Wireless On/Off control Manual (IO8)
V5.0.0 for use with firmware V4.0.0 or higher

July 28, 2015

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Warnings and Precautions

The following symbols indicate important safety warnings and precautions throughout this manual.

They are defined as follows:

WARNING	WARNING indicates that serious bodily harm or death may result from failure to adhere to the precautions.

! CAUTION	CAUTION indicates that damage to equipment may result if the instructions are not followed.
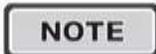
NOTE	NOTE indicates certain conditions that the user should be aware of.

Table of Contents

Introduction

Overview

This manual is a guide and reference for programming COMMPAK I/O8 radios using ENCOM's ControlPAK™ programming and diagnostics software.

This manual contains instructions, suggestions, and information which will guide you set up and achieve optimal performance from your equipment.

Description of the I/O8

The COMMPAK I/O8 has been designed specifically for remote ON/OFF control and Status/Alarm monitoring applications. The radios feature two way communications, the ability to confirm status at a Remote site and timer outputs that can be pre-programmed for up to two hours, eliminating the need for timer relays.

All typical system designs are supported including:

➢ Point to Point
➢ Point to Multipoint
➢ Multipoint to Point
➢ Multipoint to Multipoint

The radio employs ENCOM's License-Free Frequency Hopping Spread Spectrum Technology. This technology has been designed to provide reliable, long-range, wireless communications (up to 20 miles with L.O.S.).

The COMMPAK I/O8 accepts up to 8 Inputs and is configured with 8 Outputs. The I/O mapping within a system is configured using the ControlPAK™ software.

Antennas with I/O8 Units

The COMMPAK I/O8 is designed with a Reverse Polarity TNC Female antenna connector. An antenna is not supplied with the I/O8 unit; please contact your local ENCOM Wireless dealer for ordering.

Acceptable Antennas for use with I/O8 Units

There are 2 types of antennas typically used for COMMPAK I/O8 systems:

➢ Yagi antenna
➢ Omni antenna

Other types of antennas can be used if your system has special requirements.

Additional information for these antennas is located in **Appendix A**.

System Topology (System Modes)

There are two available **System Modes** when configuring the COMMPAK I/O 8.

Normal Mode is used to set up your device for communication with other COMMPAK I/O 8 units.

Example application: Wireless ON/OFF switch control

WEB_IO Mode is used to set up your device for communication with a WEB I/O Master Radio. This allows your device to be controlled anywhere an internet connection is available through the WEB I/O. Combined with ENCOM's ZoneWatch™ software, applications of almost any size can be easily and flexibly managed from one software platform.

NOTE	This feature is only available on COMMPAK I/O 8 radios using the ENC-901 wireless engine. Contact Encom for more information on possible upgrades
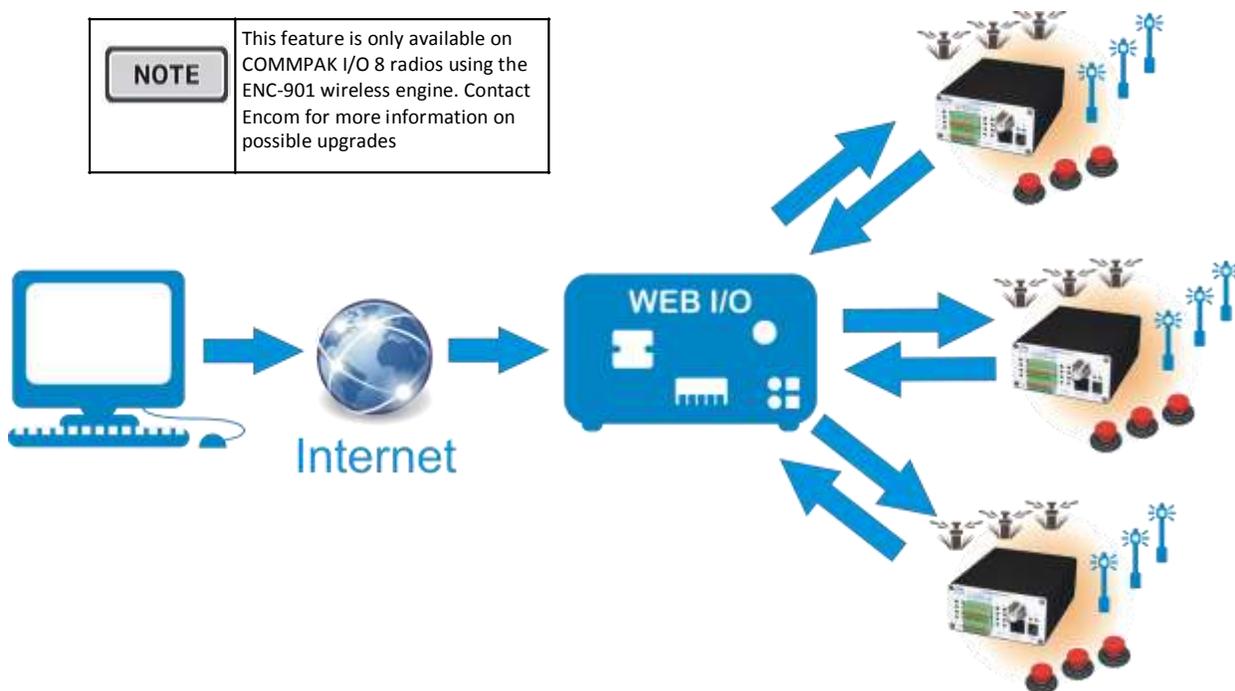
Example application: control of sprinkler systems and traffic equipment from any location with an internet connection.

I/O Topology

There are two different ways in which the user can configure the remote and master radios to communicate with each other. Point-to-multipoint or One-to-Many is used for small scale systems and consists of one master and up to 7 remotes. Latency within this kind of system is low, achieving an approximate minimum of 8ms with one remote and an additional 4.5ms for every other remote in the system, but there is no communication between remotes.

Multi-point to multi-point or Many-to-Many is used for large scale systems. Up to 255 remotes can be used per master radio and any number of repeater levels is allowed. The latency for this mode of communication is little bit higher than point-to-multipoint, but allows for significantly increased flexibility and IO Mapping between remotes is permitted.

Example application of Many-to-Many: 4 side pedestrian crosswalks

Example application of One-to-Many: mid-block traffic detection, low latency required.

Connecting a Radio to a Computer

Before using the ControlPAK™ software, a radio must be connected to the computer that the ControlPAK™ software is running on.

LED Indicators

There are four LED indicators on your Commpak I/O8 radio as follows:

➢ **PWR LED:** Indicates the radio is powered ON.
➢ **INPUT LEDs':** Indicate the status of each of the 8 inputs. The LED for an activated input will be ON.
➢ **OUTPUT LEDs':** Indicate the status of each of the 8 Outputs. The LED for an activated Output will be ON.
➢ **LINK LED:** Indicates the radio is linked and communicating.

Data Connection

You must connect your COMMPAK I/O8 radio directly to your computer for the initial programming and set up.

Your COMMPAK I/O8 radio comes supplied with a programming cable (CB-109) and a wall cube power supply (BH-36A).

1. Plug in the female end of wall cube power supply to the COMMPAK I/O8 radio and the other end into a 240V wall outlet.

2. Plug the telephone jack (RJ-45) end of the programming cable into the Commpak I/O8 unit. The serial end of the unit is to be plugged into the serial port of the computer.

Installing ControlPAK™

Before you can configure your radio, you must first have the radio connected to your computer (refer to the previous chapter), and you must install the ControlPAK™ software.

The disc located in the back pocket of the Installation Guide contains the ControlPAK™ software. Alternatively, you can download the most recent version from our website at www.encomwireless.com . Ensure you are using ControlPAK™ version 4.3.8 or higher.

Technical Specifications for Installing ControlPAK™

To run ControlPAK™ on your PC, you require the following hardware and software:

- Windows XP or Windows Vista
- 1GB RAM
- 100 MB free hard drive space
- Microsoft .NET framework 2.0

After downloading the latest version of the ControlPAK™ software from www.encomwireless.com:

1. Click **Setup**
   The *ControlPAK™ Install* screen appears.
2. Click **Next**.
   The *ControlPAK™ Software License Agreement* screen appears.
3. Click **I agree**, and then click **Next**.
   The *Upgrade/Uninstall* screen appears.
4. Click **Next**.
   The *Select Directory* screen appears.
5. Enter the directory in which you would like the ControlPAK™ software to install, or click **Next** to accept the default directory.
   The *Start Copying Files* screen appears.
6. Click **Next**.
   The Setup file copies the appropriate files to your computer, and then registers the software.
7. Click **Next**, then click **Finish**.
   The ControlPAK™ icon appears on your desktop.

Congratulations, you have successfully installed ControlPAK™.

Configuring Your I/O8 Radio

The first step in using ControlPAK™ to configure your radio is to enter the correct configuration mode. There are three options available from the main screen: **ETHERNET**, **SERIAL**, and **CONTACT CLOSURE**.

Connecting to the Radio

To connect to your radio:

1. From your desktop, double-click the **ControlPAK™** icon.
The *ControlPAK™ main* screen appears.

2. Click **CONTACT CLOSURE**.

3. Click **COMMPAK I/O8**.

The ControlPAK™ software loads, and then the *Home* screen appears.

4. Make sure the Communications Port and Baud Rate are correct. In addition the Data/Parity/Stop Bits need to be correct. These settings can be left as default unless you are using a different communications port.

Click the Connect button to connect to the I/O 8 radio.

Once this has completed, you will be brought to the General Setup screen.

ControlPAK™ Navigation Buttons

The left of the *Main Configuration* screen contains a series of function buttons. They are described in the following table.

Button	Description
	Current Settings uploads a radio's current configuration data into ControlPAK™. If you create a custom configuration and make an error, click **Current Settings** to replace the parameters that are currently displaying on-screen to the settings currently on the radio.
	Program Unit downloads your current on-screen configuration to a radio.
	Read From File uploads radio configuration data from a file into ControlPAK™. This allows you to copy a configuration to another radio. **The radio is not programmed until you click Program Radio**.
	Save to File saves the configuration settings to a file for use later on. You must click **Program Unit** each time you want to download a configuration to a radio; **Save To File** only saves a file to a folder.
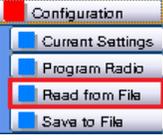
	Quality of Service Tool of the VSWR test can be found from the Tools Button
	Quality of Service Tool that allows to see the noise level in the area against the hopping pattern that is used
	Network allows you to remotely configure any radios within the system
	Diagnostic provides several diagnostic tools for your radios. Visit the Diagnostic Tools section for more information
	Provides you with information about your radio, and also allows you to upgrade the radio's firmware
	Return to the *ControlPAK™ Login* screen
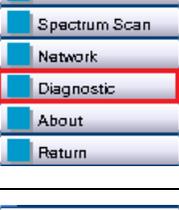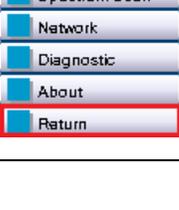
Part 1: Wizard Setup

Initial setup is done by going through the **Wizard Setup** from the **General Setup** page. This is used for first time setup, to choose your radio's operating mode and to reset your radio to factory defaults. For small, specific changes, see **Part 2: General Setup**.

From the *General Setup* page, click the **Wizard Setup** button. The *Wizard Setup* page displays.

1. **Step 1: Select Hardware Type**

   ➢ This field will be greyed out and is only used for reference. This shows what hardware you are configuring.

2. **Step 2: Select I/O Topology**

   ➢ **Point to Multi-point** offers the ability to have one COMMPAK I/O8 radio communicate to many COMMPAK I/O8 remote radios
   ➢ **Multi-point to Multi-point** offers the ability to have each COMMPAK I/O8 radio talk to every other in the radio network
   ➢ View the I/O Topology section for more details
   ➢ In **WEB_IO** mode, this option is locked to **Multi-point to Multi-point**

   Select either option for your radio network.

3. **Step 3: Select Radio Configuration**

   ➢ Select the number of repeater levels that will be used in your system.

   ➢ Select the type of radio you want to configure yours as:

1. To configure your radio as a **Master Radio**, select **Master** from the drop down menu.

2. To configure your radio as a **Remote Radio**, select **Direct Remote** or the option specifying the repeater level that your remote will be operating at from the drop down menu.

3. To configure your radio as a **Repeater Radio**, select **Repeater 1** if your radio will be operating at the first repeater level and **Repeater 2** if it will be operating at the second. **Only two repeater levels are configurable through the Wizard Setup**. **Refer to Miscellaneous Setup Options for more details.**

4. **Step 4: Edit I/O Mapping**

   ➢ I/O Mapping is used to configure the physical input and outputs for the COMMPAK I/O8 radio

   ➢ Press the **I/O Config** button to continue to I/O Configuration

Configuring I/O in WEB I/O Mode

You can reach the I/O Basic Setup window either through the Wizard Setup or with the I/O Configuration button at the bottom of the General Setup page. Everything in this section assumes you are in **WEB_IO** System Mode.

I/O Mapping Setup

The COMMPAK I/O 8 unit supports the use of a hardswitch for wireless on/off control. In the event of a conflict with the scheduler, the hardswitch will take precedence over the scheduler. If there is a loss of communication with the Master radio, the I/O 8 will still operate under its internal clock and scheduler.

To enable I/O mapping, check off the **Enable I/O Mapping** box. If the **Set I/O Mapping as Primary** box is checked off, the scheduler will be normally disabled and only used when communication is lost with the Master radio.

For more information about I/O Mapping, refer to the **Applications** section and **Appendix D**.
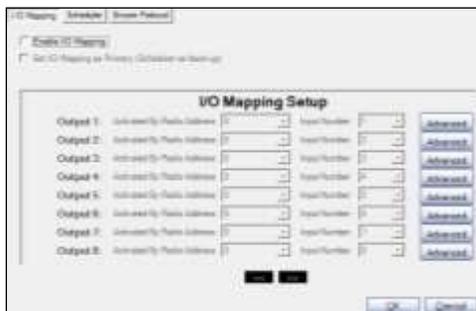
Schedule Setup
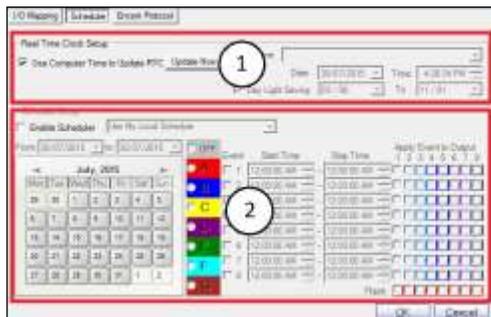
1. **Real Time Clock Setup**
   - ➢ Place a **check mark** in the box next to the **Use Computer Time to Update RTC** box to synchronize your I/O 8's internal clock with the computer's clock.
   - ➢ Press the **Update Now** button to upload the correct Time Zone, Date, Time, and Daylight Savings schedule to the I/O 8. (Make sure your computer's clock is correct)
   - ➢ **Disable** by leaving the box next to the **Use Computer Time to Update RTC box** blank. This will require manual entry of the correct Time Zone, Date, Time, and Daylight Savings schedule.

2. **Scheduler Setup**
   - ➢ **Enable** by placing a **check mark** in the box next to the **Enable Scheduler** field. Enabling this field will prompt you to reset the calendar; select Yes.
   - ➢ To have the COMMPAK I/O 8 Radio link schedules with a WEB I/O radio, select **Schedule Provided by Master** from the drop down menu.
   - ➢ A standalone schedule can be programmed to the COMMPAK I/O 8 radio as well, see **Appendix C** for more information.

Encom Protocol Setup

If you wish to require a login to make any changes to a radio, use the **Encom Protocol** tab to set this up. Check off the box labeled **Login Require** and type in the login password to be used, passwords may be up to 7 characters in length.
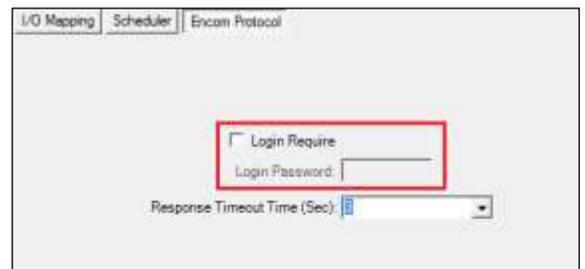
Configuring I/O in Normal Mode

You can reach the I/O Basic Setup window either through the Wizard Setup or with the I/O Configuration button at the bottom of the General Setup page. Everything in this section assumes you are in **Normal** System Mode.

I/O Mapping Setup

If you have configured your radio as a **Master** radio in **One-to-Many** selected as your I/O topology, then you will have to specify how many remotes will be in your system in the area below.
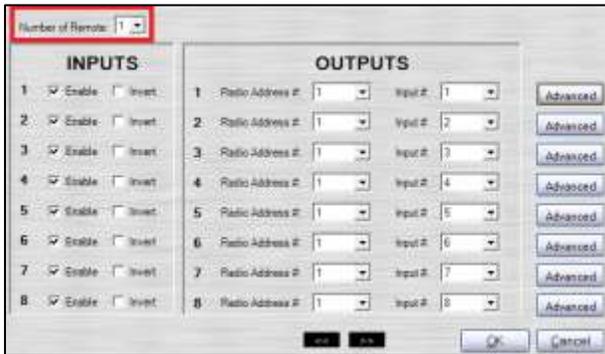
To enable I/O mapping, check off the **Enable** box next to the input you want enabled. Check the **Invert** box off if you want the corresponding output signal to be inverted. Set the **Radio Address #** field of the output that you want activated to the Radio Address of the radio that will be activating it. (If the Master is to activate Output 1, set **Radio Address #** of Output 1 to 0) Then set the **Input #** field to the physical input that will be activating the output. (If a hardswitch mapped to Input 1 is to activate Output 1, set **Input #** to 1 on Output 1).

For more information about I/O Mapping, refer to the **Applications** section and **Appendix D**.

Part 2: Configuring General Setup

The *General Setup* page allows you to configure your radio's general settings and make any number of changes to specific settings.

Complete and change the fields as necessary at the *General Setup* page. The sections below will explain the functionality of each field or button.
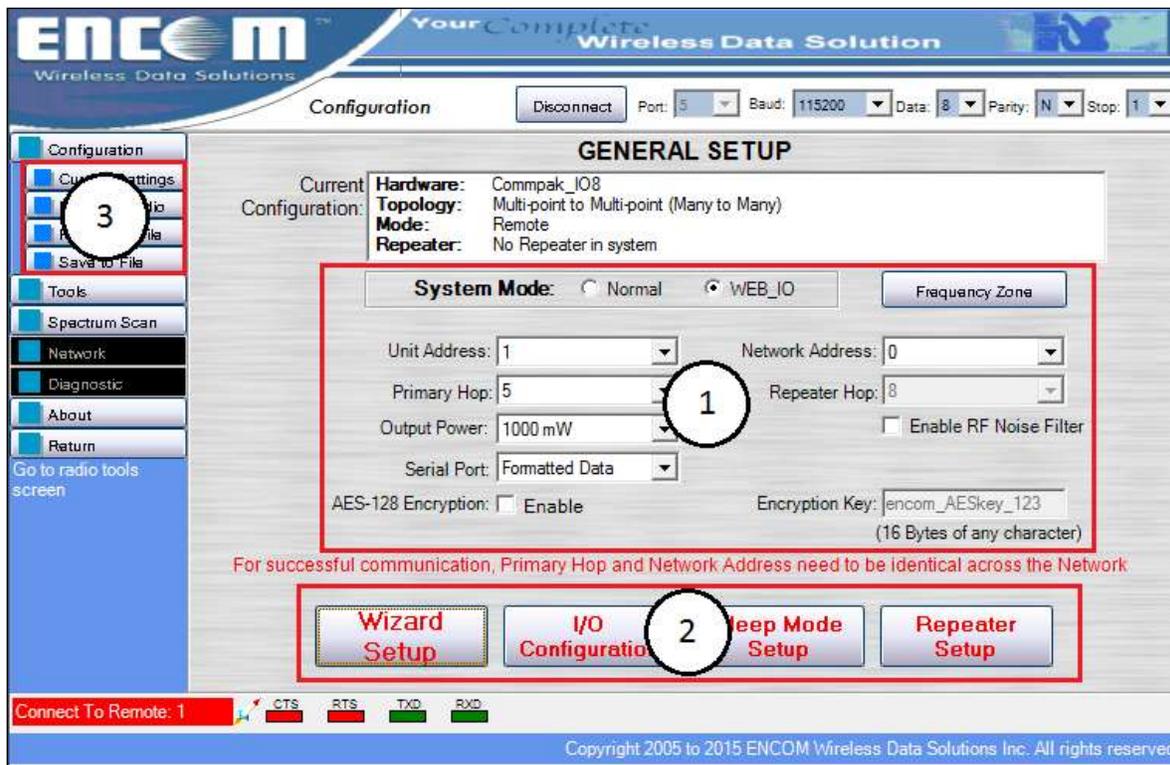
1. Wireless settings

System Mode

- ➢ Used to select whether the Radio will be communicating with another COMMPAK I/O 8 or a WEB I/O
- ➢ This function is only available on models using the ENC-901 radio (Go to the **About** page and check the **Radio Code** field)
- ➢ View the System Topology section for more details

Frequency Zone

- ➢ Allows you to select a Frequency Zone that you **do not** want the radio to use in its Hop Pattern.

- ➢ Select **Enable all Frequency Zones** if you want the radio to use the entire band:

Unit Address

- ➢ The **Master radio Unit Address** is set to 0 by ControlPAK™ and is not User configurable.
- ➢ **The Unit Address must be unique for each Remote and Repeater radio in a system.**

Network Address

- ➢ The Network Address defines a specific system to which individual radios can be assigned.
- ➢ By establishing a system under a common Network Address, the network can be isolated from another network to reduce interference.
- ➢ Only the radios that have the same network address can communicate to each other.

- ➢ Valid values for the Network Address range from 0 to 255, inclusive.

Output Power

- ➢ The default power level for the COMMPAK I/O 8 is 1 Watt.

  The radio transmit power level may be changed to meet your system requirements.

Primary Hop Pattern

- ➢ The Primary Hopping Pattern is used by the **Master** radio to communicate with:
  1. Remote radios that communicate directly to the Master radio.
  2. Repeater radios that communicate directly to the Master radio.
- ➢ The Primary Hopping Pattern is used by **Remote** radios to communicate:
  1. Directly to the Master radio.
  2. To a Repeater Radio.
- ➢ The Primary Hopping Pattern is used by a **Repeater** radio to communicate:
  1. Directly to the Master radio.
  2. With an upstream Repeater Radio.
- ➢ **Must be the same value** for each radio in a system

RF Noise Filter

- ➢ The RF Noise Filter optimizes the selectivity of the COMMPAK I/O8 receiver. When it is enabled the filter will improve the rejection of interfering signals but the radio sensitivity typically decreases by 6 dBm.

AES-128 Encryption

- ➢ Encrypts all data transmitted by this radio using the AES-128 encryption standard

- ➢ Check off the **Enable** box to use this function

- ➢ You must then enter an encryption key, your encryption key must be **exactly** 16 characters long

- ➢ Other radios **must have the same encryption key** to receive data from this radio

2. Miscellaneous Setup Options

Wizard Setup

➢ Used for initial setup and to restore radio settings to factory defaults

➢ See the **Wizard Setup** section for more details

I/O Config

➢ Used to setup the radio's I/O settings

➢ See the **Configuring I/O in WEB I/O Mode** and **Configuring I/O in Normal Mode** sections for more information

Sleep Mode Setup

➢ Used to setup Sleep Mode

➢ With Sleep mode enabled, the radio will enter a power saving 'Sleep' condition if no I/O change is detected for more than 3 seconds.

➢ Changes to the I/O will wake the radio up

➢ There are also options to turn LEDs off during sleep mode to save more power

Repeater Setup

➢ Used to setup radios that cannot be setup with the Wizard setup (Radios beyond the first 2 repeater levels)

➢ In **Step 4** of the repeater setup, **Primary Hop Pattern** will be the hop pattern used to communicate with the radio's parent. This field **must match the hop pattern of its parent**.

In the diagram below, each colored set of radios is a repeater level.

If your radio is to be a remote, its parent would be the repeater radio in the same repeater level. For example, the Blue S radio's parent is the Blue R radio.

If your radio is to be a repeater, its parent radio is the radio that it communicates with in order communicate with the Master radio. For example, if you were programming the Blue R radio, its parent radio is the Red R radio.
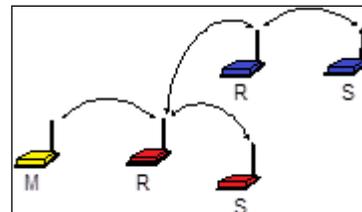
➢ The **Repeater Hop Pattern** field is only available for repeater radios. It is the hop pattern used to communicate with a repeater's remotes.

➢ **IMPORTANT:** For the hop patterns of adjacent repeater levels, one **must** be even and the other **must** be odd. Hop patterns of all repeater levels that are to be even or hop patterns of repeater levels to be odd should be still be different from each other. For example, in the diagram above, both the blue and yellow repeater levels can be odd, but the red level **cannot**. While both the blue and yellow repeater levels will have odd hop patterns, they **cannot be the same number**.

3. Saving, setting and sharing configurations

Saving a Configuration

After you edit an existing radio configuration or create a new radio configuration, the ControlPAK™ software allows you to save the new configuration to a file. This allows you to copy the radio configuration over to several other radios.

To save a configuration:

1. Configure your radio to your specifications.
   Refer to the previous sections of this manual to configure your radio.
2. After you complete your configuration, click **Save to File** at the bottom of the *Main Configuration* screen.
   The *Save As* screen appears.
3. Enter an appropriate **File Name** in the *File name* field.
4. Click **Browse Folders** and select the appropriate folder in which to store the new configuration.
5. Click **Save**.
   The *LANPak* window appears, asking you to add a description of the file.
   Enter a file description and click **OK**.
   The file is now saved under the new filename and in the folder you specified.
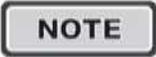
NOTE	Saving a configuration does not program the radio. To send a configuration to the radio, you must click **Program Radio.**

Setting a Configuration

After you edit or create a new configuration, you must send the new configuration to the radio. It does not happen automatically.

To set a configuration:

1. Configure your radio to your specifications.
   Refer to the previous sections of this manual to configure your radio.
2. After you complete your configuration, click **Program Radio** at the left in the *General Setup* screen.
   After the configuration downloads, you can disconnect the radio and then either program a new radio or exit the software.
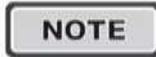
NOTE	After you edit or create a new configuration, you must send the new configuration to the radio. It does not happen automatically.

Sharing a Configuration Over Several Radios

After you save a configuration as a file, you can download that configuration to other radios.

To share a configuration file:

1. Connect the radio that you want to configure to the computer that is running the ControlPAK™ software.
2. Open **ControlPAK™** and select **CONTACT CLOSURE**, then **COMMPAK I/O8** Connect.
   The *General Setup* screen appears.

3. From the *General Setup* screen, click
   Read from File.
   A file explorer screen appears.
   Navigate to the file you want to share,
   and click **Open**.

4. The *Radio Configuration File Read
   Selection* window appears, listing all
   the configurations that are available
   in that folder.
   Select the appropriate file and click
   OK.

5. The configuration from the file
   replaces the radio's existing
   information.
   Click **Program Radio** to save this
   information to the new radio.

NOTE	Some changes will have to be made to the configuration, for example only one radio can be the Master radio, and each radio requires a **distinct unit address**.

Using the Diagnostic Tools

This section describes the ControlPAK™ Diagnostic Tools that you can use with your broadband radios. There are four Diagnostic Tools:

1. VSWR Antenna Test

2. Spectrum Scan Test

3. Signal Sensitivity Test

4. Polling Test

VSWR Antenna Test

The Voltage Standing Wave Ratio (VSWR) test measures the amount of reflected power that is traveling back into the radio from the cable length and antenna.
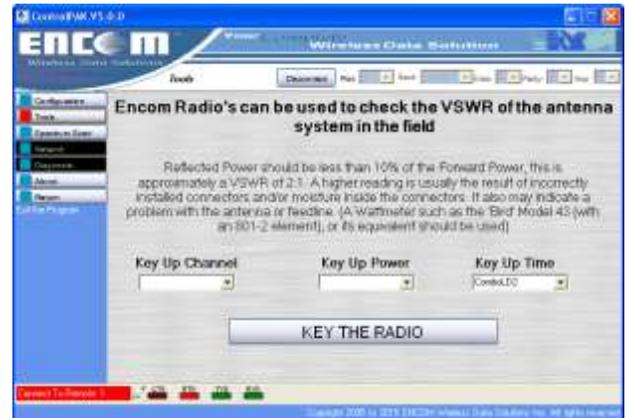
The reflected power should be less than 10% of the Forward Power; this is approximately a VSWR ratio of 2:1.

A higher reading is usually the result of incorrectly installed connectors and/or moisture inside the connectors and/or the antenna or feedline.

Use of a Wattmeter for an in depth and accurate measurement is recommended.

To run the VSWR Antenna Test:

1. Select Tools and select the frequency channel you would like to test for reflection. By default it is set at 915 MHz.

2. Select the Key Up Time. By default it is set to 10 seconds.

3. Press **Key The Radio** button to start the test.

Spectrum Scan Test

The Spectrum Scan acts as a spectrum analyzer running a frequency scan across the 900MHz frequency range to analyze for noise.
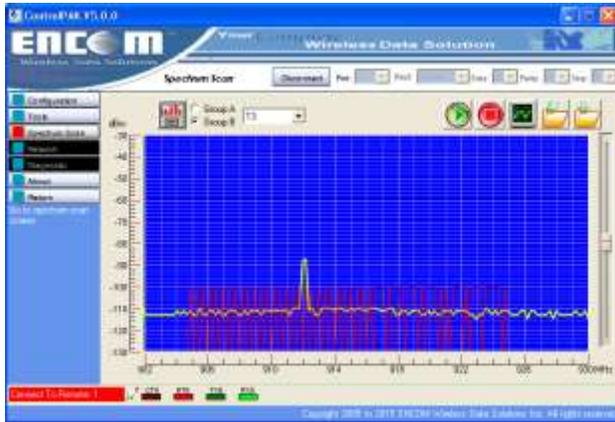
A yellow line or spiked line will appear indicating the strength of the noise in a particular frequency range.

The red bars overlapping the yellow noise line indicate the current hopping pattern that is in use. In order to minimize the noise interference a different hopping pattern can be selected and overlay on the noise pattern.

To run the Spectrum Scan Test:

1. Select the red bar graph button to overlay your hop pattern on the spectrum scan.

2. Select the hopping pattern number you are using or would like to analyze from Group A or B.

3. Press the green start button to run the spectrum analysis test. The yellow line will indicate the noise in the environment. The red button will stop the test.

4. Save the Spectrum Scans for later use for technical support assistance from Encom Wireless.

Signal Sensitivity Test

The Signal Sensitivity Test measures the ability between the Master Radio or repeater and any remote to receive a signal.

The red and green bars indicate the power of the signal currently being received from the other radio. The two sliders on the right side of each panel control the output power on the Radios. This slider should be lowered if the signal strength is too strong and raised if it is too low.

To run the Signal Sensitivity Test:
1. Select Diagnostic from the menu and then the Site tab from the expansion.

2. Select either a Master Radio or repeater as your Start node and select a remote that will communicate with your Start Node as an End Node

3. Press the Start button to begin the test. The two green and red meters will indicate the power of the signal received for their respective radios. Adjust the output power of each radio using the sliders on the right as needed.

NOTE	Before running any remote diagnostics or remote configuration functions, a pop-up will appear asking for a radio range to scan. Enter the unit address or range of addresses of the radio you want to scan.
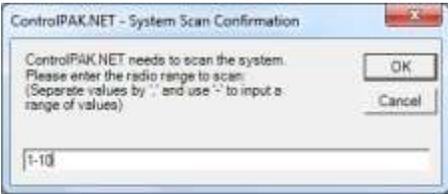
Polling Test

The polling test sends a command to one or more radios and has the radios send a message of variable size back to check for connectivity, interference and computing errors.

The panel below the Poll Cycle counter shows the results of your test as well as the message that was sent. If within a particular Poll Cycle, a message was not sent back or the message was incorrect, the message "No response" will be displayed. The Panel on the right shows all radios in your current system and the percentage of correct responses received from them.

To run a Polling Test:

1. Select Diagnostic from the Menu and the System tab from the expansion.

2. In the setup panel, use the INCLUDE option and the radio or range of radios you want to test. Alternatively, you may use the EXCLUDED option and the radio or range of radios that you *do not* want to test. Then select the length of the message the radios will send back.

3. Press the Start button to run the polling test. The number of messages requested will be shown in the Poll Cycle Transmitted field.

Applications

COMMPAK I/O8 Inputs

The COMMPAK I/O8 is configured with a 9 position quick connect barrier block for connection of up to 8 Inputs.

An Input is activated when it is connected to DC Ground using a switch or relay contacts.

An Input can also be activated when pulled low by an Open Collector output.

Inputs applied to the COMMPAK I/O8 can be Dry Contacts (no voltage applied). For example, a switch or relay.

1. **Using Input Switches with your I/O8 Radio**

   The following application outlines the connection of 4 switches to the COMMPAK I/O8 Inputs. Turning on a switch closes the contacts which connects the Input to ground.

   For example, when the switch that is connected to Input 1 is physically turned ON, Input 1 of the COMMPAK I/O8 is tied to ground and activated.
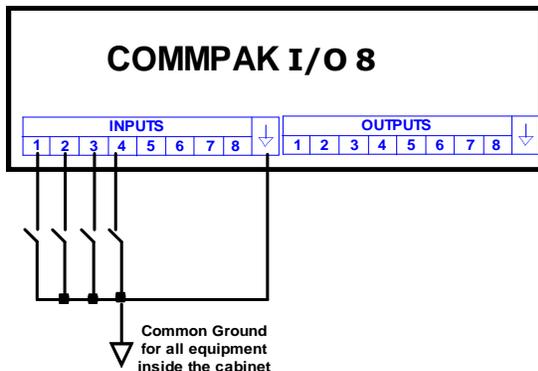
You do not have to "program" the Inputs in the ControlPAK™ software. The programming is only on the Outputs of the either this radio or another radio.

The Outputs are programmed so that the installed inputs are used as the activation switches for your system.

For example, if we are programming the outputs of another COMMPAK I/O8 the programming for the I/O configuration would be shown below:

The Outputs 1 to 4 of our Remote Radio are going to be activated by Radio address 0 (this being our Master radio with the 4 input switches) and the corresponding Input number.

Any Input can activate any Output.

For more information on configuring refer to the section on *Configuring Your I/O8 Radio*.

2. Using Relays as Input Connections with the I/O8 Radio

The following application outlines the connection of 2 relays to the COMMPAK I/O8 Inputs.

When a relay is activated, the Open contacts of the relay close which connects the COMMPAK I/O8 Input to ground. This will activate the corresponding I/O8 input.

The following diagram shows 120 VAC relays but any type of relay with dry contacts (no voltage applied to the contacts) may be used.

NOTE	ONLY the relay dry contacts are connected to the COMMPAK I/O8 inputs. The relay operating voltage is not a concern.
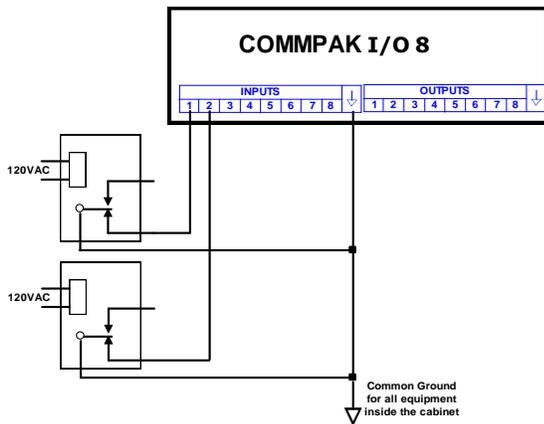
You do not have to "program" the Inputs in the ControlPAK™ software. The programming is only on the Outputs of the either this radio or another radio.

The Outputs are programmed so that the installed input relays are used as the activation switches for your system.

For example, if we are programming the outputs of another COMMPAK I/O8 the programming for the I/O configuration would be shown below:

The Outputs 1 and 2 of our Remote Radio are going to be activated by Radio address 0 (this being our Master radio with the 2 input relays) and the corresponding Input number.

Any Input can activate any Output.

For more information on configuring refer to the section on *Configuring Your I/O8 Radio*.

COMMPAK I/O8 Outputs

The COMMPAK I/O8 is configured with a 9 position quick connect barrier block for connection of 8 outputs.

The COMMPAK I/O8 Outputs are Open Collector Outputs with the following specifications:
- ➢ Maximum voltage: 30 VDC
- ➢ Maximum sink current per output: 250 mA

The COMMPAK I/O8 Open Collector Outputs are pulled low ("switched" to ground) when activated.

⚠ CAUTION	You must connect your equipment signal ground to the COMMPAK I/O8 ground in order to ensure there is a common ground point and at the same level.

⚠ CAUTION	The COMMPAK I/O8 Outputs do not provide a power source for your equipment.

1. Using a Traffic Controller for an Output Connection with the I/O8 Radio

The following application shows you how to connect a Traffic Controller to the output of the COMMPAK I/O8 radio.

A Traffic Controller may require a Voltage Level Change on its inputs in order for activation to occur. A pull up resistor is required on the input(s) of the equipment that requires a Voltage Level Change on its Inputs.

If your equipment is not configured with internal pull up resistors on its inputs they must be installed as shown below:
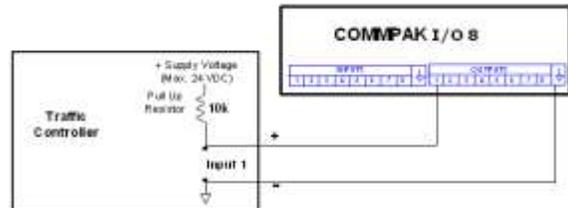
In the above diagram, when the COMMPAK I/O8 Output is not activated, the Controller Input is pulled up to its supply voltage through the pull up resistor. The Controller Input is at a high level.

When the COMMPAK I/O8 Output is activated, it is pulled to ground and the Controller Input is also pulled to ground. The Controller Input is at a low level.

Refer to the User Manual for your Traffic Controller or other equipment to determine if it requires a Voltage Level Change and if it is configured with a pull up resistor.

You do not have to "program" the Inputs in the ControlPAK™ software. The programming is only on the Outputs of the either this radio or another radio.

The Outputs are programmed so that the installed Open Collector Output is used as the activation switch for your system.

For example, if we are programming the outputs of another COMMPAK I/O8 the programming for the I/O configuration would be shown below:

The Output 1 of our Remote Radio is going to be activated by Radio address 0 (this being our Master radio with the Open Collector input relay) and the corresponding Input number.

Any Output can activate any Input.

For more information on configuring refer to the section on *Configuring Your I/O8 Radio*.

2. Using a Standard Coil Relay as an Output Connection with I/O8 Radios

The following application shows how to connect a relay to your COMMPAK I/O8 radio Output.

In order to drive a relay or contactor load, connect the COMMPAK I/O8 radio to the relay as shown below:
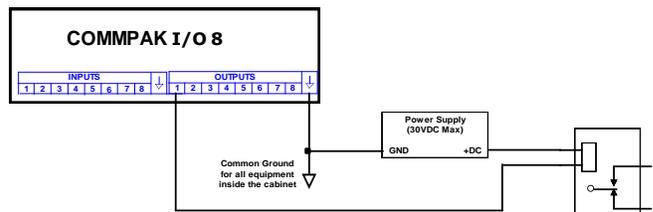
Damage to the COMMPAK I/O8 outputs may occur if the COMMPAK I/O8 maximum output ratings (current and voltage) are exceeded

You do not have to "program" the Inputs in the ControlPAK™ software. The programming is only on the Outputs of the either this radio or another radio.

The Outputs are programmed so that the installed Open Collector Output is used as the activation switch for your system.

For example, if we are programming the outputs of another COMMPAK I/O8 the programming for the I/O configuration would be shown below:

The Output 1 of our Remote Radio is going to be activated by Radio address 0 (this being our

Master radio with the Open Collector input relay) and the corresponding Input number.

Any Output can activate any Input.

For more information on configuring refer to the section on *Configuring Your I/O8 Radio*.

3. Using a Solid State Relay as an Output Connection with I/O8 Radios

The following application shows how to connect a Solid State Relay to your COMMPAK I/O8 radio Output.

In order to drive a solid state relay, use an external 10 ohm resistor (1/4W) and connect the COMMPAK I/O8 radio to the relay as shown below:
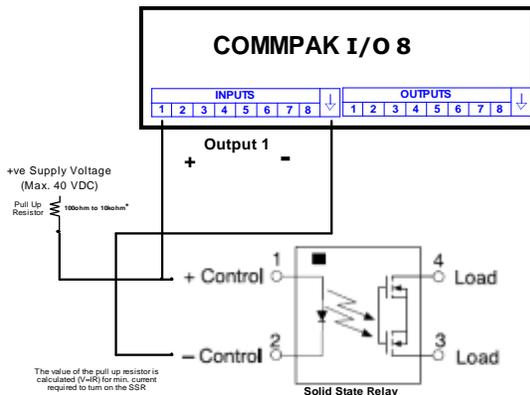
COMMPAK I/O 8

| | CAUTION | Damage to the COMMPAK I/O8 outputs may occur if the COMMPAK I/O8 maximum output ratings (current and voltage) are exceeded |

Use the ControlPAK™ software to program the radio's output with the same method as in the "Standard Coil Relay" section above. Depending on the type of SSR you are using (an inverted type is recommended), you may need to change the default relay status from **Normal OFF** to **Normal ON** by clicking on the **Advanced** button in the **I/O Configuration** window as follows:

(Please be aware, after changing the output from "Normal OFF" to "Normal ON", the corresponding output status LEDs will also be inverted)

Loop Back Status Confirmation

For applications requiring confirmation of data reception or confirmation of end device status, a COMMPAK I/O 8 installation can be configured with a "Loop Back" or "External" Status confirmation:

1. Loop Back Status confirmation requires the connection of the COMMPAK I/O 8 Output to the end device as well as one of the COMMPAK I/O 8 Inputs. The Output is looped back to an Input. This setup confirms the COMMPAK I/O 8 has received the Contact Closure status change only - it does not indicate the status of the end device.

2. External confirmation requires the User to connect a Status signal from the equipment into one of the COMMPAK I/O 8 Inputs. This setup confirms the Contact Closure status change was received by the COMMPAK I/O 8 and it provides an indication of the status of the end device.

1. Using a Loop Back Status Confirmation

The following application shows how to setup a system configured with a Loop Back Confirmation Status.

The diagram is as follows:
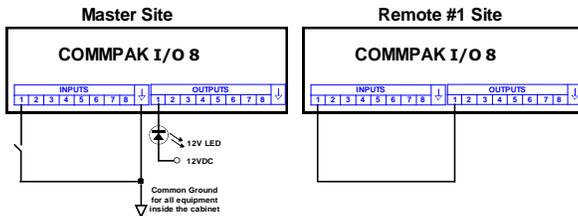
The system would operate in the following manor:

➢ The switch at the Master Radio location is turned ON.
➢ This status change is transmitted to the Remote Radio.
➢ Output 1 of the Remote Radio is activated.
➢ The relay is activated by Output 1 (which is to connect to an end device).
➢ Input 1 of the Remote Radio is pulled low by Output 1 and is activated. This status change is transmitted to the Master.
➢ Output 1 of the Master is activated, which turns the corresponding LED ON.
➢ This setup confirms the Remote Radio received the status change but it does not indicate the status of the device connected to the Remote Radio.

You do not have to "program" the Inputs in the ControlPAK™ software. The programming is only on the Outputs of the Remote Radio.

For example, if we are programming the outputs of the Remote COMMPAK I/O8 the programming for the I/O configuration would be shown below:
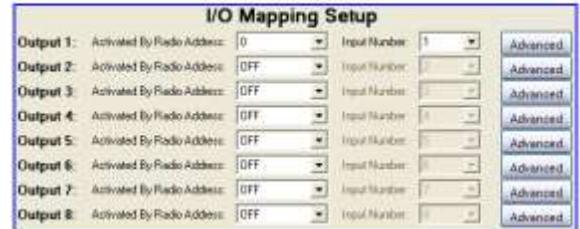
Any Output can activate any Input.

For more information on configuring refer to the section on *Configuring Your I/O8 Radio*.

2. Setting Up an External Status Confirmation with I/O8 Radios

The following application is an example of using a COMMPAK I/O8 Radio system configured for External Confirmation. The diagram below shows the layout:
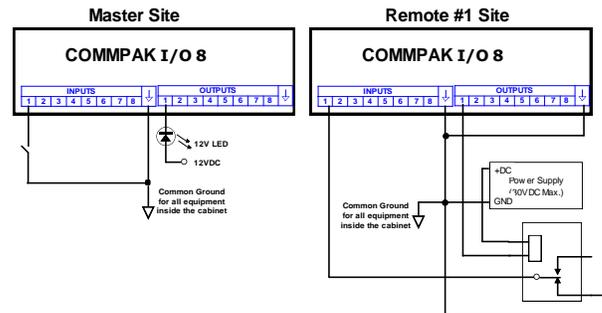
This system operates in the following manor:

➢ The switch at the Master is switched ON (closed).
➢ Input 1 of the Master is now connected to ground through the switch and is activated. This status change is transmitted to the Remote Radio.
➢ Output 1 of Remote Radio is activated.
➢ The relay is activated; both sets of its contacts switch. The set of contacts with no connections shown would be connected to the end device. The other set of contacts ties Input 1of the Remote Radio to ground.

➢ Input 1 of the Remote Radio is now connected to ground through the relay contacts and is activated. This status change is transmitted to the Master.

➢ Output 1 of the Master is activated, which turns the LED ON.

This setup confirms the Remote Radio received the status change and it indicates the status of the device connected to the Remote Radio.

You do not have to "program" the Inputs in the ControlPAK™ software. The programming is only on the Outputs of the Remote Radio.

For example, if we are programming the outputs of the Remote COMMPAK I/O8 the

programming for the I/O configuration would be shown below:

Any Output can activate any Input.

For more information on configuring refer to the section on *Configuring Your I/O8 Radio*.

Testing

Testing a Wireless Link

Use the following procedure to test a wireless link:

	Always perform these tests on a bench or in a lab setting before field deploying your system.
NOTE	

1. Program one radio as a **Master** and one as a **Remote**.
   Working with two radios helps you understand their basics features and functionality.
2. Setup up the radios with the most basic application of a switch on the master activating an output on the Remote.
   If the radios can "see" each other, not only will the link light be active on the Remote Radio but the correct LED confirmation will occur on the Output.

Once you understand how the two radios should work, repeat this test process with each additional radio you plan to add to the system.

Refer to the following section on *Configuring Your I/O8 Radio*.

Optimizing a Wireless Link

After testing your Wireless Link to determine it is working, use the following procedure to optimize your Wireless Link among the radios in your system.

	Perform this procedure in the field; in a lab setting you should always have near-perfect results.
NOTE	

When mounting the remote radio antennas:

➢ Mount the antennas on the highest possible point; for example, the luminaire of a traffic light.
➢ Mount the antennas with a clear line of site to one another.
➢ Make sure the polarization of your antennas is the same throughout the entire system; for example vertical or horizontal, no mix.
➢ Physically tighten the antenna connections and move on to the next remote location. Repeat this procedure at each Remote radio site.

Optimizing to Minimize Noise Interferences

To minimize Noise Interferences on your system:

1. Change the polarization of the antennas to horizontal.
2. Run the Spectrum Scan to determine where most of the noise occurs. Change the Hop Pattern of the system to ensure that the pattern is overlapping the frequencies with the least noise.

For Non-Integrated Antenna Systems

Non-integrated units do not have polarization stickers, but can be properly oriented by changing the direction the antenna elements are facing.

If a non-integrated antenna's elements are pointing up and down (the elements are running parallel to the pole), it is in the vertical position and has vertical polarization.

To change the polarization to horizontal, rotate the antenna 90 degrees, so the antenna's elements are parallel to the ground.

Appendix A: Acceptable Antennas for I/O8 Use

Antenna Overview

There are 2 types of antennas typically used for COMMPAK I/O 8 Systems: the Yagi and the Omni antenna. Other types of antennas can be used if your system has special requirements.

Yagi antennas are directional antennas that transmit and receive signals primarily from the front of the antenna. They also transmit and receive signals from the sides and back but at reduced levels. The Yagi antenna can be installed Vertically or Horizontally polarized.

Yagi antennas are used for Remote COMMPAK I/O 8 sites, as these sites only communicate with the Master site or a Repeater site. Yagi antennas can be used at the Master and Repeater sites if the System layout will allow acceptable signal levels between Sites. A Repeater Site, for example, with a Yagi Antenna may have some Remote sites communicating via the back of the Yagi, which is acceptable if the Received Signal strength is high enough and stable.

Omni directional antennas transmit and receive signals in all directions around the 'sides' of the antenna. The Omni antenna is only available as vertically polarized. Omni antennas are typically used at the Master and Repeater sites.

Antenna Polarization and Clearance

Antenna polarization is an important factor in the installation of your System. A Vertically Polarized antenna transmits the radio signal waves perpendicular to the earth's surface. A Horizontally Polarized antenna transmits the radio signal waves parallel to the earth's surface. ALL of the antennas in a System must have the same polarization.

Antenna clearance is another factor that must be considered. Yagi antennas should be installed with no obstructions in front of or close to the sides.   Omni antennas ideally should be mounted with no obstructions close to them but they can be mounted to the side of a pole, etc. with the required offset.

Appendix B: Advanced Users

Logging on as an Advanced User

1. Go to the ControlPAK™ main interface.

2. 2. Double click the 4 colored squares next to the ControlPAK™ logo on the bottom left. A text field will appear.

	Operating this software as an advanced user will allow you to make changes that may permanently damage the radio. Damage caused by using this functionality **IS NOT** covered under warranty.

3. In the new text field type in "radio"

4. Mouse over **Contact Closure** and click on **COMMPAK I/O**

You have now logged in as an advanced user

Appendix C: Using the Schedule Input Wizard

NOTE	This feature is only available on units using an ENC-901 radio in WEB_IO mode.

Create a New Schedule with the Schedule Wizard

1. Log in as an advanced user

2. Enable the schedule option by placing a check mark in the Enable Scheduler box located in the **I/O Configuration** option under the Scheduler tab.

3. Click on the **Change** Schedule button and then the Wizard button on the bottom of the window to create a New Schedule. You will be taken to the *Schedule Input Wizard* screen.
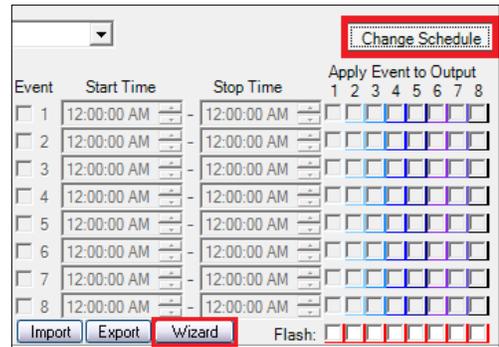
4. Select the Wizard Button to start the Schedule Wizard Setup
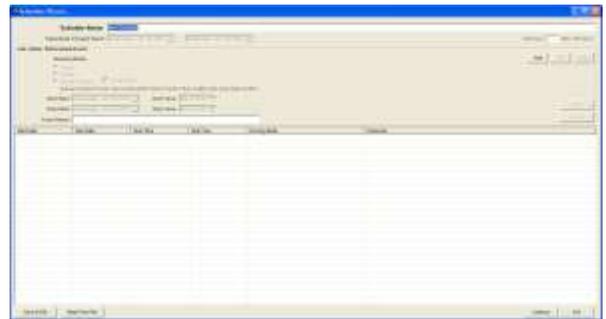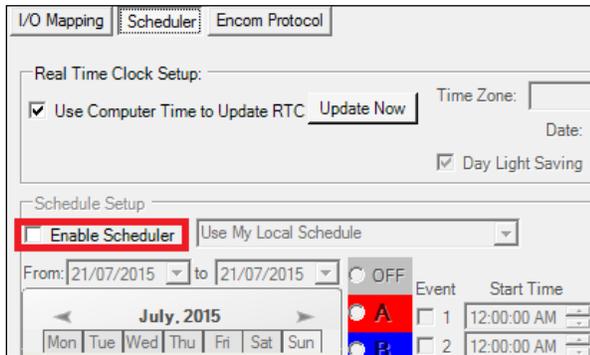
5. Select the **ADD** Button to highlight the Add/Delete/Edit Schedule Events field. Complete the following fields on the *Add/Delete/Edit Schedule Events* field (refer to the table on the following page):

Section	Field Name	Description
Schedule Information	Schedule Name	Enter a radio description (up to a maximum of 50 characters).
	Event Name	Enter a description of the Event to be added (up to a maximum of 50 characters).
Schedule Date & Time	Start Date	Select the starting date for your scheduled events from the drop down calendar menu. The format will be represented as day/month/year.
	Stop Date	Select the ending date for your scheduled events from the drop down calendar menu. The format will be represented as day/month/year.
	Start & Stop Time	The Start Time is in a 12-hour format and is user defined by highlighting the selected entry and scrolling to the time to be applied on the Start Date. The Stop Time is in a 12-hour format and is user defined by highlighting the selected entry and scrolling to the time to be applied on the Stop Date.
Daily Event	Running Mode	**The Running Mode allows the user to choose what days during the Start and Stop Dates the event is to occur**. The events can occur on a Weekly or Special Occasion basis. **Weekly Running Mode:** Select the day option that the event is to occur on. **Special Occasion:** Select this option if you would like to add a Holiday or an All Day Event to the schedule. An All Day Event for example could be Parent/Teacher Interviews.

4. After you finish adding in the Date and Time of your Scheduled Events, you have a few options:

   ➢ **Add in more Scheduled Events to this schedule**. If you would like to add in more events to this schedule click the ADD button to enter in additional events.

➢ **Save the Current Schedule**. **It is highly recommended to save your Schedule at all times.** This should be stored in a directory on your computer for later access if needed. Use the **Save to File** button to save your schedule.

Appendix D: Create a New Schedule by Manual Entry

An alternate method allows for a schedule to be manually entered in the WEB I/O. A manual entry is useful if you need to add an extra time slot to a particular schedule but still would like to maintain the original schedule.

A time group is denoted by the letters A to G and each group can have up to eight events. Only one time group can be used on a particular day.

To set a manual entry:

1. Log in as an Advanced User.

2. Select the *Change Schedule* button and this will activate the time group letters.

2. Select a time group, i.e. "A". This will highlight the Event option:

3. Place a check mark in the event number that is to be used. This will enable the start/stop time to be added for the event. Select the desired start/stop time for the event.

4. Add the new event to the calendar by clicking on the days that the event is to occur on.
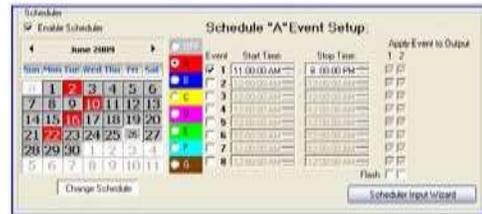
When the event has been added to the correct days on the calendar, de-select the *Change Schedule* button.

Appendix E: Advanced I/O Mapping Configuration

The advanced I/O Input Configurations are for advanced users in setup of their inputs or output.

(Timing functions can be set individually on each Input or Output lines)
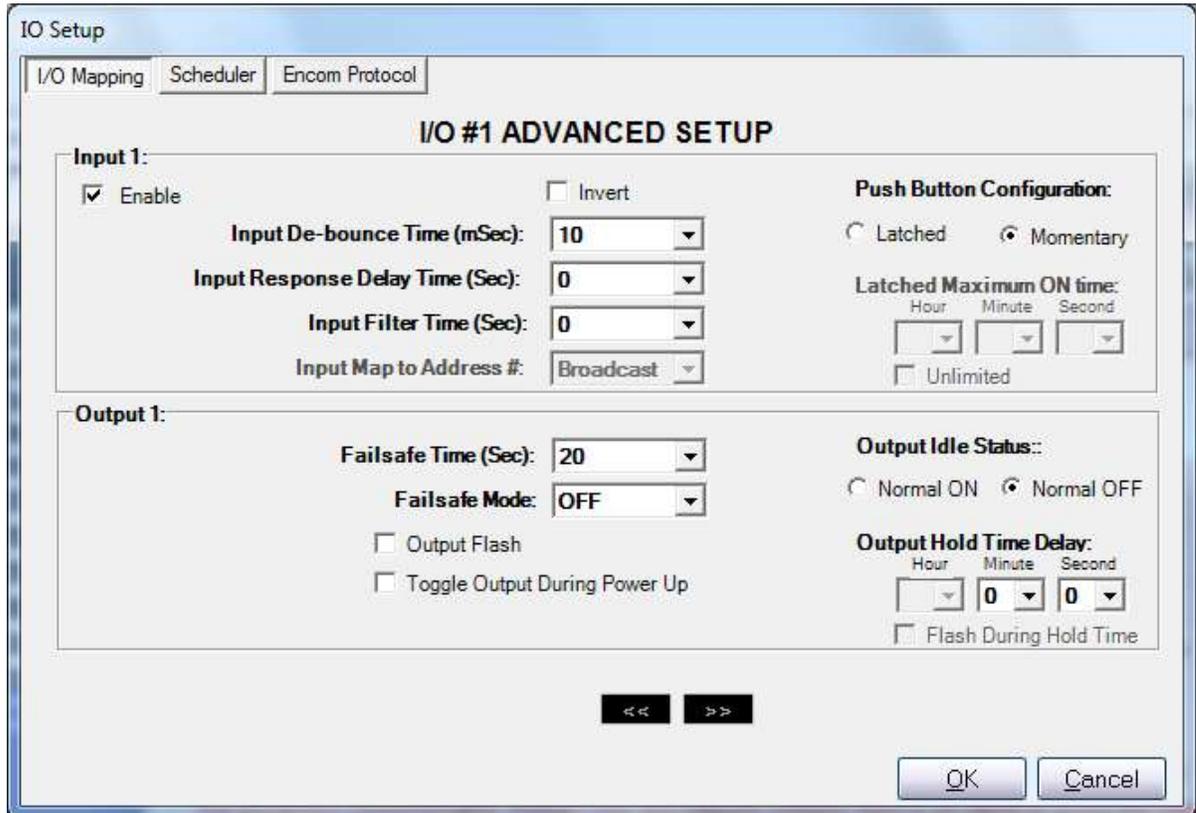
The I/O configuration divides into two main sections – Input & Output.

Section	Field Name	Description
Input	Input De-bounce Time (Available in MP-to-MP mode only)	0 – 255 ms (default is 10ms) The time needed for the system to recognize that particular input change is valid and is not caused by random noise.
	Input Response Delay Time (Available in MP-to-MP mode only)	0 – 255 seconds (default is 0 sec.) The accepted input change will NOT apply until this Input Response Delay Timer expired. E.g.: 1. If input pulse is shorter than the Input Response Delay Time: Input / Output — Input Response Delay 2. If input pulse is longer than the Input Response Delay Time: Input / Output — Input Response Delay
	Input Filter Time (Available in MP-to-MP mode only)	0 – 254 seconds (default is 0 sec.) This function is particularly useful to detect the present of a fixed frequency on that input. Set the filter time greater than 1 cycle and less than 2 cycle time of the interested frequency.
	Input Map to Address #	Read only parameter, cannot be changed.
	Push Button Configuration (Available in MP-to-MP mode only)	This function can convert a regular Momentary switch to a Latched switch.
	Latched Maximum ON Time (Available in MP-to-MP mode only)	If Latched function is selected, Latched maximum ON time can be used as a failsafe to avoid latching that input forever or select the "Unlimited" checkbox to disable this function.
Output	Output Idle Status	This is used to control the output as "Normal ON" or "Normal OFF" in an idle state.
	Output Hold On Time	0 – 4 Hours, resolution of 1 minute (in MP-to MP mode) 0 – 4 Minutes, resolution of 1 second (in P-MP mode) The output will hold the change until Output Hold On Timer expired. The timer will start again if output change before timer expired. E.g.: 3. If only one pulse within the Output Hold On Time: Input / Output — Output Hold On Time 4. If more than one pulses within the Output Hold On Time: Input / Output — Output Hold On Time
	Output Flash Enable	When this function is enabled, the output will flash in ½ sec. intervals while active.
	Failsafe Time	1 – 256 seconds (default is 1 sec. in P-MP and 10 sec. in PM-MP) This entry configures the amount of time the radio will wait for data for an Output before reverting that Output to its Failsafe condition.
	Failsafe Mode	OFF/ON/LAST/FLASH (Default is OFF) OFF – Output will turn OFF until radio receives data. ON – Output will turn ON until radio receives data. LAST – Output will maintain last state until radio receives data. FLASH –Output will flash in ½ sec interval until radio receives data.
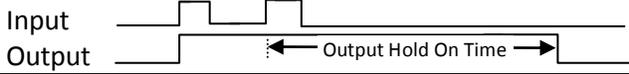
Appendix F: Upgrading/Downgrading Firmware

1. Connect to the COMMPAK I/O 8 unit using ControlPAK™ and Navigate to the About screen to verify the BootLoader version. If the unit has a version of the BootLoader lower than version 1.2.0, then it is recommended that you have a spare unit on hand in the case that the firmware upgrade or downgrade is unsuccessful.

2. Click the **Firmware Upgrade** button.
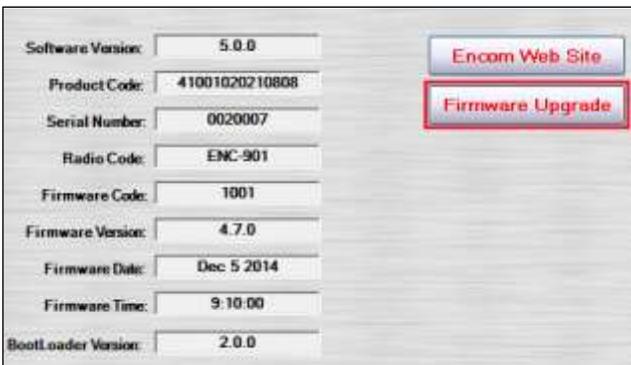
3. **Accept** the Firmware Upgrade License Agreement.
4. Read the warning message, check the box that says you have read and understand the warning and then hit the **Next** button.
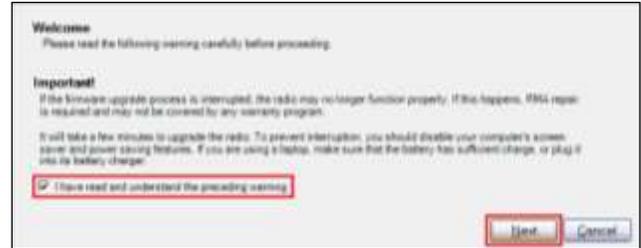
5. Select the firmware version to upgrade or downgrade to. As long as the radio has version 1.3.0 or higher of the BootLoader, you can freely switch between these versions of the firmware. When you have made your choice, click the **Next** button. A progress bar will show the status of the upgrade or downgrade.
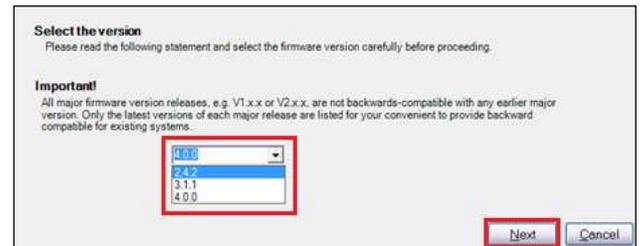
6. After the upgrade or downgrade completes, the software will automatically disconnect the radio. Re-connect the radio and navigate to the **About** screen and confirm that the I/O 8 unit now has the correct firmware version.
7.

Appendix G: RF Exposure

FCC

FCC Regulations allow up to 36 dBm effective radiated power (ERP). Therefore the sum of the transmitted power (in dBm), the cabling loss and antenna gain cannot exceed 36 dBm.

- ➢ 1mW = 0 dBm
- ➢ 10 mW = 10 dBm
- ➢ 100 mW = 20 dBm
- ➢ 1000 mW = 30 dBm

When transmitting 1 Watt (30 dBm) and the cable and connector losses are 2 dB, the antenna gain cannot exceed 36 - (-2) - 30 = 8 dBi.

If an antenna with a gain higher than 8 dBi were to be used, the power setting must be adjusted appropriately.

Health Canada

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website:

www.hc-sc.gc.ca/rpb

Appendix H: Declaration of Conformity

FCC

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) This device must accept any interference received, including interference that may cause undesired operation

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the users' authority to operate the equipment.

Industry Canada

This device complies with Industry Canada's RSS-210 specifications

ENCOM Wireless provides field-proven, cost-effective wireless data solutions for
municipal and industrial clients, with applications in the areas of:
* Intelligent Transportation Systems
* Public safety communications
* Municipal corporate security and IT networks
* Water and waste water management
* Electrical utilities
* Oil and gas

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