240 charge voltage. • **Battery Volts** – **For SPT** - When configured, reports actual voltage of battery. If less than 22.5 volts, status is fault; nominal voltage is 25 to 28 volts. – **For HPSA** - When configured, reports actual voltage of battery. If less than 45 volts, status is fault; nominal voltage is 50 to 56 volts. • **Amp 1-8** - Reports the following: – **OK** – **Fault**

TABLE 4.3 Commonly Referenced BIT Results Descriptions (continued)

Field	Description
ACU Status	The ACU Status only applies to the ACU-117 model. The ACU-340 will only report a yellow block with a black exclamation mark, meaning that a problem exists with a connected RS-232 device. Reports the ACU statuses as follows: • **Status** - Reports the following: – **None** if no ACU is defined. – **OK** – **Fault** if any of the criteria below are also "Fault". • **External** - Reports the following: – **OK** – **Fault** (typically a shorted speaker wire to the building ground). • **Battery** - Reports the following: – **OK** – **Fault** if battery voltage is low or missing. • **Mains** - Reports the following: – **OK** – **Fault** if missing 120/240 charge voltage. • **Microphone** - Reports the following: – **OK** – **Fault** • **Amplifier** - Reports the following: – **OK** – **Fault** • **Interface** - Reports the following: – **OK** – **Fault** if missing status request from transceiver for 30 seconds or more. • **Line Open**/**Line Shor**t - Reports the following: – **OK** – **Fault** if speaker wires are disconnected or shorted together.

4.2.4.5 Rebooting the TRX from the Configuration Tool

1. Set mode to **Wired,** or **On-line**.
2. From the **site tree,** select the transceiver that needs rebooted and do one of the following:
   – From the **Edit** menu, select **Properties**.

   OR

– Right-click the unit and select **Properties** from the shortcut menu.

OR

– Click the  icon on the toolbar.

The unit's Properties dialog box appears.

3. Select the **BIT** tab and click **Reboot the Unit**.
4. Click **OK** to close the dialog box.

4.2.5 TRX Unit ID

Every TRX has a unique Unit ID number between 2 and 16,383 that is arbitrarily assigned at installation time. The Unit ID is the transceiver's address in the WAVES system. It is used by the Configuration Tool to link each unit to its RF sources. For VHF/UHF Radio-400/500 transceivers the Unit ID is preset in manufacturing.

A TRX may also be assigned an Installation ID. This identifier groups multiple units into an "installation group". The Installation ID is used by TRXs operating in Lock Mode "AUTO" to only receive from sources within their own group. TRXs operating in Lock Mode "NORMAL" ignore the Installation ID.

4.2.5.1 Assigning Unit and Installation IDs to a TRX

Assigning the unit and installation IDs applies only to TRX transceivers.

For VHF/UHF Radio-400/500 transceivers the Unit ID is preset in manufacturing.

You must assign each unit a unique Unit ID between 2 and 16,383.

TRX Unit ID and Installation ID parameters can only be set in **Wired** mode. If it is assigned in Off-line mode then the Configuration Tool saves it only in the base station's computer database.

1. Connect one end of the **CAB-PC-ADU-3 cable** to the **Serial** port of your PC and the other end to the **RS-232** port of the TRX.
2. Set mode to **Wired**.
3. Select the unit on the site tree and do one of the following:
   – From the **Edit** menu, select **Properties**.

   OR

   – Right-click the unit and select **Properties** from the shortcut menu.

   OR

   – Click the  icon on the toolbar.

   The unit's Properties dialog box appears.

4. Select the **Unit ID** tab.

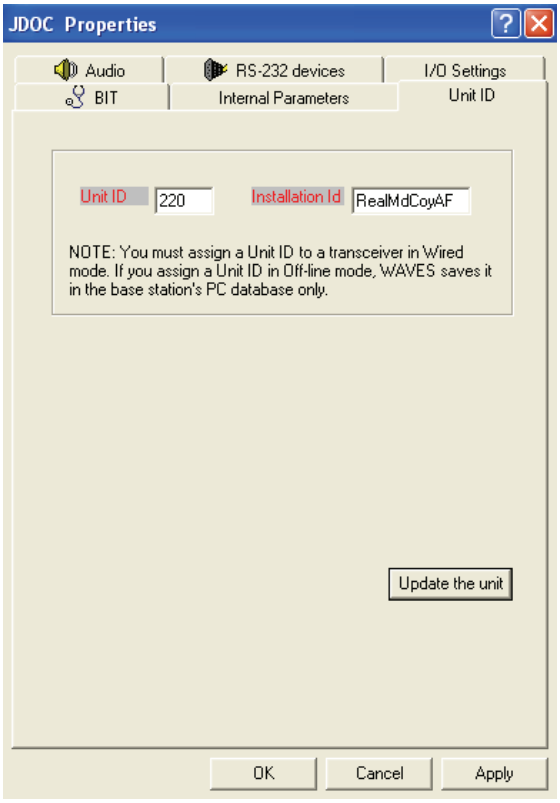


FIGURE 4.6 Unit ID settings tab

5. In the **Unit ID** box, type a numeric value.

   Assign any number from 2 to 16,383. The eight least significant bits of the Unit IDs for each of a TRX's children (RF listeners) should be different. See Section 4.1.2, "Defining BIT Monitoring Parameters"for instructions on configuring BIT parameters.

NOTE

Do not set the Unit ID to 0 (zero). If set to 0, connection lines for RSSI will not display on the WAVES 7 map.

---

6. In the **Installation Id** box, type a name. This is an optional entry.
7. Click **Update the Unit** to send all the parameters to the TRX.
8. Click **OK** to close the dialog box.

If you are working in Wired mode, the settings are saved in the base station computer's database after an acknowledgment is received.

You cannot assign a Unit ID in On-line mode. You can assign it in Off-line mode, in which case a message appears informing you that the ID was not sent to the field transceiver and asking if you want to save it in the database. If you click Yes, the new settings are stored in the database. Later you must update the field transceiver as follows:

a. Connect one end of the CAB-PC-ADU cable to the **Serial** port of your computer and the other end to the **RS-232** port of the TRX.

b. Switch to **Wired** mode and click **Update the Unit** on the **Unit ID** tab of the **Properties** dialog box.

4.2.6 Internal Parameters

Internal parameters must be set up for each transceiver. Required parameters differ for a TRX and a VHF/UHF radio. The following list describes the parameters you will see on the Internal Parameters tab.

Unit Address - The Configuration Tool *automatically* assigns a unit address based on its position in the site tree and loads it when assigning the internal parameters. It is not modifiable from this window.

Unit Type - Defines the unit's type as CRLU (base station transceiver), RLX (field receiver), PRLU (field relay), SRLU (satellite relay), or a backup CRLU (BCRLU).

Sw Mode - RF switching mode. May be defined as "Enabled" or "Disabled." The "Enabled" state enables the TRX to search for an alternate RF source in case the quality of its current RF source drops below a preset limit.

Lock Mode - "Auto" or "Normal". In "Normal" mode the TRX will lock only onto an RF source from the RF Settings table. In "Auto" mode the TRX will lock onto the first received source with a matching installation ID and not on the Ineligible Sources list.

TX Offset - A value selected for the transceiver's forward RF transmissions. See Appendix A, "TRX Transmitting Offset Assignments" for a list of TX offset numbers.

RF Settings - Pairs of Unit IDs and Offset values for TRX units that serve as RF sources for the TRX being set up. Up to nine sources may be specified. This table is only active in Normal Lock Mode.

Ineligible Sources - A table of unit IDs of the RF sources that the TRX may not receive from. This table is only active in Auto Lock Mode.

SRLU - When the unit type is an SRLU or Backup CRLU, the user may choose the primary source of the audio and voice channels. Two choices are available: Base and Local. When "Base" is selected, the primary source is the CRLU. When "Local" is selected, the primary source is the SRLU.

4.2.6.1 TRX Internal Parameters

The TRX is a transmitter node in the WAVES wireless network that receives and plays messages addressed to them using FHSS technology to broadcast RF signals over a wide range of frequencies. Frequency offsets are used to spread RF signals. Receiving stations use their frequency offset settings to recognize and retrieve RF signals directed to them.

4.2.6.1.1 Setting TRX Internal Parameters for “Normal Mode”

Setting up TRX Internal Parameters is most efficiently done in **Wired** mode. That way, the unit does not need to re-sync with its sources. However, Internal Parameters may be set in **On-Line** mode, except if the unit is a CRLU.

1. Select the unit on the site tree and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit’s Properties dialog box appears.
2. Select the **Internal Parameters** tab.

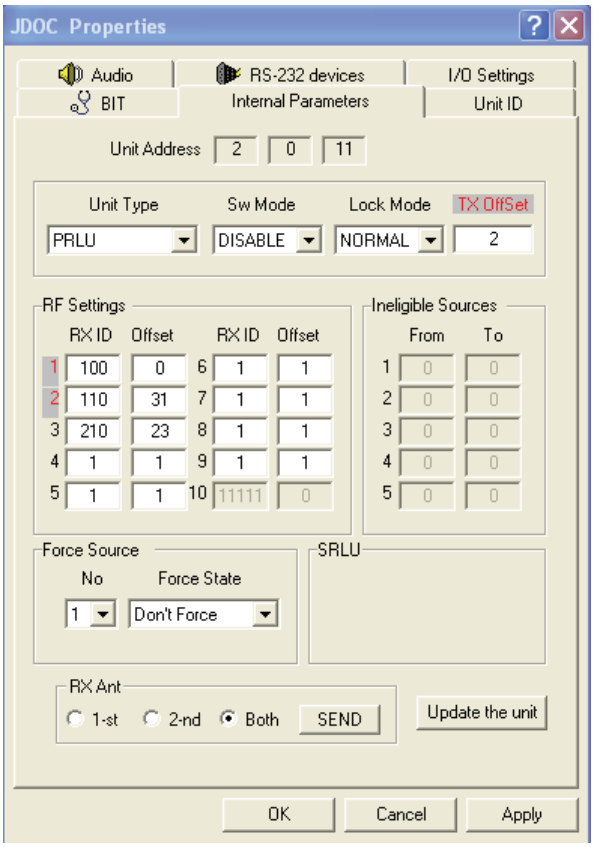


FIGURE 4.7 Internal Parameters settings tab

3. From the **Unit Type** list box, select the type of unit.

If you select SRLU or Backup CRLU as the Unit Type, the Audio and Voice source selections appear within the SRLU group box.

a. In the **SRLU** box, select one of the following **Audio** sources: **Base** for CRLU input or **Local** for SRLU input.

b. Select one of the following **Voice** priority: **Base** to give CRLU voice messages priority over local announcements, **Local** to give priority to local PTT messages.

4. From the **Lock Mode** list box, select **Normal**.
5. In the **RF Settings** box, enter the **RX ID** and **Offset** parameters as per the RF plan. See Appendix A, "TRX Transmitting Offset Assignments" for a list of transmit offset numbers.
6. Click **Update the Unit** to send all the settings to the TRX.
7. Click **OK** to close the Properties dialog box.
8. Verify that the unit reports an **OK** status (blue icon) on the site tree.

4.2.6.1.2 Setting TRX Internal Parameters for "Auto Mode"

Setting up TRX Internal Parameters is most efficiently done in **Wired** mode. That way, the unit does not need to re-sync with its sources. However, Internal Parameters may be set in **On-Line** mode, except if the unit is a CRLU.

1. Select the unit on the site tree and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
2. Select the **Internal Parameters** tab.
3. From the **Unit Type** list box, select the type of unit.
4. From the **Lock Mode** list box select **Auto**.
5. If applicable, in the **Ineligible Sources** box, enter the unit IDs of RF sources that the unit may not receive from.
6. Click **Update the Unit** to send all the settings to the TRX.
7. Click **OK** to close the Properties dialog box.

4.2.6.2 VHF or UHF Radio Internal Parameters

Radio-400 and Radio-500 are VHF and UHF transmitter nodes in the WAVES wireless network that receive and broadcast messages addressed to them on a single frequency, narrow band. Frequency settings are preprogrammed per customer specifications.

1. Select the unit on the site tree and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
2. Select the **Internal Parameters** tab.
3. From the **Unit Type** list box, select **RLX**.
4. From the **TX Offset** box, use the default setting of "**2**".
5. Click **Update the Unit** to send all the settings to the unit.
6. Click **OK** to close the Properties dialog box.

4.3 VERIFYING DATABASE INTEGRITY

4.3.1 Peeping Unit Information

You can monitor a transceiver's internal parameters by using the Peep Unit Information option on the Configuration Tool.

1. Set mode to **On-line, Wired**, or **User**.
2. Select a unit on the site tree.
3. From the **Commands** menu, select **Peep Unit Info** or click the  icon. The Monitor Unit dialog box appears.

It may take several seconds for the unit information to appear.

Different transceiver types report different information. The dialog box automatically adjusts itself to the information contained within it.

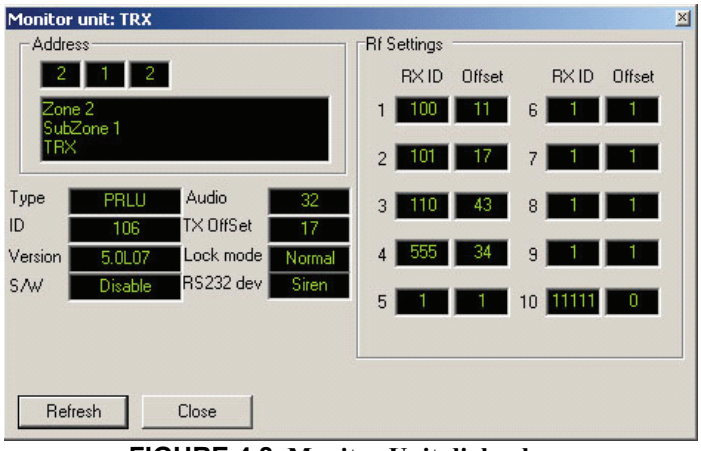


FIGURE 4.8 Monitor Unit dialog box

4.3.1.1 Refreshing the Monitor Unit Data

- From the **Monitor Unit** dialog box, click **Refresh**.

4.3.1.2 Closing the Monitor Unit Dialog Box

- From the **Monitor Unit** dialog box, click **Close**.

4.3.2 Using the Verify Command

The Verify command compares the contents of a transceiver's internal database with the intended settings as they appear in the WVS database.

1. Set mode to **On-line, Wired**, or **User**.
2. From the **site tree**, select the unit you want to verify.
3. From the **Commands** menu, select **Verify**. The Verify Settings for Unit dialog box opens.

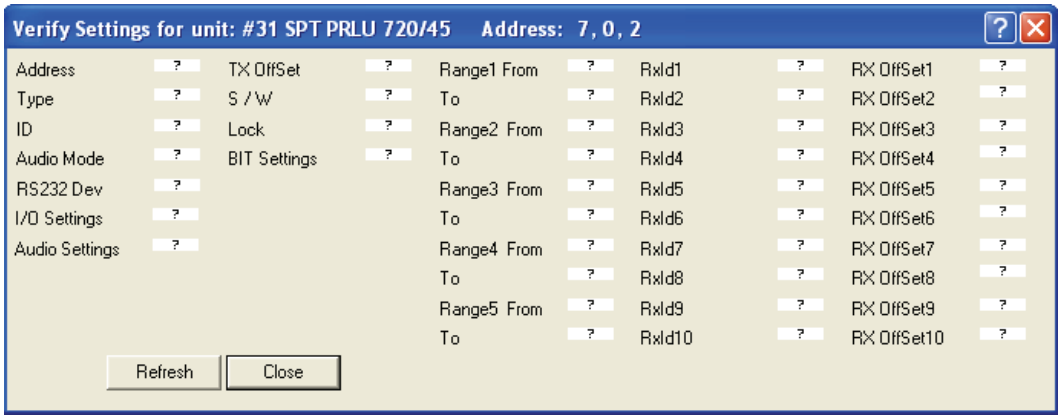


FIGURE 4.9 Verify Settings for Unit dialog box

Each database entry that matches will display a **blue O.K**. A database entry that does not match will display a **red ERROR**. To correct an error, update the unit with the correct parameters.

The "Audio Settings" category compares the current TRX settings with the stored 'default' setting (not the current database setting) and will report "ERROR" if the TRX settings are not the default settings.

4.3.2.1 Refreshing the Verify Settings Data

- From the **Verify Settings for Unit** dialog box, click **Refresh**.

4.3.2.2 Closing the Verify Settings Dialog Box

- From the **Verify Settings for Unit** dialog box, click **Close**.

4.4 EXPORTING THE DATABASE TO A TEXT FILE

You can export database information as a text file and then print the file. The report includes the following information:

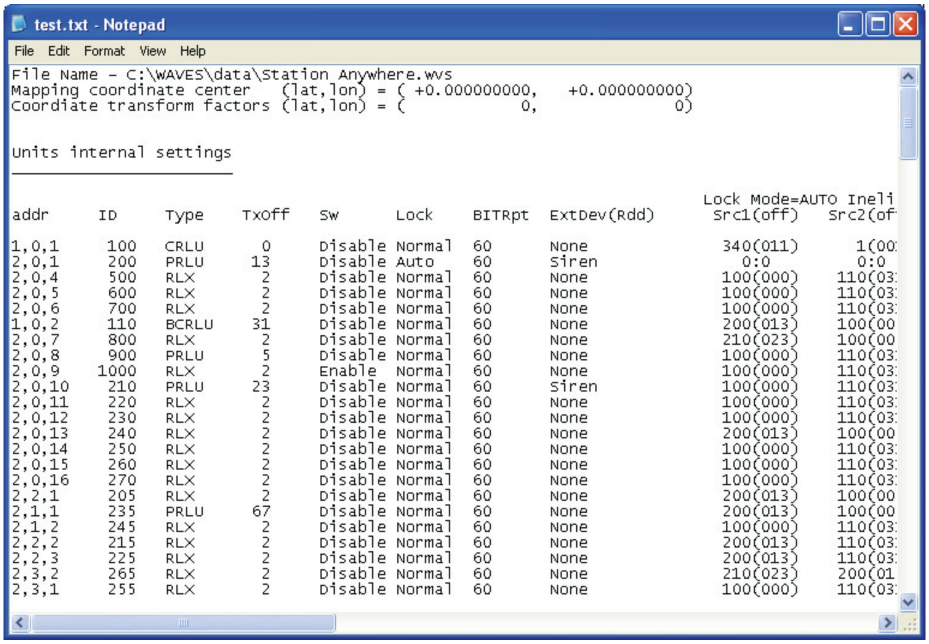
- Unit Internal Settings
  - Address

  - ID
  - Type
  - Tx Offset
  - Installation ID
  - Switching and Lock Modes
  - BIT Reporting Rate
  - External Device Settings
  - SRLU/Backup CRLU Audio Sources
  - RF Sources
- Unit Design Settings
  - Theater, Zone, Sub-Zone, or Unit Name
  - Associated Bitmap File (if any)
- Unit Audio Settings
  - System Audio Mode
  - Volume Settings (Zone and sub-zone numbers are relative, unit settings are absolute, corresponding to the numbers shown in the Properties window.)
  - Bass and Treble Settings (for Units only)
  - Mute Settings
- Wireless Activator families
  - WA Family Number
  - WA Family Name

4.4.1 Exporting and Printing the Database

1. From the **Commands** menu, select **Export Data Base**. The Export DataBase confirmation dialog box appears.
2. Click **Yes** to export the database to TXT file or No to cancel the action. If Yes was selected, the Save a File dialog box appears.
3. Enter the **File name** and click **Save**. The default location for the saved file is C:\Waves\Data.
4. Open the **C:\Waves\Data** directory and locate the file.

5. Open the file with an ASCII editor, such as Notepad, and then print the file using the standard Windows printing procedure.



File Name - C:\WAVES\data\Station Anywhere.wvs
Mapping coordinate center (lat,lon) = (+0.000000000, +0.000000000)
Coordiate transform factors (lat,lon) = (0, 0)

Units internal settings

addr	ID	Type	Txoff	Sw	Lock	BITRpt	ExtDev(Rdd)	Lock Mode=AUTO Src1(off)	Ineli Src2(of
1,0,1	100	CRLU	0	Disable	Normal	60	None	340(011)	1(00
2,0,1	200	PRLU	13	Disable	Auto	60	Siren	0:0	0:0
2,0,4	500	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,0,5	600	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,0,6	700	RLX	2	Disable	Normal	60	None	100(000)	110(03
1,0,2	110	BCRLU	31	Disable	Normal	60	None	200(013)	100(00
2,0,7	800	RLX	2	Disable	Normal	60	None	210(023)	100(00
2,0,8	900	PRLU	5	Disable	Normal	60	None	100(000)	110(03
2,0,9	1000	RLX	2	Enable	Normal	60	None	100(000)	110(03
2,0,10	210	PRLU	23	Disable	Normal	60	Siren	100(000)	110(03
2,0,11	220	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,0,12	230	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,0,13	240	RLX	2	Disable	Normal	60	None	200(013)	100(00
2,0,14	250	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,0,15	260	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,0,16	270	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,2,1	205	RLX	2	Disable	Normal	60	None	200(013)	100(00
2,1,1	235	PRLU	67	Disable	Normal	60	None	200(013)	100(00
2,1,2	245	RLX	2	Disable	Normal	60	None	100(000)	110(03
2,2,2	215	RLX	2	Disable	Normal	60	None	200(013)	110(03
2,2,3	225	RLX	2	Disable	Normal	60	None	200(013)	110(03
2,3,2	265	RLX	2	Disable	Normal	60	None	210(023)	200(01
2,3,1	255	RLX	2	Disable	Normal	60	None	100(000)	110(03

FIGURE 4.10 Database exported as a text file

4.5 UPDATING TRX FIRMWARE

On occasion it will be necessary to update or reload the TRX's firmware.

There are two methods for updating the TRX firmware: Wired Update and Wireless Update.

See Appendix B, "TRX Firmware Update Procedures" for instructions.

CHAPTER 5

Setting Up Peripheral Devices

A WAVES system can include several types of peripheral devices that enhance the message and alarm notifications to personnel. This chapter describes administrator procedures for configuring peripheral devices in the Network Configuration Tool.

The following sections are included in this chapter.

- Display Signs
- Speaker Tower (SPT)
- High-Powered Speaker Array (HPSA)
- Wireless Activator System (WA)
- Nuclear, Biological, and Chemical (NBC) Detectors
- Autonomous Control Unit (ACU)
- Digital Output Devices

5.1 DISPLAY SIGNS

The WAVES system supports several types of visual display signs. You must configure sign properties before the sign can execute a script from WAVES 7 to display a message.

5.1.1 Setting the Display Sign RS-232 Type

1. Set mode to **On-line**.
2. From the **site tree**, select the unit that is connected to a display sign and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the shortcut menu.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.

3. Select the **RS-232 devices** tab.

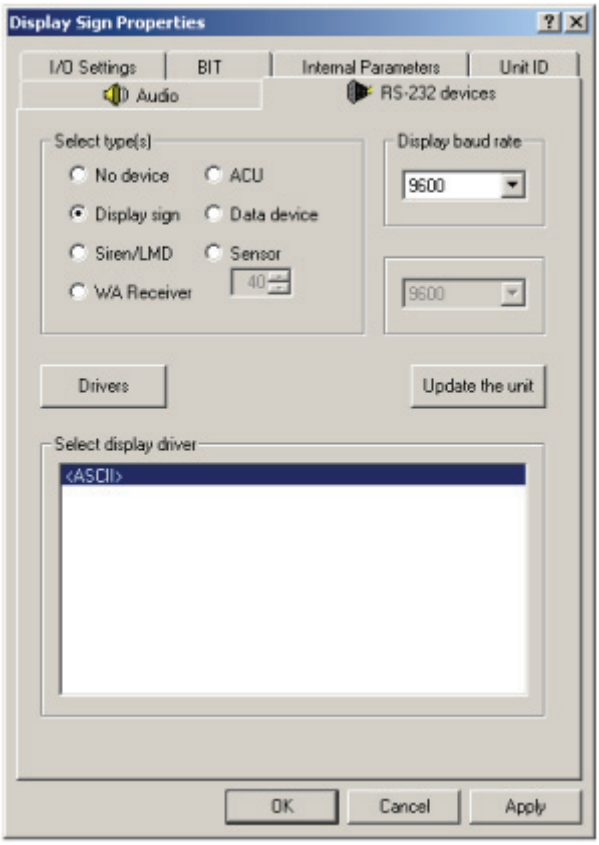


FIGURE 5.1 RS-232 devices - display sign settings

4. From the **Select display driver** box, choose **<ASCII>**.
5. From the **Display baud** rate box, click the arrow and select the correct rate.
   - **For Galaxy 3010, 3020, or G200 display signs:** Select **19200**.
   - **For an InfoNet display sign**: Select **9600**.
6. Click **Update the unit** and then **OK** to close the Properties dialog box.

5.2 SPEAKER TOWER (SPT)

The SPT is a high-powered siren system designed to broadcast live or prerecorded messages for public warning in cases of emergency, natural disasters, or military conflicts. This peripheral device acts as a node in the WAVES network that communicates through an RS-232 interface connected to a TRX located inside the SPT electronics enclosure. For For instructions on configuring the SPT settings, see the *SPT Installation and User Manual*.

5.3 HIGH-POWERED SPEAKER ARRAY (HPSA)

Like the SPT, the HPSA is also a high-powered siren system designed to broadcast live or prerecorded messages for public warning. As a peripheral device, it acts as a node in the WAVES network that communicates through either a TRX or UHF/VHF Radio-400/500 transceiver located inside the HPSA electronics enclosure. For instructions on configuring

the HPSA settings, see the either the *HPSA-3000 Series Installation* and *User* manuals or *HPSA-4000 Series Installation and User Manual*.

5.4 WIRELESS ACTIVATOR SYSTEM (WA)

The Wireless Activator System allows personnel to remotely communicate with a WAVES Base Station to issue notification of critical alarm and emergency events. The system consists of the following:

- **Wireless Activator Transmitter (WTX)**
- **Wireless Activator Receiver (WRX)**

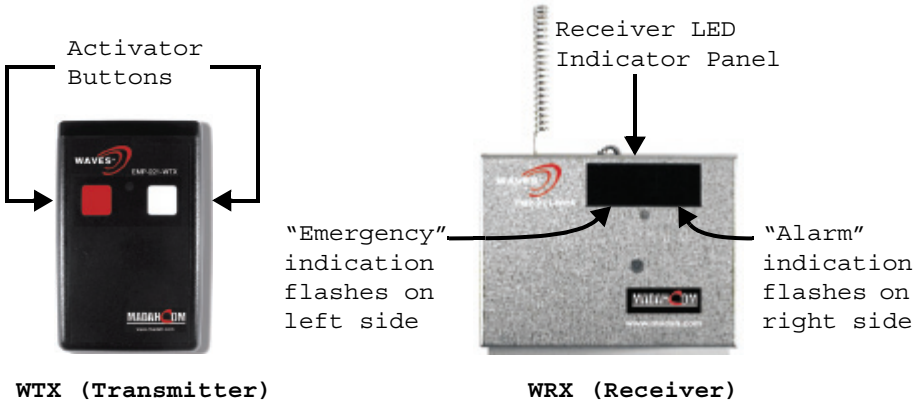


FIGURE 5.2 WA System devices

After WA devices have been defined and configured in the Network Configuration Tool database, the administrator can then assign activators and set up WA events in WAVES 7. The following WA events can be configured:

- **Alarm** - An event triggered when the *white* button on a WA Activator is pressed and when the WA Receiver is not already in Alarm or Emergency mode.

  When triggered, the activator number appears, flashing on the right side of the WA Receiver's (WRX) LED panel.
- **Emergency** - An event triggered when the *red* button on the WA Activator is pressed and when the WA Receiver is not already in Emergency mode.

  When triggered, the activator number appears, flashing on the left side of the LED panel.
- **LowBattery** - An event triggered when an activator determines that its battery power is low.
- **NotExists** - An event triggered when an activator is lost from the receiver's list of known activators, or regained communications.

5.4.1 Defining Wireless Activator System Properties

The WRX initiates a change-of-state warning by communicating with a TRX unit by-way-of the unit's RS-232 port. Each group of activators is called a "family" and is assigned a family name. Each individual WTX is assigned a unique identifier, identifying it to its own WRX.

5.4.1.1 Defining WA Families

1. Set the mode to **Off-line**, **On-line**, or **Wired**.
2. From the **File** menu, select **Properties**.
3. Select the **Activator Families** tab.
4. Click **New Family**. A new WA family named "Family <#>" is added to the list box.

Each family represents a WRX and all WTXs associated with it.

5. Select the newly added family and click **Rename**. The Edit name dialog box appears.
6. Enter a new name for the family and click **OK**.

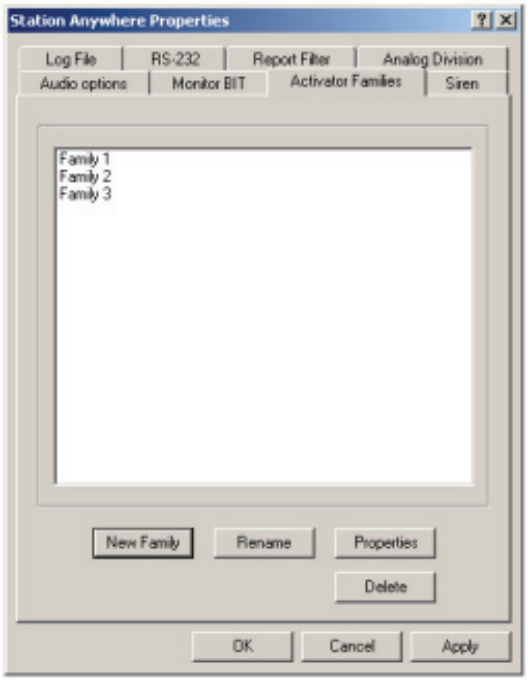


FIGURE 5.3 Activator Families settings tab

7. From the list box, select the family and click **Properties**. The Activator Definition Table appears.
8. From the **Activator Definition Table**, for each transmitter address click its "**In-Use**" button.The WRX can communicate with up to 23 activators.

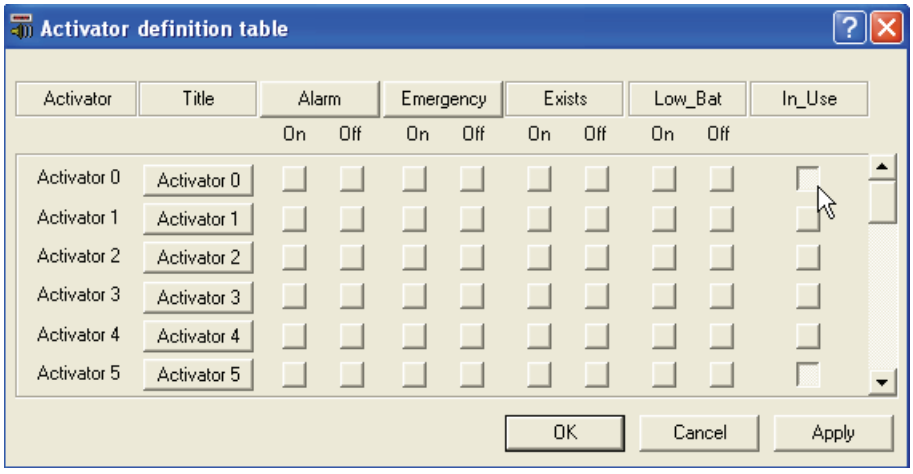


FIGURE 5.4 Activator Definition Table

9. Click **Apply** to save the new setting and then **OK** to close the dialog box.
10. Click **OK** to close the Properties dialog box.

5.4.1.2 Configuring the TRX for WA Communication

1. Set the mode to **Off-line**, **On-line**, or **Wired**.
2. Click the unit on the site tree that is connected to the WRX.
3. Do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the element and select **Properties**.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
4. Select the **RS-232 devices** tab.

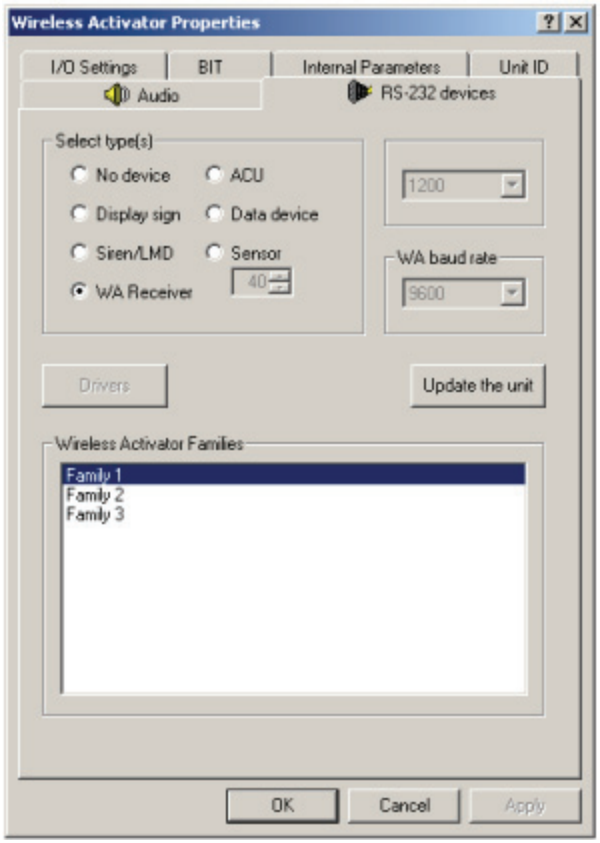


FIGURE 5.5 Defining a WRX Receiver RS-232 device

5. From the **Select type(s)** box, select the **WA Receiver** radio button.
6. From the **Wireless Activator Families** list box, select the family you wish to assign to the WRX.
7. Click **Update the unit** to send all the settings to the TRX.
8. Set other properties as described in Section 4.2, "Configuring Transceiver Properties".
9. Click **OK** to close the dialog box.

10. Set up wireless activator events as described Section 5.4.2, “Setting Up WA Events”.

5.4.2 Setting Up WA Events

WA events are defined in WAVES 7 to announce activator activity. Refer to the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system for instructions on setting up WA events.

5.4.3 Monitoring Wireless Activators

WA activity is monitored from the WAVES 7 screen by an operator. Refer to the *WAVES 7 Operator Manual* or *WAVES 7 Online Help* for instructions on monitoring wireless activators.

5.5 NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DETECTORS

The Network Configuration Tool, when coupled with the appropriate TRX firmware version, adds the capability to interface with specialized sensors through the TRX RS-232 port. The firmware provides interface protocols for communication with the following sensor devices.

- RAE Systems® ppbRAE detector (with firmware version 1.22, or later)
- Smiths Detection® GID-3 detector (with DWIU-enabled firmware)

The TRX periodically polls the sensors for data and reports the data to WAVES, where an operator monitors the system for alerts.

After detectors have been defined and configured in the Network Configuration Tool database, the administrator can then set up detector events in WAVES 7.

5.5.1 Configuring the TRX for NBC Detector Communications

The TRX must be running a compatible firmware version to interface with the sensor. Contact Cooper Notification/MadahCom Customer Support if assistance is needed.

1. Set mode to **Wired** or **On-line**.
2. From the **site tree**, select the unit that is connected to an NBC detector and do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the **shortcut menu**.

     OR
   - Click the  icon on the toolbar.

   The unit’s Properties dialog box appears.
3. Select the **RS-232 devices** tab.

4. From the **Select type(s)** box, click the **Sensor** radio button.

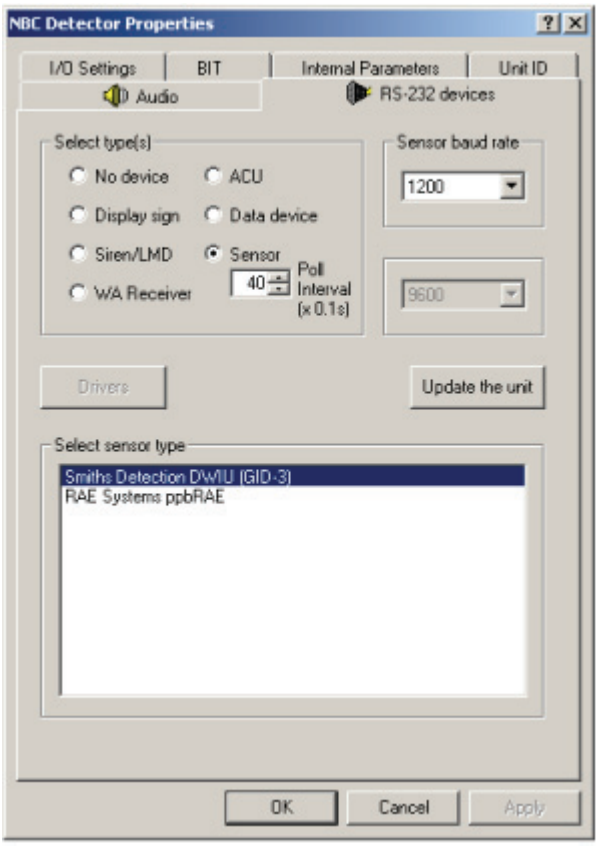


FIGURE 5.6 RS-232 devices tab - Sensor settings

5. In the **Poll Interval** box, type or select the polling interval, in tenths of a second (i.e., 40 = 4 seconds). The TRX will poll the sensor for data at this interval. Valid values are from 10 to 60 tenths of a second. A value of zero disables polling.
6. From the **Select sensor type** box, choose the chemical detector type.
7. From the **Sensor baud rate** box, select the baud rate.
8. Click **Update the unit** to send all the settings to the TRX.
9. Set other properties as described in Section 4.2, “Configuring Transceiver Properties”.
10. Click **OK** to close the dialog box.
11. Set up detector events as described Section 5.5.2, “Setting Up NBC Detector Events”.

5.5.2 Setting Up NBC Detector Events

Detector events are set up in WAVES 7 to announce detector activity. Refer to the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for your system for instructions on setting up NBC events.

5.5.3 Monitoring NBC Detectors

Detector activity is monitored from the WAVES 7 screen by an operator. Refer to the *WAVES 7 Operator Manual* or *WAVES 7 Online Help* for instructions on monitoring gas detectors.

5.6 AUTONOMOUS CONTROL UNIT (ACU)

The ACU is an individual building mass notification system that can be connected to a base-wide WAVES system.

It includes a WAVES audio command center that is a state-of-the-art Emergency Voice Evacuation Control Panel, which provides the ability to dispatch several preprogrammed messages from a local operator console. The system is also capable of delivering live voice messages using an integral microphone.

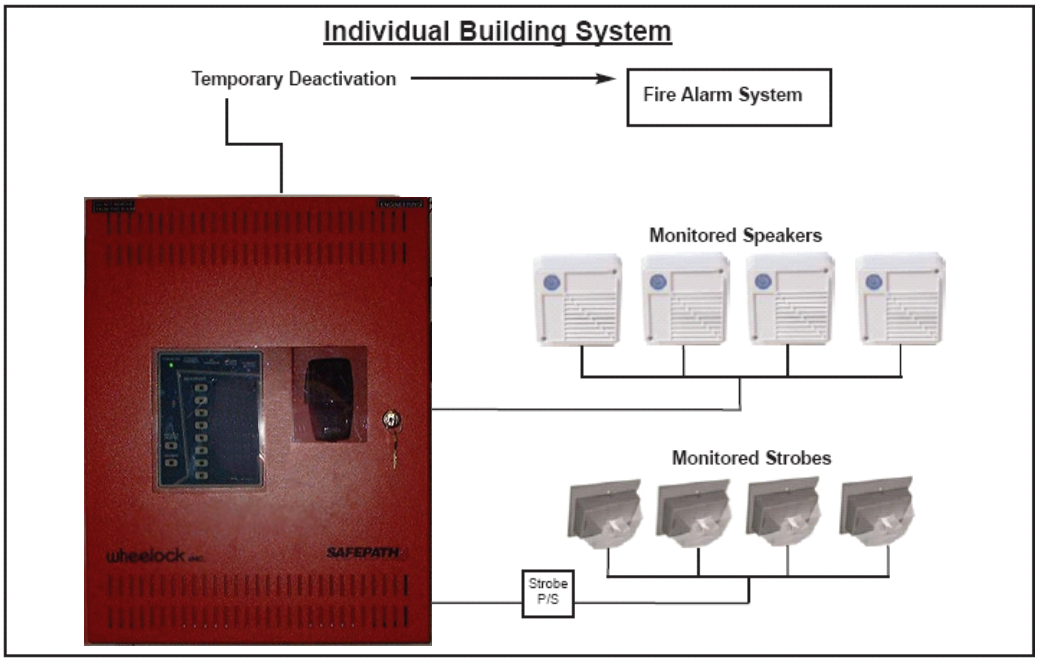


FIGURE 5.7 ACU communications

When an optional TRX is added to the ACU, the TRX functions as the audio and data input/output node when the system is in base-wide mass notification mode.

The ACU also integrates with fire alarm systems by providing a deactivation signal for fire-alarm audible notification appliances while WAVES delivers voice messages.

After the ACU has been configured in the Network Configuration Tool database, the administrator must define the ACU type in WAVES 7.

5.6.1 Configuring a Transceiver for ACU Communications

1. Set mode to **Wired** or **On-line**.
2. From the **site tree**, select the ACU and do one of the following:
   – From the **Edit** menu, select **Properties**.

   OR

– Right-click the unit and select **Properties** from the **shortcut menu**.

OR

– Click the  icon on the toolbar.

The unit's Properties dialog box appears.

3. Select the **RS-232 devices** tab.
4. From the **Select type(s)** box, click the **ACU** radio button.

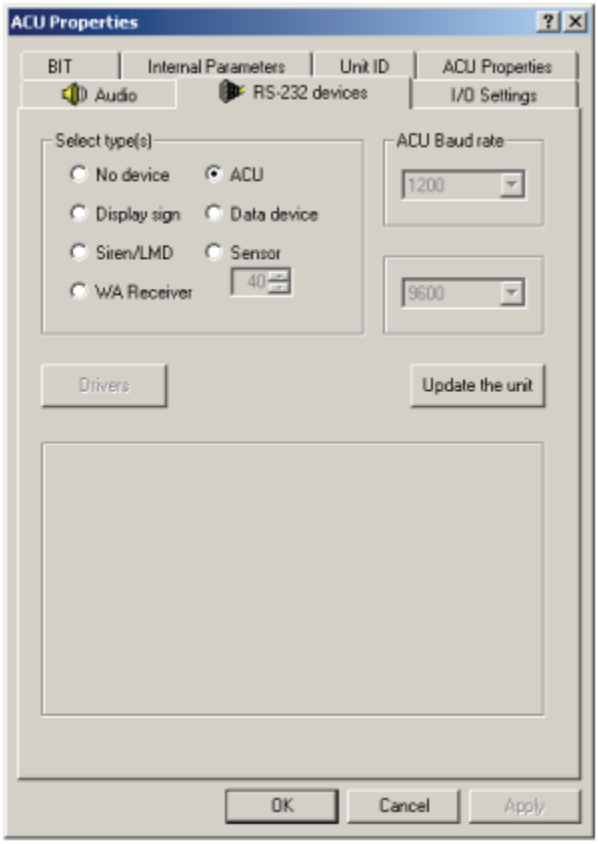


FIGURE 5.8 RS-232 devices tab - ACU settings

5. Click **Update the unit** to send the setting to the transceiver and then **OK** to close the dialog box.
6. Set other properties as described in Section 4.2, "Configuring Transceiver Properties".
7. Repeat **Step 2**, to reopen the unit's Properties dialog box. A new tab appears in the dialog box, "ACU Properties".
8. Select the **ACU Properties** tab.

The ACU Properties tab only appears after the unit has been configured as an ACU on the RS-232 devices tab.

FIGURE 5.9 ACU Properties settings tab

9. From the **Number of Available Messages** list, select the number that represents how many PB-2 through PB-8 buttons are actually green back-lit (active) on the front of the ACU control panel.
10. Click **Time Sync** to synchronize the ACU log reports to the computer clock. In normal operation, WAVES does this automatically at startup and once per day thereafter.
11. Click **Apply** to save the settings and then **OK** to close the dialog box.

5.6.2 Identify the ACU Type

Before ACU messaging can begin you must identify the type of building emergency system installed at your site. This is done from WAVES 7. Refer to the *WAVES 7 Administrator Manual* or *WAVES 7 Online Help* for instructions.

5.6.3 Activating ACU Messages

ACU messages are activated from the WAVES screen using buttons and scripts set up by the WAVES Administrator. See the *WAVES 7 Operator Manual* or *WAVES 7 Online Help* for instructions.

5.6.4 Monitoring the ACU Status

ACU status is monitored from the WAVES 7 screen by an operator. Refer to the *WAVES 7 Operator Manual* or *WAVES 7 Online Help* for instructions on monitoring devices.

5.7 DIGITAL OUTPUT DEVICES

WAVES 5.6.1 and higher allows you to configure automatic activation of output devices, such as strobes, that are attached to Digital I/O 2 (J2 Pin 9 on the TRX) and can be turned on by a 5-Volt signal.

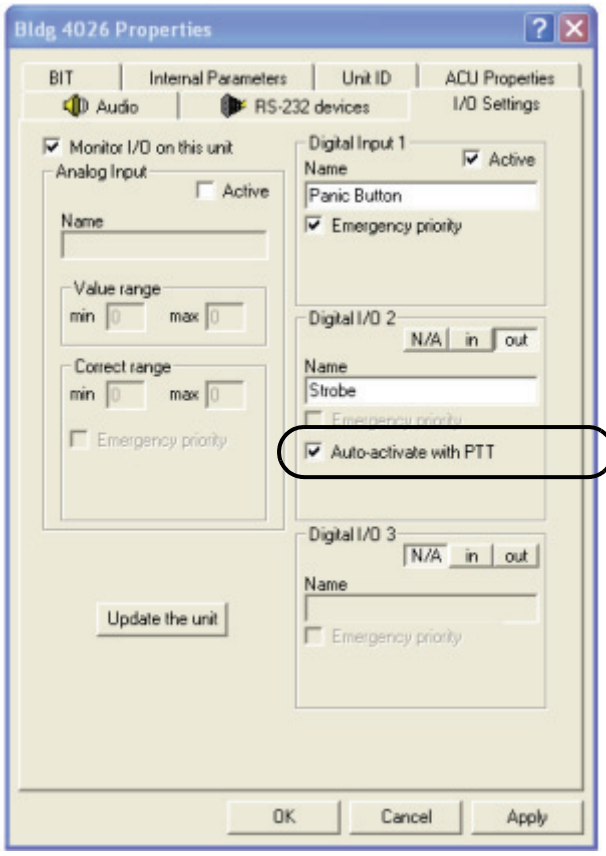
To set auto-activate digital output devices:

1. Set mode to **Wired** or **On-line**.
2. From the site tree, select the unit (the output device must be attached to Digital I/O J2 Pin 9 on the TRX) and then do one of the following:
   - From the **Edit** menu, select **Properties**.

     OR
   - Right-click the unit and select **Properties** from the **shortcut menu**.

     OR
   - Click the  icon on the toolbar.

   The unit's Properties dialog box appears.
3. Select the **I/O Settings** tab.



Digital I/O 2: Select "Auto-activate with PTT" to assert this output any time PTT announcements are made.

FIGURE 5.10 Auto-activate digital output device

4. From the **Digital I/O 2** box, click the **Out** button to activate the digital pin as output signal.

If Digital I/O 2 is configured as output (Out), checking the “Auto-activate with PTT” check box causes output to be asserted whenever the TRX makes a PTT announcement. For example, an attached strobe will automatically flash whenever audio is played to the unit. If the option is not checked, the strobe will only flash when an I/O ON command is issued.

5. Type a descriptive name in the **Name** box.
6. Select the **Auto-activate with PTT** check box.
7. Click **Update the Unit** to send all the settings in the Properties dialog box to the transceiver.
8. If necessary, set other properties as described in Section 4.2, “Configuring Transceiver Properties”.
9. Click **OK** to close the dialog box.

APPENDIX A

TRX Transmitting Offset Assignments

This appendix presents the recommended transmitting offset assignment order for a WAVES site.

The following sections are included in this appendix.

- Using Transmitting Offset Numbers
- Transmitting Offset Numbers List

A.1 USING TRANSMITTING OFFSET NUMBERS

An offset number is an RF frequency value assigned by you to a CRLU-201 or TRX-401 that enables it to recognize which RF signals to accept and which to ignore. The following list provides important information when assigning offset numbers.

- Assign “0” as the transmitting offset of the CRLU and “2” to those transceivers configured as RLXs on the **Internal Parameters** tab of the unit’s Properties dialog box.
- Offset numbers can be reused on the same site IF the two TRXs are not within RF range of each other.
- To avoid transmission difficulties, make sure that you do not assign similar transmitting offsets to field transceivers defined as PRLUs in the same area. For example, do not assign “5” and “7” to two field transceivers located close to each other.

A.2 TRANSMITTING OFFSET NUMBERS LIST

The following table lists the recommended transmitting offset assignment order.

TABLE A.1 RF Transmit Offset Numbers

Item	Offset #
CRLU	0
RLX	2
1.	31
2.	13
3.	53
4.	5
5.	23
6.	43
7.	67
8.	3
9.	37
10.	59
11.	11
12.	73
13.	47
14.	7
15.	17
16.	41
17.	71
18.	19
19.	29
20.	61
21.	70
22.	24
23.	45
24.	6

Item	Offset #
25.	60
26.	12
27.	50
28.	66
29.	40
30.	9
31.	74
32.	36
33.	14
34.	30
35.	55
36.	38
37.	18
38.	63
39.	27
40.	44
41.	75
42.	21
43.	34
44.	52
45.	69
46.	16
47.	57
48.	33
49.	65
50.	10

Item	Offset #
51.	48
52.	20
53.	64
54.	15
55.	49
56.	4
57.	58
58.	26
59.	51
60.	35
61.	62
62.	72
63.	54
64.	25
65.	42
66.	28
67.	68
68.	8
69.	39
70.	46
71.	32
72.	56
73.	1
74.	22

APPENDIX B

TRX Firmware Update Procedures

On occasion it may be necessary to update or reload the TRX's firmware. This appendix provides instructions for updating the firmware.

The following sections are included in this appendix.

- Firmware Updating Methods
- Wired Mode
- Wireless / On-Line Mode

B.1 FIRMWARE UPDATING METHODS

There are two methods for updating the TRX firmware:

- Wired Mode
- Wireless / On-line Mode

The Wired method is faster and less disruptive to system operations than a Wireless update making it the preferred method. However, under special circumstances, where access to a TRX unit is restricted, the Wireless update method may be preferable.

The firmware update is a two-step process. First, the hex file containing the binary code is transferred to a buffer within the unit. When this step is successfully completed, the content of the buffer is burned into the TRX unit's on-board memory.

B.2 WIRED MODE

1. Disconnect the TRX power cable from its power source. The TRX turns off.
2. Connect one end of the **CAB-PC-ADU-3** cable to your computer **Serial** port and the other end to the TRX **RS-232** port.
3. From the **Network Configuration Tool**, set mode to **Wired**.

4. From the **Commands** menu, select **Version Update**. The Version Update dialog box appears.

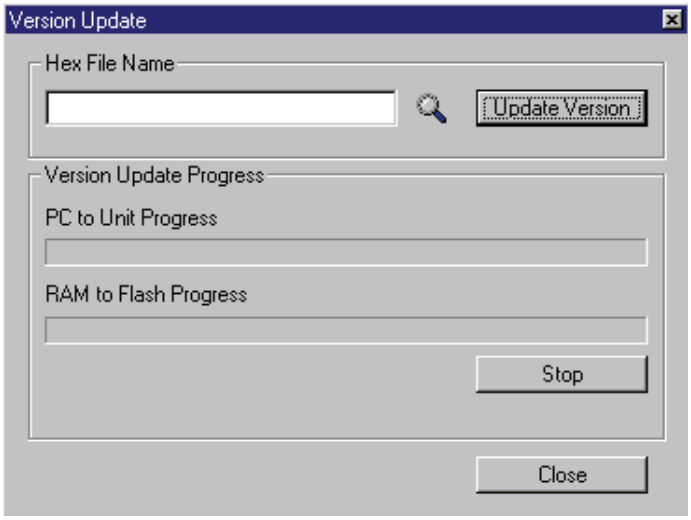


FIGURE B.1 Version Update dialog box

5. From the **Hex File Name** box, do one of the following:
   - Enter the appropriate file name and add the **.hex** extension to the end of the name.

     OR
   - Click the magnifying glass and locate the file.

NOTE

Be prepared to plug the TRX power cable back into its power source within 5 seconds AFTER clicking the Update Version button.

---

6. Click **Update Version**. The message "Waiting for Ready to Receive" appears.

Warning

MAKE SURE ELECTRICAL CONNECTIONS ARE SECURE BEFORE APPLYING POWER TO A UNIT. FAILURE TO SECURE CONNECTION MAY CAUSE AN ELECTRICAL ARC RESULTING IN PHYSICAL SHOCK OR DAMAGE TO EQUIPMENT.

---

7. Immediately (within 5 seconds) plug the TRX power cable into its power source to turn the TRX on.

   A series of messages are issued documenting the actions taking place. The update progress can be seen from the Version Update Progress box on the Version Update dialog box.
8. Verify that the update was successful by selecting the **Commands** menu and choosing **Peep Unit Info** or by clicking the  icon. The Monitor unit window opens.
9. Check the version number and ensure it matches the newly installed update.

B.3 WIRELESS / ON-LINE MODE

A CRLU cannot be programmed using the wireless method.

1. Open the **Network Configuration Tool** as described in Section 2.1.1, “Launching the Application”.
2. Set the mode to **On-line**.
3. From the **site tree**, select the zone, sub-zone, or unit to be updated.

When a zone or sub-zone that contains multiple units is selected as the site tree target their units will be listed separately in the **Units’ update status list** box of the Wireless Firmware Update dialog box (see Figure B.2).

Avoid attempting updates to groups of more than 15 units as the probability of success is diminished.

4. From the **Commands** menu, select **Wireless Update**. The Wireless Firmware Update dialog box appears.

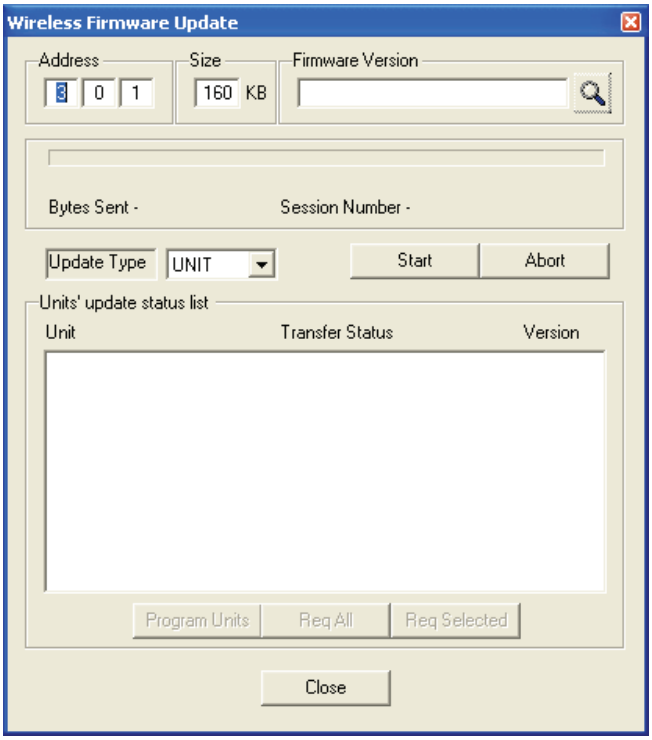


FIGURE B.2 Wireless Firmware Update dialog box

5. From the **Address** box, verify that the address is correct for the selected TRX.
6. From the **Firmware Version** box, do one of the following:
   – Enter the appropriate file name and add the **.hex** to the end of the name.

   OR

- Click the magnifying glass and locate the file.

7. Click **Start**. Acknowledgment is provided informing you that the file transfer is in progress. Also, a progress bar indicates the number of bytes being sent to the TRX unit.
8. From the **Units' update status list** box, verify that the file transfer process was successful by checking the **Transfer Status** column.

   If the transfer was not successful, click Start again.
9. From the **Units' update status list** box, highlight the unit(s) you want to update and click **Program Units**. The follow actions occur:
   - A message appears informing you that the program command was sent.
   - The TRX's Sync indicator LED flashes quickly, indicating that firmware loading is in progress.
10. Upon successful completion of the programming, a message appears informing you that the unit is back on and displays the new firmware version.
11. Click **Close**.

APPENDIX C

Configuring the RF AGC Setting

When a TRX is shipped the RF AGC turned Off. In the event a BIT report shows the AGC as “On” use the instructions in this appendix to reset it to “Off”.

The following sections are included in this appendix:

- Setting the AGC to “Off”

NOTE

THIS PROCEDURE SHOULD ONLY BE PERFORMED BY A TRAINED COOPER NOTIFICATION FIELD ENGINEER.

C.1 SETTING THE AGC TO “OFF”

Write a WACOL CustomCmd statement to execute the procedure.

1. From the **View** menu, select **WACOL Shell**. The WACOL Shell dialog box appears.

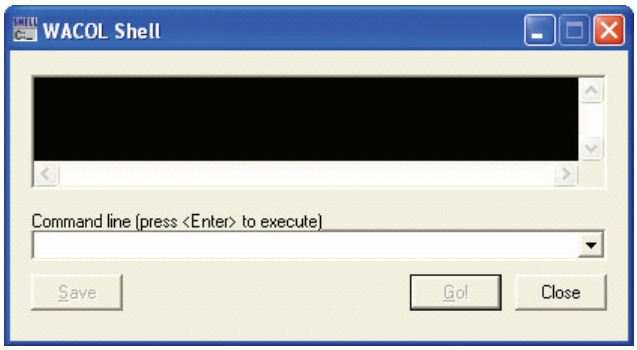


FIGURE C.1 Blank WACOL Shell dialog box

2. In the **Command Line** box type the following:

   prim “customcmd”, addr(1,0,1), 172, 5, “OF A5 05 50 5A”

   - Where *172* is the opcode for *AGC* control and *5* is the number of *command arguments in the quoted string*.
   - Where *OF* (letter “O”) turns the *AGC Off* and the *remaining parameters are a required constant for the AGC command*.

3. Click **Go!**. The Network Configuration Tool executes the WACOL statement. The WACOL statement appears in the command list box and is added to the command list.

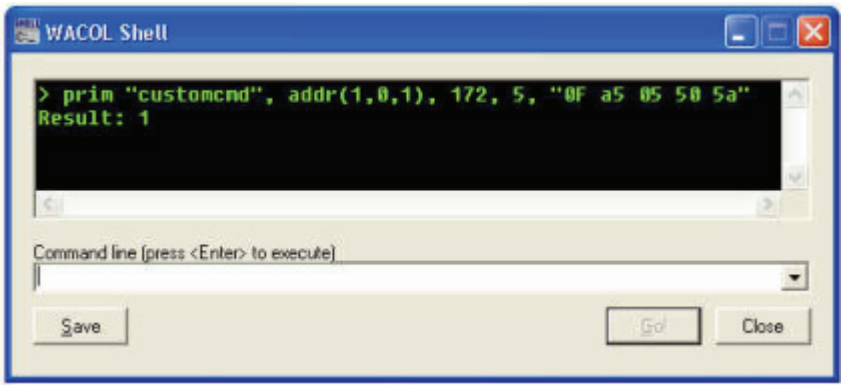


FIGURE C.2 WACOL Shell command AGC Off

4. Click **Close**.

APPENDIX D

Troubleshooting

This appendix includes a list of problems that may arise when using WAVES and possible solutions.

The following sections are included in this appendix:

- Resolving System Problems

D.1 RESOLVING SYSTEM PROBLEMS

The following table provides a list of possible problems that may occur when operating WAVES and resolutions for the problems. Contact Cooper Notification/MadahCom Customer Support if a problem persists or is not discussed in this manual.

TABLE D.1 Troubleshooting System Problems

Problem	Resolution
The "Select Com Port" dialog box popped up when you ran WAVES for the first time.	The dialog box is telling you what COM ports are available for use. • Change the **COM port** or click **Cancel** to close the dialog box. The Network Configuration Tool may already be running. • Click **Cancel**. A hardware failure if the selected COM port may have occurred. • Check devices for failure notifications.
The audio from a TRX speaker is unclear.	Check the reception quality of the TRX in the BIT Result. If the RSSI value is below 160, assign a different primary and secondary RF source to the TRX. (In a WAVES system, a minimum of 160-179 is required to meet the "Acceptable" level for signal strength and greater than 180 is "Good".) Check the Audio Mode setting.

TABLE D.1 Troubleshooting System Problems

Problem	Resolution
A unit's icon changes to the blue battery icon on the site tree.	Indicates that the AC power supply to the TRX has been interrupted and that the TRX is now receiving power from its backup battery.
A unit's icon changes to the red battery icon on the site tree.	Indicates that the backup battery power supply is low (has 10V or less).
A unit's icon changes to the blue battery with an "X" across it on the site tree.	Indicates that the TRX does not have a backup battery even though it is registered as having one.

.

Glossary

A

ACU	Autonomous Control Unit. A UFC-compliant device that is the core component of an individual building system. It incorporates an Audio Command Center capable of dispatching several prerecorded messages as well as live voice messages throughout the protected building.
ADU-301	Audio Data Unit. The ADU-301 is the interface between the Command Unit Computer and the base station transceiver, providing an interface between its input audio and data channels and the base station transceiver. It converts serial data from the Command Unit Computer to a form usable to the transceiver. It also provides an interface between the PC and base station transceiver.
All Call Mode	Sends a live message to all unit devices in the installation site even when the computer is turned off.
Alternate Base Station	Used if the WAVES primary base station becomes unserviceable or inaccessible.
AreaAlert	The AreaAlert function is designed to identify and alert units based on their location, not their function. When a threatened area is identified, a list is constructed of units that lie in that area. WAVES determines which of its transceiver units is/are contained within the defined area and uses that list as the selected units when executing the specified script.
AVM	Audio Visual Message. A Network Configuration Tool dialog box used to manage rdd drivers.

B

BCRLU	Backup CRLU. Acts as an SRLU until a specific discrete signal is detected, at which time it takes over the CRLU functions for the entire network.
BIT	Built-In-Test. Network-wide supervisory diagnostic report.

C

CAP	Common Alerting Protocol. CAP messaging is a worldwide used XML-based data format that allows individuals to exchange public warnings and emergency alerts between alerting systems. CAP integration with WAVES allows a sending

	agency to issue a standardized message to the WAVES system, triggering a configured CAP Event that executes a WACOL script.
CBRN	Chemical, Biological, Radiological and Nuclear. Detection system that sends status and alarm messages to the WAVES Operator console.
COTS	Commercial Off The Shelf.
CRLU-201	Central Relay Unit. A fully integrated transceiver located at a base station. The CRLU-201 transmits multiple channels of audio and visual display messages, and RS-232 data and control information, and receives RS-232 data and BIT reports for subsequent transmission to the IBS software.

D

DCE	Data Communication Equipment. A device that communicates with data terminal equipment in RS-232 communications. For example, a modem.
DTE	Data Terminal Equipment. A device that controls data flowing to or from a computer.
DTMF	Dual Tone Multi Frequency. The WAVES DTMF utilizes a Dialogic® interface card to access the WAVES system remotely by any touch-tone phone. The user responds to pre-defined prompts in a manner similar to a voice-mail system to record a message to play or select a WAVES script to execute.

F

FHSS	Frequency Hopping Spread Spectrum. WAVES CRLU and TRX transceivers use FHSS technology to broadcast RF signals over a wide range of frequencies. Frequency offsets are used to spread the RF signals. Receiving stations use their frequency offset settings to recognize and retrieve RF signals directed to them.

H

HPSA	High-Powered Speaker Array. A high-powered public address and siren system used in the WAVES network to broadcast live or prerecorded messages. The HPSA employs TRX or VHF/UHF radio transceivers for communicating within the WAVES system and supports both planar and horn arrays.

I

IBS	Integrated Base Station. The IBS is the command center of the WAVES network. All sensor appliances, like panic buttons and NBC detectors send their signals through the RF network to the IBS, which is running WAVES software. WAVES software is set up during installation to either immediately respond and alert personnel to safety through notification appliances, such as speakers, strobes, and LED text signs, or to allow the operator at the IBS to decide what appropriate action to take.
IDS	Intrusion Detection System. Sends detection status messages to WAVES.

L

LMD	Local Message Device. In a WAVES network the LMD enables simultaneous activation of different messages at different nodes, allowing each transceiver or

	speaker tower at a site to play different messages simultaneously, while retaining the common-message alerting that WAVES already performs. Local and WAVES Base Station audio messages are managed in a selectable prioritization.

M

MNS	Mass Notification System.
MSA	Mobile Speaker Array. An HPSA system housed on a sturdy trailer base with an extendable horn mast, locking outriggers and jockey wheel, and multiple power sources. The MSA is used in the WAVES network to broadcast live or prerecorded messages, employing TRX or VHF/UHF radio transceivers to communicate within the WAVES system.

N

NAB	Network Access Bridge. Acting as a bridge between a WAVES Base Station and a satellite WAVES system, a NAB consists of headless PC (without monitor, keyboard, or mouse) running NAB software, a COTS VHF radio controller and/or an ADU-301 and CRLU-201, a power supply, and the case that houses all of these components. The NAB is Ethernet-based, extending the range of WAVES communication to nodes distributed over a wide area and limitless distance.
NBC	Nuclear Biological Chemical. Detection system that sends status and alarm messages to the WAVES Operator console.
Normal Mode	Sends a live message to only those devices selected from the WAVES Selection panel.
Notification Appliance	Any appliance that alerts or protects personnel.

P

PAS	Personnel Alerting System.
PDB	Power Distribution Board.
Peripheral Device	Any appliance that provides input or sends a message into the WAVES system.
POB	Power-on BIT. Tests the hardware configuration during the power-on process.
POI	Point-of-Impact.
PRLU	Primary Relay Unit. A field transceiver, TRX-401, addressable node configured as a PRLU in the wireless network that receives and broadcasts messages addressed to it. A PRLU can also retransmit messages it receives from a CRLU or another relay node, extending the range between the CRLU and an RLX.
PTT	Push-to-Talk. Broadcasts a live message that is being spoken into a microphone.

R

Radio-400	An addressable VHF transmitter node in the WAVES wireless network that receives and broadcasts messages addressed to it on a single frequency, narrow band. Commands sent from a WAVES IBS are received by the radio and played to attached end-of-line devices. The radio also transmits messages and status reports upstream to the IBS. Frequency settings are preprogrammed per customer specifications and within the VHF range of 30 - 300 megahertz.

Radio-500	An addressable UHF transmitter node in the WAVES wireless network that receives and broadcasts messages addressed to it on a single frequency, narrow band. Commands sent from a WAVES IBS are received by the radio and played to attached end-of-line devices. The radio also transmits messages and status reports upstream to the IBS. Frequency settings are preprogrammed per customer specifications and within the UHF range of 300 - 3000 megahertz.
RF	Radio Frequency. A radio frequency signal sent and received through the WAVES network.
RLX	Field Receiver End Unit. An addressable TRX field transceiver node configured as an RLX in the wireless network that receives and passes broadcast messages to devices connected to it.
Roam Secure	Cooper Notification's Roam Secure Alert Network works together with Roam Secure Information Exchange (RSIX) as an anywhere, anytime information sharing and emergency alerting system, delivering real-time critical emergency communication to any text-enabled device, phone, or fax on national, regional, and local levels. RSAN uses the Common Alerting Protocol as its messaging format.
RSAN	Roam Secure Alert Network.
RSIX	Roam Secure Information Exchange. RSIX works behind the scenes in the RSAN system to automatically aggregate and deliver information and alerts in real-time on national, regional, and local levels.
RSSI	Received Signal Strength Indicator. A measurement of strength (not necessarily the quality) of the received signal in a wireless environment.

S

SectorAlert	SectorAlert allows the grouping of units into a geographic set (sector) that enables all units in the sector to always be alerted together. The sectors are visually identified on the site map by drawing a square, rectangle, or polygon SectorAlert grid around a group of units by using longitude and latitude coordinates. In SectorAlert mode, when an AreaAlert message is received, the Threat Area is not compared with the unit locations but with the sector location. If any part of the Threat Area lies within a sector, all units in that sector are alerted.
SPL	Sound Pressure Level. The physical intensity of the alarm sound.
SPT	Speaker Tower. A high-powered public address and siren system used in the WAVES network to broadcast live or prerecorded messages.
SRLU	Satellite Relay Unit. An addressable TRX field transceiver node configured as a SRLU in the wireless network that receives and broadcasts messages addressed to devices attached to it. An SRLU can also accept audio and voice input from a locally-connected base station and transmit it as messages from the CRLU, but only to units defined to be in its downline tree.
Stored Messages	An optional local messaging feature that is inherently part of a high-powered speaker array unit’s device controller board. Stored message capability enables simultaneous activation of different messages at different nodes, allowing each transceiver or HPSA at a site to play different messages simultaneously, while retaining the common-message alerting that WAVES already performs.

T

TACWAVES	Tactical Wireless Audio Visual Emergency System. A fully functional standalone portable alerting system capable of being rapidly deployed in the field for disaster relief, humanitarian missions, tent city operations, and temporary events to broadcast emergency announcements in wide areas.
TRX-401	The TRX-401 is an addressable transceiver node in the wireless network that receives and broadcasts messages addressed to it. It is addressable as a PRLU or RLX. Each transceiver is assigned a unique address. The TRX is a fully integrated unit with an integral power supply, audio amplifiers, and dual diversity antennas, and supports connections to optional external antennas.

U

UHF	Ultra High Frequency. A band of radio frequencies from 300-3000 megahertz.
UPS	Uninterruptible Power Supply. A device used to maintain a continuous power supply in the event of primary power interruption.
UWI	Universal WAVES Interface. An accessory to the TRX designed specifically to provide a simple way to interface the WAVES system to third party systems.

V

VHF	Very High Frequency. A band of radio frequencies between 30-300 megahertz.

W

WA	Wireless Activator. The Wireless Activator System consists of an EMP-221-WRX Receiver (WRX Receiver) which communicates with up to twenty-three (23) EMP-221-WTX Activators (WTX Activators). Together, they trigger and report alarm and emergency events to WAVES system.
WACOL	WAVES Command Language. Script commands used to execute WAVES procedures.
WAVES	Wireless Audio Visual Emergency System. WAVES is a secure wireless technology that prevents jamming, interference, and eavesdropping and protects the network in the event of a disaster, allowing messages to continue broadcasting without interruption. Existing security systems, such as fire alarms, intrusion detection, and CBRN detection systems can integrate with WAVES.

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Cooper Notification
7565 Commerce Court
Sarasota, FL 34243
Tel.: 941.487.2300
Fax: 941.487.2387
www.coopernotification.com