WAVE Siren™
WIRELESS AUDIBLE VISUAL ENUNCIATOR

WAVE Interface Transmitter

USER'S GUIDE

WAVE employs state-of-the-art wireless technology to address the most demanding audible and visual event notification and hazard warning applications over areas of less than an acre to hundreds of acres.

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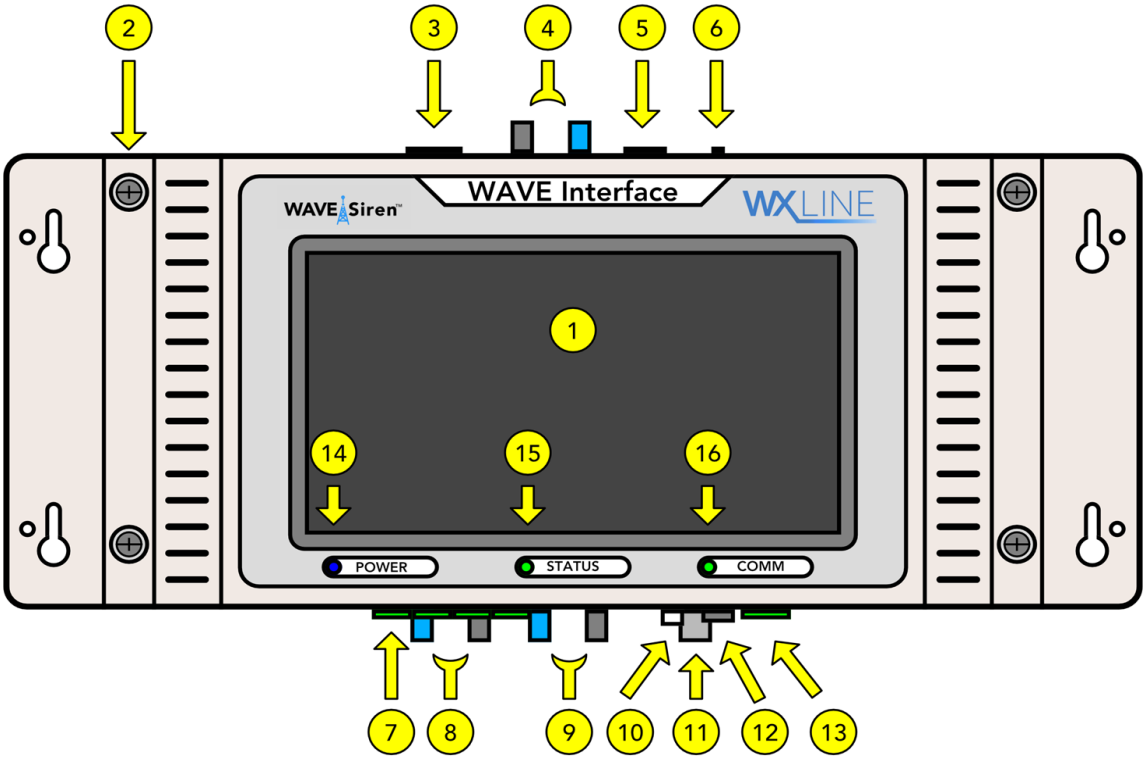
WARRANTY SUMMARY

Wxline, LLC warrants that the products it distributes, and sells will be free from defects in materials and workmanship for a period of one year from the date of receipt by the end-user. If a product proves defective within the respective period, Wxline, LLC will provide timely repair or replacement of the product. The effectiveness of the Strike Guard and WAVE system is dependent on proper design, installation, monitoring, and maintenance for each unique facility.

Wxline, LLC makes no warranty of any kind, express or implied, except that the goods sold under this agreement shall be of the standard quality of Wxline, LLC and the buyer assumes all risk and liability resulting from the use of the goods, whether used singly or in combination with other goods. Wxline, LLC neither assumes nor authorizes any person to assume for Wxline, LLC any other liability in connection with the sale or use of the goods sold and there are no oral agreements or warranties collateral to or affecting this agreement.

THE WAVE INTERFACE AT A GLANCE

Figure 1: WAVE Interface At a Glance



1. LCD Capacitive Touch Screen Control Panel
2. Interface cover captive thumb screw
3. Lightning Data Receiver Control Cable Input (RJ45)
4. Fiber-optic Port 1 (BLUE = TX, BLACK = RX)
5. USB Type A connector for firmware updates
6. Master reset button
7. Relay outputs (x4)
8. Optional Fiber-optic Port 3 (BLUE - TX, BLACK = RX)
9. Optional Fiber-optic Port 2 (BLUE - TX, BLACK = RX)
10. Power On/Off latching push-button
11. BNC antenna connector
12. Fuse holder (3 amp, 250 V, fast blow)
13. Power input (15 VDC)
14. Power LED (BLUE = on external power, YELLOW = on backup batteries, RED = backup batteries critically low voltage)
15. Status LED (GREEN = normal operation, RED = Transmitter disabled)
16. Comm LED (GREEN = normal operation, BLUE = transmitting

Figure 2: WAVE Interface - Main Functions.

CHAPTER 1

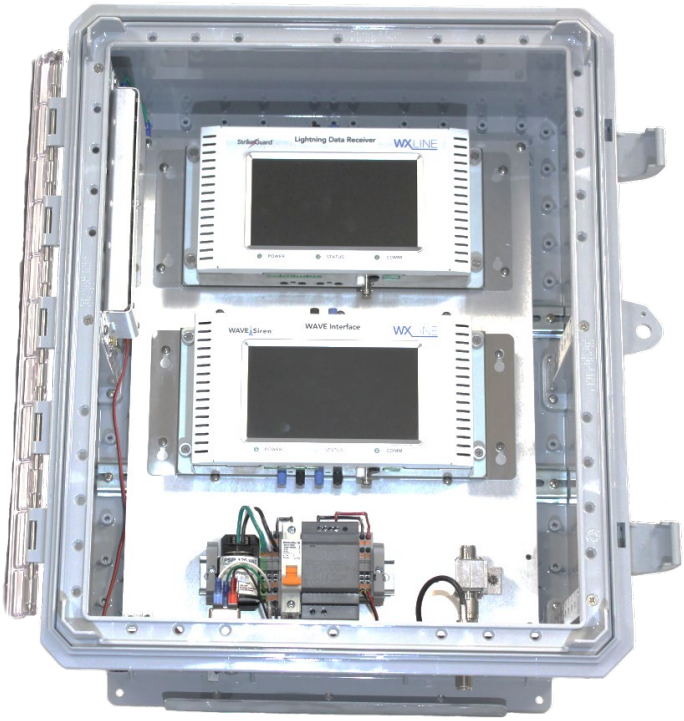
INTRODUCTION

The WAVE Interface is at the heart of a notification and control system that communicates with remote WAVE equipment via 27 MHz, digitally encoded radio messages, and fiber-optic cable. The remote WAVE equipment responds to Interface messages by controlling audio and visual warnings, and / or by isolating connections to sensitive equipment.

The remote WAVE equipment consists of a combination of Siren Stations, Strobe Stations, and WAVE Sequencers. The Siren Stations are configurable to control up to four horns and up to eight strobe lights. The Strobe Station controls a strobe lamp, only. The Sequencer isolates connections to equipment to mitigate damage during electrical storms.

The Interface provides the ability to manually control remote WAVE components through specific user-selected messages sent via radio or fiber-optic. The Interface is typically connected to a lightning detection system to provide automated warning of electrical storms and automated shutdown of vulnerable equipment in the field and subsequent restoration of 'all clear' conditions.

A pair of lead-acid batteries provide auxiliary power for the WAVE Interface to ensure continued operation through typical power outages. The battery is recharged automatically when primary power is restored. Primary power is 90-240 VAC, or optionally from a solar panel.



The WAVE Interface is designed for use in an office environment. The design of the wall mount plate and connectors allow for a simple, straightforward instal-lation.

The optional Wxline Equipment Indoor Bulkhead (WxEIB) provides electrical and environmental protection for the WAVE Interface to ensure longevity and protection of the Wxline components.

Figure 3: Wxline Equipment Indoor Bulkhead

NOTE | **Strike Guard Lightning Data Receiver and WAVE Transmitter are assembled and mounted in a 20 x 16 x 10-inch enclosure with clear door and complete lightning protection for incoming conductors and power supply. (WxEIB-TR).**

CHAPTER 2
SITE SELECTION

There are three main elements to the WAVE Interface to consider during site selection:

Antenna	line-of-sight transmission and reception
Antenna Cable	connects the Interface and antenna Interface
Unit	accessible and electrically grounded.

ANTENNA

The standard WAVE Interface antenna is a three-foot whip with stainless steel mounting hardware. An optional 18-foot model is available when controlling distant or obstructed remote equipment. The antenna is typically mounted on a rooftop, with the Interface located inside the building, below. The antenna operates more efficiently with a radius of nine or more feet of rooftop surface beneath it and should therefore be mounted at least 9 feet from the edge of the roof, if possible.

Radio messages from the Interface are output via the antenna in a nearly omnidirectional pattern and are received by the remote equipment in the field. The WAVE Interface outputs a 10-WATT signal with a maximum range of 10 miles under ideal conditions. T he terrain and environment of most sites reduce the practical range to about 3 miles. Radio transmission is line-of-sight, so the signal may be blocked or attenuated by buildings, hills, groves of trees, etc. The antenna should be mounted such that minimal blocking or attenuation of the radio signal occurs.

ANTENNA CABLE

The standard antenna cable is type RG58-U coax. Each cable is prepared and tested at Wxline prior to shipment. Cables are terminated with a UHF (PL- 259) connector at the antenna end and either a BNC or UHF connector at the Interface end.

NOTE | **All ¼ wave antennas work best if they are installed in the center of a metal ground plane with at least ¼ wavelength radius. The antenna can still work on a smaller ground plane, but the efficiency will be reduced.**

The cable is typically routed from the antenna to the service entrance of the building where it is grounded and protected with an RF surge arrester. From there the cable is routed to the Interface. Routing channels must be large enough to accommodate one of the cable connectors.

NOTE | **The outside diameters of the cable connectors are 0.571", 1.076" and 0.717" for the BNC, BNC-elbow, and UHF versions, respectively.**

The antenna cable comes in optional lengths of 25, 50, 70 and 100 feet, with the standard length being 70 feet. Longer custom cable lengths are available, with a recommended maximum of 300 feet to minimize signal loss. A low loss cable is recommended for cable lengths exceeding 150 ft.

NOTE | **Coil the excess cable into a figure-8 pattern with 6-inch diameter loops, then lay or hang the coiled section. This will minimize mechanical stress on the cable and nearby equipment, as well as minimize the magnetic effect of coiling the cable into a loop.**

WAVE Interface UNIT

The Interface is normally mounted on a wall in an office environment and is often co-located with lightning detection equipment, with cable connections between the two pieces of equipment. It is important to bond the WAVE Interface chassis to the chassis of the Strike Guard Lightning Data Receiver to minimize the potential difference between these enclosures in the event of close lightning. At a minimum, a cable serving as a ground strap ties the two chassis together, electrically.

The optional Wxline Equipment Interface Bulkhead (WxEIB) addresses the grounding issue elegantly by mounting all the equipment to a grounded aluminum panel inside a fiberglass enclosure. In addition, the WxEIB includes surge protection for the AC input to the power supplies, as well as the Interface antenna input.

CHAPTER 3
INSTALLATION

The WAVE Interface is designed for a wall mount installation. The installation location requires a connection between the Interface chassis and the electrical ground at the service entrance of the building.

NECESSARY TOOLS AND EQUIPMENT

Cordless Drill: make pilot holes for wall anchors and for cable routing, as needed

Phillips #2 Screwdriver: secure Interface Wall Plate and mounting antenna Small Screwdriver: change DIP switch settings, as necessary

Digital Voltmeter: to verify connections, as necessary

ORDER OF INSTALLATION

1. Route the antenna cable
2. Mount the antenna and connect the cable
3. Configure Address Switches, if necessary
4. Mount the Interface
5. Connect the antenna cable to the Interface
6. Connect the control cable to the Interface
7. Install the Interface batteries and top cover
8. Connect power and depress power button to on position

RADIO FREQUENCY (RF) ADDRESS SETTING

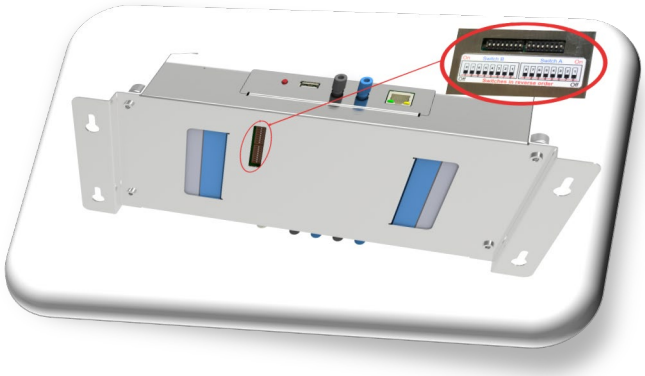


Figure 4: Radio Frequency switches

Back view of WAVE Interface with cut-out displaying two sets of inverse RF switches.

The RF system address is configurable to avoid conflict with other systems using WAVE equipment operating in the vicinity. There are two, 8-position DIP switches to configure the RF address labeled SWITCH A and SWITCH B. The switch setting is a binary pattern that functions as the radio address for a given system. This allows for 65,535 distinct addresses to choose from. A cutout on the back of the unit permits user access to the DIP switches.

This switch setting is typically set and tested at the factory prior to shipment. However, these switches can be reconfigured by the customer.

NOTE | **The RF address switch settings of the Interface must agree with the corresponding switches of the remote WAVE equipment in the field.**

ANTENNA INPUT

On a standard mount, the antenna cable at the Interface end is terminated with a BNC connector. After the cable is properly routed through RF surge arresters it is attached to the Interface's Antenna Input. Ideally, the RF surge arrester is located at the utility service entrance to safely shunt transient currents to ground and away from the WAVE Interface.

NOTE | **This installation scheme requires two sections of antenna cable and an RF surge arrester available from Wxline.**

When sold with the WxEIB option, the cables within the enclosure are installed with the Interface and all connections are tested and verified at Wxline prior to shipment. The antenna cable is terminated at both ends with UHF connectors. Attach the antenna cable to the WxEIB after the cable is properly routed.

CONTROL CABLE

The Interface's Control Input senses dry relay contact transitions to interpret when a particular lightning mode state is initiated or has expired. These transitions notify the Interface to control the remote WAVE equipment in the field accordingly.

The Control Cable is a pigtail with an RJ45 plug for the Interface and stripped and tinned conductors to mate with a screw terminal block at the Strike Guard Lightning Data Receiver.

BATTERY INSTALLATION

For battery backup, a pair of 6 Volt, 3.5 Amp-Hour, lead-acid batteries are installed in their respective compartments on each side of the Interface, under the touch screen. With the top cover removed, position each battery such that the label installed at Wxline is facing up and that each battery's terminals face the center of the Interface. If batteries are obtained from another vendor, orient the battery such that the terminals are closer to the top circuit board when entering the battery channel.

Once the batteries are in place, carefully install the Interface top cover and secure it with the four supplied thumb nuts.

Figure 5: Lead acid rechargeable battery for solar-powered WAVE Siren Station.

CONNECT POWER

The Interface power supply output is rated for 15 VDC at 2.5 Amps and runs from 90 VAC to 240 VAC, single phase at 50 Hz or 60 Hz.

Connect the power supply output to the DC input of the Interface, then connect the power supply input to AC power.

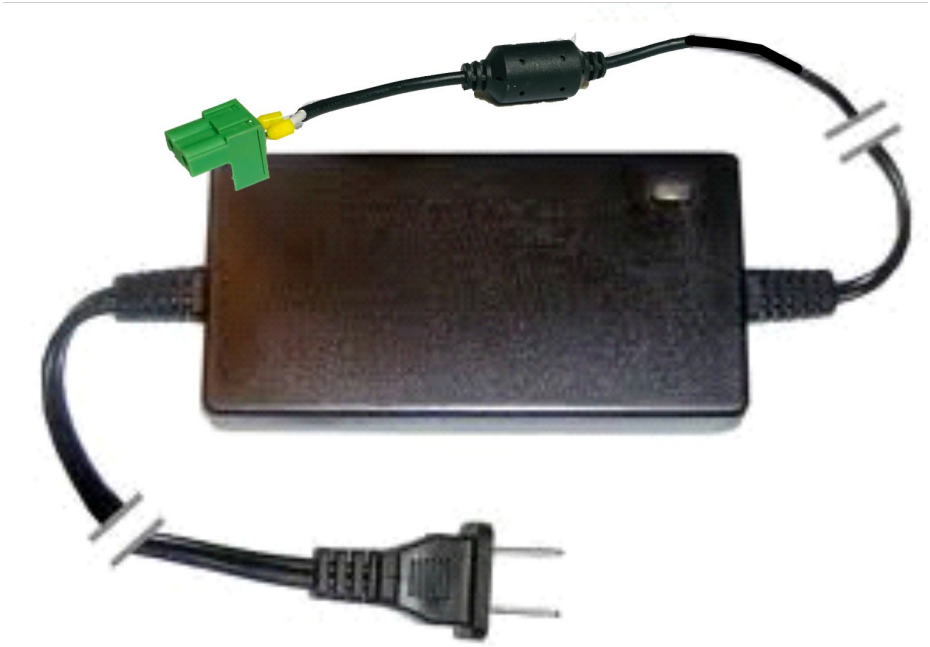


Figure 6: Power supply for WAVE Interface.

CHAPTER 4

INTERFACE FEATURES

CAPACITIVE TOUCH SCREEN

Capacitive touch screens are control displays that utilize the electrical properties of the human body as input. When a finger (or specialized input device, such as stylus) touches the display it detects when and where the display is touched by the user. When the Interface is in its normal state, the screen displays the system clock in HH:MM, 24-hour format. The display allows the user to view the Interface status, configuration, and user menus. Configuration via user menus is described in detail in Chapter 5, Operating the Interface.

POWER BUTTON

The POWER Button provides a means of powering the Interface ON and OFF. Assuming that external power or batteries are connected, a spring-loaded button will power ON the unit if it is OFF.

LED INDICATORS

There are three LED lights visible on the Interface cover:

- **Power**
- **Status**
- **Comm**

The Status LED illuminates green during normal operation and illuminates red when the transmitter is disabled. (Figure 1)

The Power LED illuminates blue during normal operation and illuminates yellow when running on battery power.

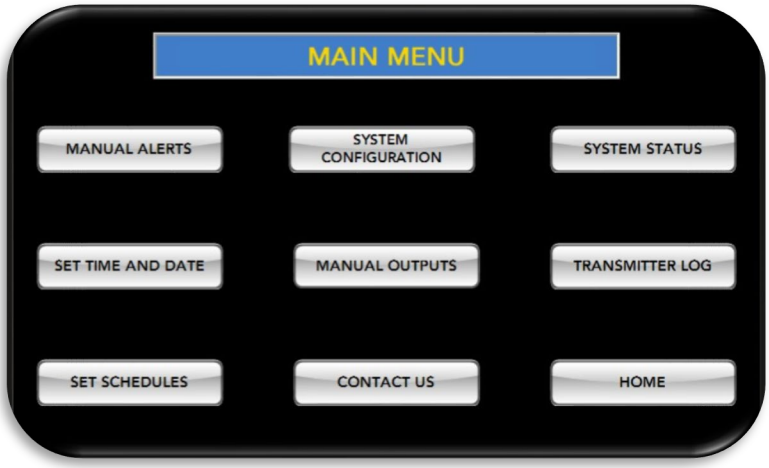
NOTE | **The Power LED will go red when batteries are critically low, and the system is about to shut down.**

The Comm LED flashes green under normal operation and briefly flashes blue during transmission of a radio message.

Figure 7: WAVE Interface LED lights

CHAPTER 5

OPERATING THE INTERFACE



The Interface is designed to control WAVE Sirens, Strobes and Sequencers remotely via radio commands.

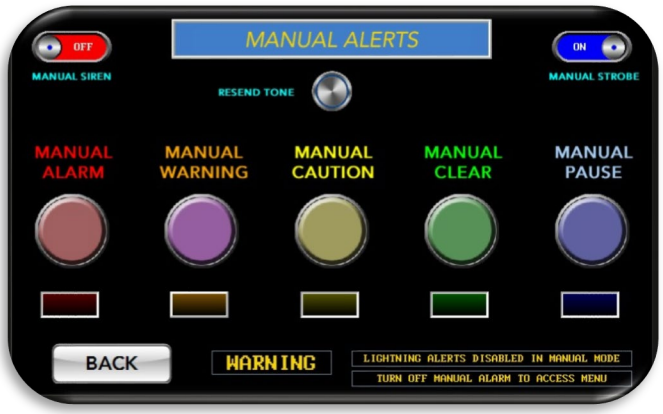
MENU OPTIONS AND NAVIGATION

Access to the Interface configuration is made by navigating through user menus selected via the touch screen. Navigation is facilitated via a set of various, multi-purpose keys on the touch screen. The functions of these keys vary, depending on the screen or menu being viewed and are redefined as necessary while the user navigates through the menu tree.

The MAIN MENU key brings the user to the main menu, providing an overview as well as giving options to user input or displaying the status.

The WAVE Interface main menu page is the access point to all the available features:

MANUAL ALERTS:



- Press "MANUAL ALERTS" from the main menu page.
- Press the desired manual alert button to activate the selected alert mode.
- Press the desired manual alert button again to de-activate the selected alert mode.

- Slide the "MUTE SIREN" button to "off" or "on" to disable or enable the Wave Siren Station sirens when sending a manual alert.
- Slide the "DISABLE STROBE" button to "off" or "on" to disable or enable the Wave Siren Station strobes when sending a manual alert.
- Press the "RESEND TONE BUTTON" to play the selected alert tone again.

NOTE | **All lightning alerts are ignored when manual alerts are activated. Manual alerts must be deactivated to allow return to the main menu and normal operations.**

SET TIME AND DATE:

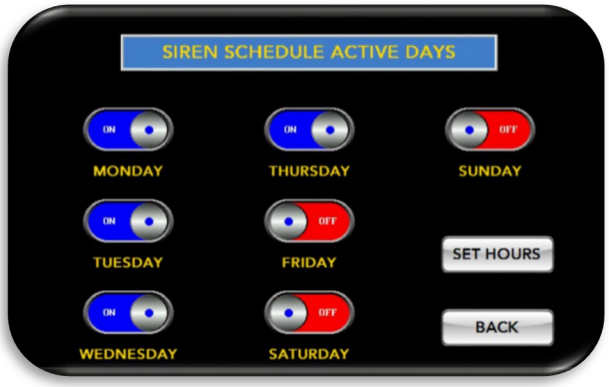
- Press "SET TIME AND DATE" button from the main menu.
- Press the "SELECT" up or down buttons to select between hour, minute, second, month, day, or year. A green indicator light will flash underneath the selection.
- Press the "ADJUST" buttons to increment or decrement the time or date.
- Press the "SET" button to set the time and date and return to the home screen.

NOTE | **The clock displays the hours in military format. Each day begins at 00:00:00 and ends at 23:59:59.**

SET SCHEDULES:

Press to view and change the Sirens, Strobe and/or Sequencer hours of operation.

SETTING HOURS OF OPERATION:



- Press the "SET SCHEDULES" button from the main menu.
- Press the schedule button for the desired WAVE system component to be scheduled (Siren, Strobe, or Sequencer). The interface will display the schedule summary page.
- Press the "RESCHEDULE" button from the schedule summary page. The interface will display the active days page.
- Use the slider buttons to turn on or off operations for each day of the week.
- Press the "SET HOURS" button from the active days page. The interface will display the set hours of operation page.
- Press the "SELECT DAY" buttons to select the start and stop times for the desired day of the week.
- Press the "ADJUST TIME" buttons to change the hour and minute of the desired start or stop time for the selected day of the week.

- Press the "SET SCHEDULE BUTTON". The interface will display the schedule summary page.
- Press the "CONFIRM" button to set the schedule and return to the main menu or press the "RESCHEDULE" button to edit the schedule again.

NOTE | **For scheduling of additional features, the sequencer can be preset to certain operating hours at the factory.**

TRANSMITTER CONFIGURATION:

- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "Transmitter Configuration" button from the System Configuration Menu.

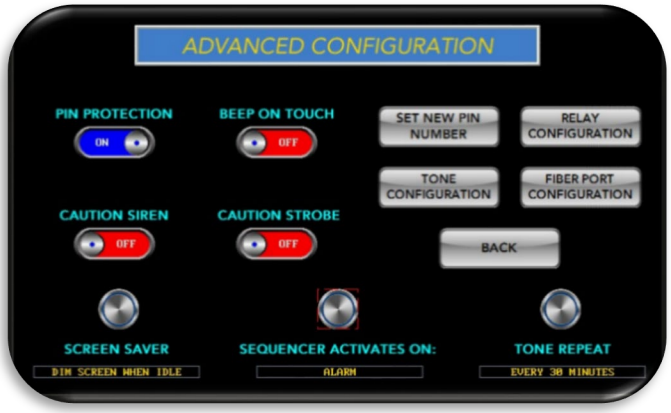
- Press the "SIRENS" button to select desired behavior for the WAVE Siren Station horns.
- Press the "STROBES" button to select the desired behavior for the WAVE Siren Station strobe lights.
- Press the "SEQUENCER" button to select the desired behavior for the WAVE sequencer.

Always Off:	The Interface will not send any messages to control the selected devices. Hours of operation cannot be scheduled in this configuration.
Always On:	The Interface will send messages to control the selected device at any time, 24 hours a day, 7 days a week. Hours of operation cannot be scheduled in this configuration.
On with schedule:	The interface will send messages to control the selected device only during scheduled hours of operation.
On with schedule / finish event:	The interface will send messages during hours of operation. Should hours of operation cease during an active alert the Interface will continue sending messages to the selected device until the alert is cleared.**#**

- Sliding the "TRANSMITTER" button enables or disables the transmitter.
- Press the "LDR MAIN RELAY" button and select the appropriate configuration that matches the main relay jumper setting inside the Lightning Data Receiver. The default setting is Alarm: Lightning within 5 miles.
- Press the LDR AUX RELAY" button and select the appropriate configuration that matches the auxiliary jumper setting inside the Lightning Data Receiver. The default setting is Caution: Lightning within 20 miles.

NOTE | **The Siren, Strobe as well as the Sequencer schedule must be set to 'on with Schedule' in the SYSTEM CONFIGURATION settings to allow the user to SET SCHEDULES. Both selections can be found under the MAIN MENU.**

ADVANCED CONFIGURATION:



- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Slide the "PIN PROTECTION" button to the on or off position. The on position enables pin protection for the interface requiring the input of a pin number to access the menu and controls.
- Slide the "BEEP ON TOUCH" button to the on or off position. The on position enables the interface to issue a short beep sound when buttons are pushed.
- Slide the "CAUTION SIREN" to enable or disable caution siren messages to be sent from the interface.
- Slide the "CAUTION STROBE" to enable or disable caution strobe messages to be sent from the interface.
- Press the "SCREEN SAVER" button the select the desired screen saver option. The screen saver activates after approximately 5 minutes of inactivity. "Always Off" will disable the screen saver and the display will always be at full brightness level. "Dim Screen When Idle" will dim the screen to approximately 25% of full brightness (to preserve touch screen life) when the interface is idle and will return to full brightness during an alert or with user interaction. "Off when idle" will turn off the touch screen backlight when the interface is idle and will return to full brightness during an alert or

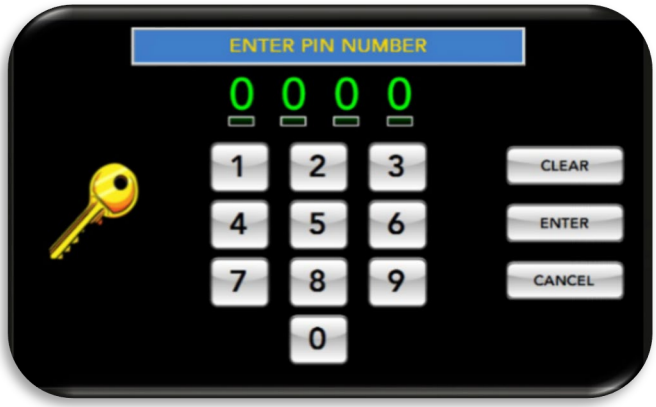
when the screen is touched. The screen saver will not activate when manual alerts are active, when on manual output pages, or during transmission tests.

- Press the "SET NEW PIN NUMBER" button to change the pin number.
- Press the "RELAY CONFIGURATION" button to change relay output configurations.
- Press the "TONE CONFIGURATION" button to access tone configurations for fiber-optically connected WAVE Siren Stations.
- Press the "FIBER PORT CONFIGURATION" button to access configuration of the optional fiber ports.

NOTE | **If pin protection is enabled, the user will be prompted to enter a pin number before access to the main menu is granted.**

- The radio button for the screen saver can be cycled to 'DIM SCREEN WHEN IDLE', 'SCREEN OFF WHEN IDLE' or 'SCREEN SAVER OFF'. If the screen saver is switched off all the time, the touch screen lifetime is shortened.

SETTING A NEW PIN NUMBER:



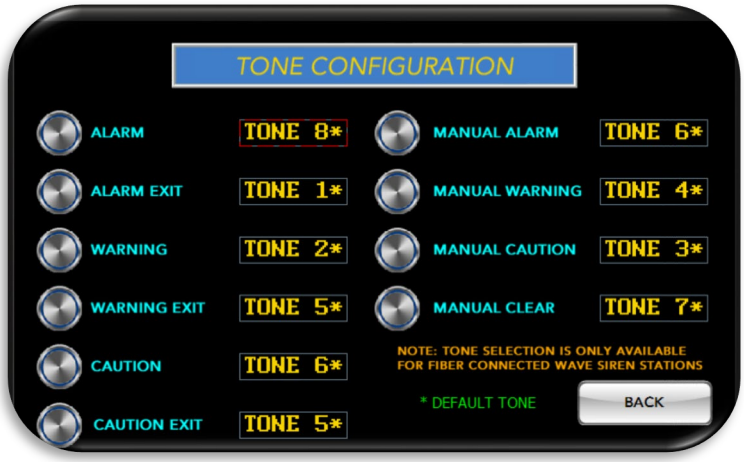
- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Press the "SET NEW PIN NUMBER" button from the Advanced Configuration Page.
- Enter a new 4-digit pin number on the keypad.

- Press "ENTER" to set the new pin number and return to the Advanced Configuration Page. Press "CLEAR" to clear the number and re-enter the new pin. Press "CANCEL" to cancel the input of a new pin number.

RELAY CONFIGURATION:

- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Press the "RELAY CONFIGURATION" button from the Advanced Configuration Page.
- Press the "CONFIGURE" button from the Relay Configuration Summary page.
- Press the "SELECT" buttons to choose which relay to configure.
- Press the "ADJUST" buttons to choose what will trigger a relay action. "With LDR Main Relay" will cause the Interface relay to react to the closure of the main relay on the Lightning Data Receiver. "With LDR Aux Relay" will cause the Interface relay to react to the closure of the auxiliary relay on the Lighting Data Receiver. "With LDR relays open" will cause the Interface relay to react if both relays on the Lightning Data Receiver are open. "Off" will disable the Interface relay. For Pin out schematic and detail contact Wxline directly.

TONE CONFIGURATION:

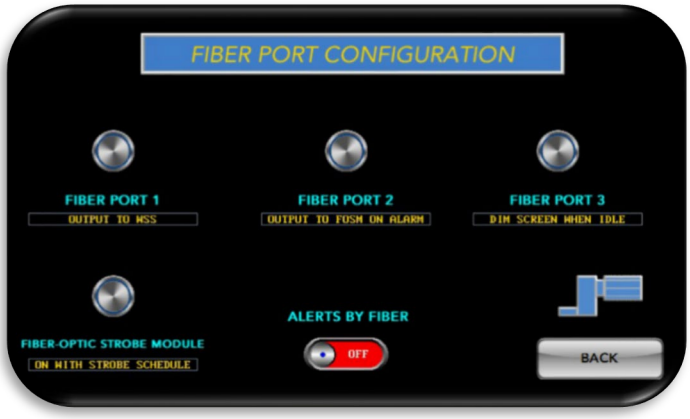


- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Press the "TONE CONFIGURATION" button from the Advanced Configuration Page.

- Press the desired alert mode button to change the tone played for that alert state.
- Press "BACK" to return to the advanced configuration page.

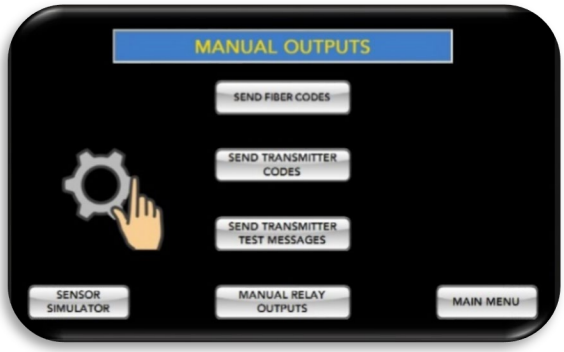
NOTE | **Tones can only be configured for WAVE Siren Stations that are fiber-optically connected to the WAVE Interface. Remote WAVE Siren stations will continue to play the tones that have been assigned to them through its setup process.**

FIBER PORT CONFIGURATION:

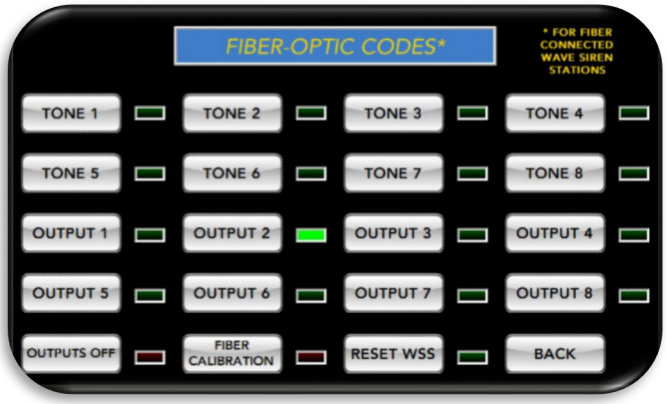


- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Press the "FIBER PORT CONFIGURATION" button from the Advanced Configuration Page.
- Press the "FIBER PORT (X)" buttons to configure the output of the desired fiber port. "Off" disables the fiber port. "Output to FOSM Alarm" will turn on the fiber output of the selected port when in an alarm state for control of a WAVE Fiber Optic Strobe Module. "Output to FOSM Caution will turn on the fiber output of the selected port when the interface is in a caution state for control of a WAVE Fiber Optic Strobe Module. "Output to WSS" will enable communication to and control of a WAVE Siren Station via the selected fiber port. "Output LDR Data" will enable the interface to transmit / repeat alert codes detected from the Lightning Data Receiver from the selected fiber port.
- Press the "FIBER-OPTIC STROBE MODULE" button to select the desired behavior of a connected WAVE Fiber-Optic Strobe Module (FOSM). "Off" will disable interface communication to the FOSM. "On With Alert" will allow the interface to communicate to the FOSM during an alert state. "On with Schedule" will allow the interface to communicate to the FOSM only during strobe hours of operation.
- Slide the "ALERTS BY FIBER" button to the on position if connected to a Lightning Data Receiver via a fiber-optic cable. The default position is off and is used if connected to a Lightning Data Receiver via an RJ45 communication cable.
- Press the "BACK" button to return to the advanced configuration menu.

MANUAL OUTPUTS



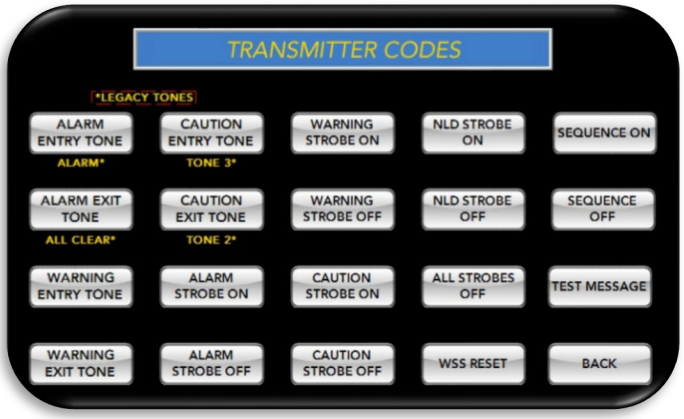
SENDING MANUAL FIBER-OPTIC CODES:



- Press the "MANUAL OUTPUT" button on the main menu page.
- Press the "SEND FIBER CODES" button on the Manual Outputs Page.
- Press the "TONE(X)" buttons to send a message to the WAVE Siren Station to play the selected tone.
- Press the "OUTPUT(X)" buttons to send a message to the WAVE Siren Station to activate the selected relay output (normally controlling strobes or light stacks).
- Press the "FIBER CALIBRATION" button to enter the Fiber Calibration Screen and output a solid red light out of the optional fiber ports.
- Press the "RESET WSS" button to send a message to the WAVE Siren station causing the station to perform a reset.**#**
- Press the "BACK BUTTON" to return to the manual outputs menu.
- Note: All alerts are ignored, and the screen saver option is disabled on this screen for use in diagnostics. Please exit the page to resume normal operation.

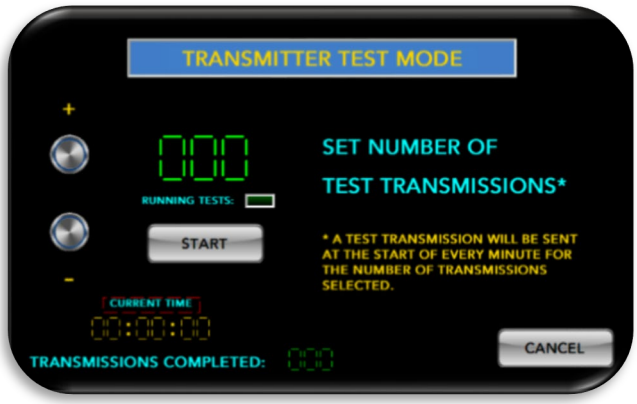
SENDING TRANSMITTER CODES:

- Press the "MANUAL OUTPUT" button on the main menu page.
- Press the "SEND TRANSMITTER CODES" button on the Manual Outputs Page.
- Press the button to transmit the code for the desired function of a remote WAVE Siren Station.
- Press the "BACK BUTTON" to return to the manual outputs menu.



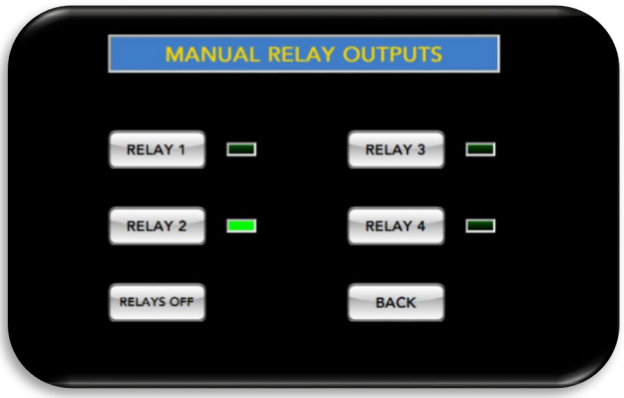
NOTE | **All alerts are ignored, and the screen saver option is disabled on this screen for use in diagnostics. Please exit the page to resume normal operation.**

SENDING TRANSMITTER TEST MESSAGES:



- Press the "MANUAL OUTPUT" button on the main menu page.
- Press the "SEND TRANSMITTER TEST MESSAGES" button on the Manual Outputs Page.
- Press the "SET NUMBER OF TEST TRANSMISSIONS" buttons to select the number of test transmissions to be sent to remote WAVE Siren Stations.
- Press the "START" button to begin the test transmissions.
- A test message will be transmitted at the top of every minute for the number of transmissions selected.
- Press "Cancel" to abort the test messages and return to the manual outputs menu page.

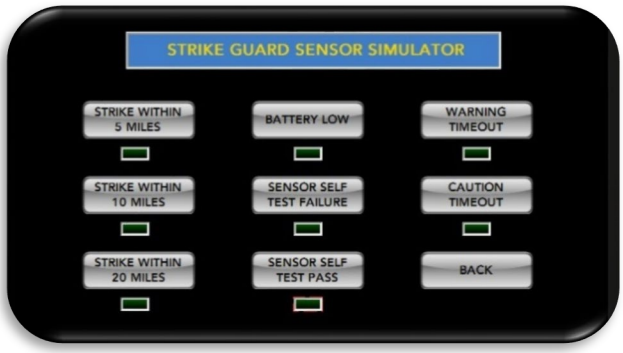
MANUALLY ACTIVATING THE SIGNAL RELAYS:



- Press the "MANUAL OUTPUT" button on the main menu page.
- Press the "Manual Relay Outputs" button on the Manual Outputs Page.
- Press the "RELAY(X)" buttons to activate the selected relay. Press the button again to deactivate the selected relay.
- Press the "RELAYS OFF" button to deactivate all the relays.
- Press the "BACK" button to return to the manual outputs menu page

SENSOR SIMULATOR:

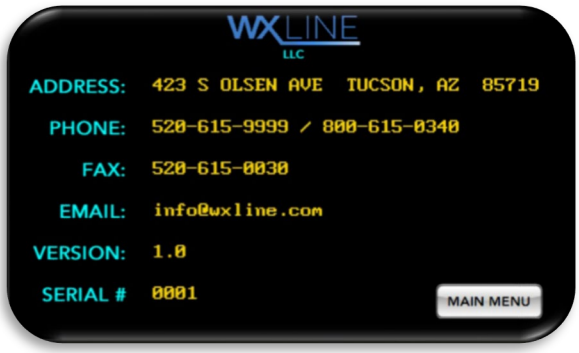
- Press the "MANUAL OUTPUT" button on the main menu page.
- Press the "SENSOR SIMULA-TOR" button on the Manual Outputs Page.
- Press the desired button to send a simulated sensor message to the Lightning Data Receiver.
- Press the "BACK" button to return to the manual outputs menu page



NOTE

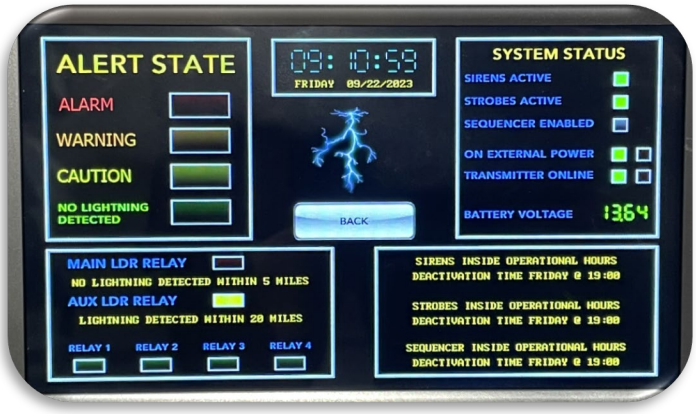
This Simulator feature is for diagnostics and can only be used with the optional fiber ports. A fiber-optic cable must be connected from a fiber port output on the interface to the fiber input on the Lightning Data Receiver.

CONTACT US:



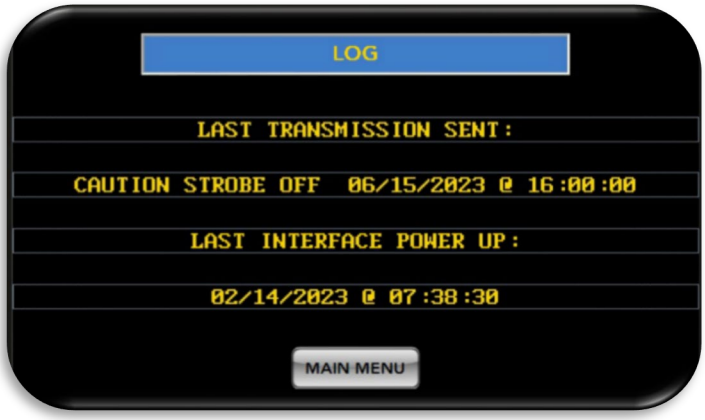
Press to view Wxline's contact information as well as the Interface's serial and version numbers.

SYSTEM STATUS:



Select to see an overview of important information about the system status of the WAVE Interface.

TRANSMITTER LOG:



This selection displays the date and time of the last transmission as well as when it was last powered up.

HOME: Select to return to the home page.

When the WAVE Interface is not in an active lightning alert state or not in an active manual alert state, it returns to the home page. The time and date are displayed as well as green scanner lights to indicate normal operation. Pressing the 'MAIN MENU' button will navigate to the main menu page.

CHAPTER 6
MAINTENANCE

General maintenance and inspection should be done annually.

BATTERIES

The WAVE Interface provides long-term, battery back-up capability to ensure continuity of operation during thunderstorms when commercial AC power reliability is often compromised. For longest battery life and ease of use, the WAVE Interface uses a pair of lead-acid gel cell batteries rated at 6 Volt, 3.5 Amp-Hours.

To access the batteries, remove the top cover of the Interface by removing the four thumbscrews at each corner.

NOTE | **Old or defective batteries can quickly corrode battery contacts. Always inspect the spring battery contacts of the Interface when replacing batteries and clean, as necessary. Contacts that are heavily corroded may need to be replaced.**

CHASSIS GROUND CONNECTION

To prevent electrical disturbances caused by thunderstorms, it is crucial to connect a bond wire from the WAVE Interface's chassis to the metal chassis of nearby electrical enclosures and other metal infrastructure of the building, including the Strike Guard Lightning Data Receiver. If a WXEIB hosts both the WAVE Interface and the Strike Guard Lightning Data Receiver, the internal bonding for these components is already complete. However, connecting a bond wire from the WXEIB to the electrical/metallic building infrastructure is still necessary. The bonding wire should have a diameter of at least 6 AWG. Additional information can be found in the National Electrical Code® (NEC) Section 250.

The earth's ground connections should be inspected, annually. Verify that the wire has a snug, mechanical connection. Inspect the wire and terminals for oxidation or damage and replace as necessary.

NOTE | **Disengage external power when performing maintenance on the Interface in the WxEIB.**

ANTENNA AND ANTENNA CABLE

Radio messages are coupled to the Interface antenna via RG-58 coax cable and broadcast to the remote equipment. Damage to either the antenna or cable will degrade the radio signal strength at the WAVE Sirens and Sequencers in the field. Therefore, both the

antenna and its cable should be periodically inspected to ensure reliable Interface operation. A damaged cable or antenna should be repaired or replaced.

INTERFACE OPERATION

Manual signals can be sent to the remote field equipment by navigating through the user menu to send radio or test codes. This should be done annually to verify the operation of both the Interface and Sirens, Strobes or Sequencers in the field. See Sections 4 on Features and Section 5 on Operation for specific information.

NOTE

The Interface output can be measured using a dummy antenna / peak detector and a voltmeter. See the procedures in Section 8 on Troubleshooting for more details.

CHAPTER 7
THEORY OF OPERATION

The WAVE Interface consists of four subsystems:

Radio PCB	encodes and transmits radio messages for remote WAVE Sirens and Sequencers.
Processor PCB	provides the user interface for configuration, manages the battery charger and battery-backup operation and internal diagnostics.
Battery	provides backup power for the Interface.
Antenna & cable	broadcasts radio messages to the remote equipment.

RADIO PCB

The Radio PCB (Printed Circuit Board) broadcasts messages to remote WAVE equipment. The output is a digitally encoded 10-watt signal at 27.255 MHz. Messages are briefly transmitted, as necessary, and since radio transmission is not continuous, no FCC license nor registration is required.

Each Radio PCB has a configurable radio address, set to agree with that of the WAVE Sirens and Sequencers in each system. Two banks of 8-position DIP switches allow for 65,536 unique address settings. Therefore, several WAVE systems may operate near one another without conflict, provided that each Interface is set to a unique address. The Radio PCB is located on the back side of the Interface, the switches on the Interface are the inverse of those on the other WAVE products in the system.

WAVE Interface back cover

The Radio PCB is configured at the Wxline factory to broadcast hourly test messages. A complementary configuration at each Siren and Sequencer allows them to signal a communication error when they fail to register a valid Interface message within four hours.

PROCESSOR BOARD

The Processor Board is the master control of the Interface, managing the major functions:

- user interface
- sensing contact transitions at the Control Input
- battery charger and backup power
- internal diagnostics

USER INTERFACE:

The user interface provides the status of the Interface and a means to configure and manually operate the unit. Status is provided via the 7' capacitive LCD Touch Screen and three LEDs: Status, Power and Transmit. Manual activation of radio messages is accomplished via navigating through the user menus. Powering the Interface ON and OFF is accomplished via the ON-OFF Button. See Sections 4 and 5 for details of these functions.

CONTROL INPUT:

Normally, the Interface Control Input is connected to a relay in the Strike Guard Receiver via the control cable. This relay changes state when either entering or exiting a lightning alarm state. The relay transition provides notification to the Interface of the alarm state change.

The Control Input produces a current-limited 12 mA signal, so that when connected to a pair of normally open, dry relay contacts the Interface senses the contact transitions as being either:

- open to closed
- closed to open

A relay transition triggers the Interface to send a set of radio messages to remote WAVE equipment to control Siren horns, Strobes and Sequencer outputs. The set of messages that are sent are determined by the Interface configuration. For detailed information on configuration, see the subsections for Hours of Operation and Setup and Tests in Section 5, Operating the Interface. The Interface is configurable to work with either single-pole, single-throw (SPST) or single-pole, double-throw (SPDT) contacts.

NOTE

The Interface capacitive touch display indicates an alarm notice when an alarm state is detected, regardless of the Interface configuration. Whenever there is doubt regarding the proper activation of remote WAVE equipment, please view the Interface display to determine if an alarm state exists.

The WAVE Interface Control Input is typically connected to the integral relays in the Strike Guard Data Receiver. The table below reflects the Control Cable connections to the screw terminal block in the Data Receiver.

RELAY	MAIN RELAY K200			AUX RELAY K201			
CONTACT	1	2	3	4	5	6	7
FUNCTION	NC	NO	COM	NC	NO	COM	GND
WAVE INTERFACE		Green & White	Orange		Orange & White	Orange	

BATTERY-BACKUP:

Under the Interface cover are battery channels that house a pair of 6 Volt, 3.5 Amp-Hour lead-acid batteries. During normal operation, an external supply powers the Processor Board and charges the batteries, as necessary. When external power is removed, the batteries serve as backup power for the Interface.

The interface is normally powered by 15VDC through the power input plug. While being powered by an external source the "Power" LED will flash blue.

The back up batteries will engage with the loss of the 15VDC input voltage. The "Power" LED will flash yellow while being powered by the batteries and voltage remains above 11.5 volts. The WAVE Interface can be powered for approximately 6 hours on the back-up batteries but will vary (6 – 12 hours) depending on how many transmissions are sent while on battery power as well a screen saver settings. The transmitter will be disabled, and the "Power" LED will begin flashing red when the battery voltage falls below 11.5 volts. At 10.7 volts the interface will shut down completely to preserve the back-up batteries and will not be able to be powered up until the battery voltage returns to 12 volts or higher.

The batteries serve primarily as battery-backup power for the Interface when external power is absent. Running time on battery power is affected by the age of the batteries and the number of radio messages transmitted. Battery run time is approximately 6 -12 hours with a fresh set of charged batteries and minimal radio transmissions. Batteries that are discharged to the point that an automatic shutdown has occurred should be recharged for at least 24 hours before being considered fully charged.

During radio transmission with external power present, the batteries deliver a portion of the current delivered to the Radio PCB and antenna. Thus, when charged the batteries assist the external power supply during radio transmission. However, batteries that are weak or discharged may diminish or attenuate radio transmission, since they are recharging.

Batteries will normally last from one to three years in the WAVE Interface.

Battery life varies and depends on how frequently they are discharged and the ambient operating temperature. Elevated ambient temperatures tend to reduce battery life.

WXEIB, SOLAR OPTION:

When mounted within a Wxline Equipment Indoor Bulkhead (WxEIB), with a solar power option, an additional battery is used for backup power for both the WAVE Interface and the Strike Guard Receiver. A 12 Volt, 12 Amp-Hour battery typically provides five days of battery run time when fully charged.

The solar power option uses a 55-Watt solar panel that outputs 15 - 22 Volts DC to the WxEIB. The WxEIB power supply regulates the solar panel voltage for the Interface and Strike Guard Receiver, as well as charge the 12 Volt, 12 Amp-Hour battery, as necessary.

ANTENNA AND CABLE

The standard antenna is a three-foot whip that is typically mounted on the rooftop of the building where the WAVE Interface is installed. The antenna is sufficient for most installations where the remote equipment is one to three miles distant from the Interface. For installations where the reception is marginal, an 18-foot extended range model is available.

Standard lengths of cable are available in approximately 25, 50, 75 and 100 feet. Custom lengths are also available, although it is recommended that lengths of RG-58 do not exceed 150 feet, due to cable losses. If longer lengths of cable are needed, RG-8 may be used for up to approximately 300 feet.

CHAPTER 8
TROUBLESHOOTING

The WAVE Interface sends radio messages to remote WAVE Sirens, Strobes and Sequencers. This section assumes that manual tests with the Interface failed to produce the corresponding behavior in some or all the remote equipment.

NO AUTOMATIC ACTIVATION OF REMOTE EQUIPMENT

CONTROL INPUT CABLE

Poor cable connections are the cause of many field failures. Check if the cable connections are loose or broken. Check the condition of the cable, itself for damage. See Figure 8: Radio Receiver PCB for control cable connections.

INTERFACE CONFIGURATION

The Interface display indicates an alarm notice when an alarm state is detected, regardless of the Interface configuration. Whenever there is doubt regarding the proper activation of remote WAVE equipment, please view the Interface display to determine if an alarm state exists.

A configuration change can prevent the Interface from sending radio messages. For example, an Interface with a calendar-clock that is out of adjustment when using hours of operation may fail to activate remote WAVE equipment.

NO RESPONSE IN REMOTE EQUIPMENT

RADIO CONFIGURATION

Each WAVE Siren and Sequencer has a Radio Receiver PCB and each Radio Receiver PCB has a configurable RF address. This address must be set to agree with that of the WAVE Interface to recognize Interface messages. Verify the address switch settings of the WAVE Interface. The Radio Receiver PCB is shown in the following figure.

FEATURE OF THE WAVE INTERFACE HAS BEEN DISABLED

The WAVE Interface will occasionally display the messages that certain features of the WAVE Interface have been disabled. This could mean that the user is attempting to perform a function that would contradict pervious settings.

Example: The user wants to set up a strobe schedule when the strobe settings are already configured to be 'always on'.

If the message 'this feature of the WAVE Interface is disabled' appears, press the 'BACK' button and check the configuration settings for the Interface.

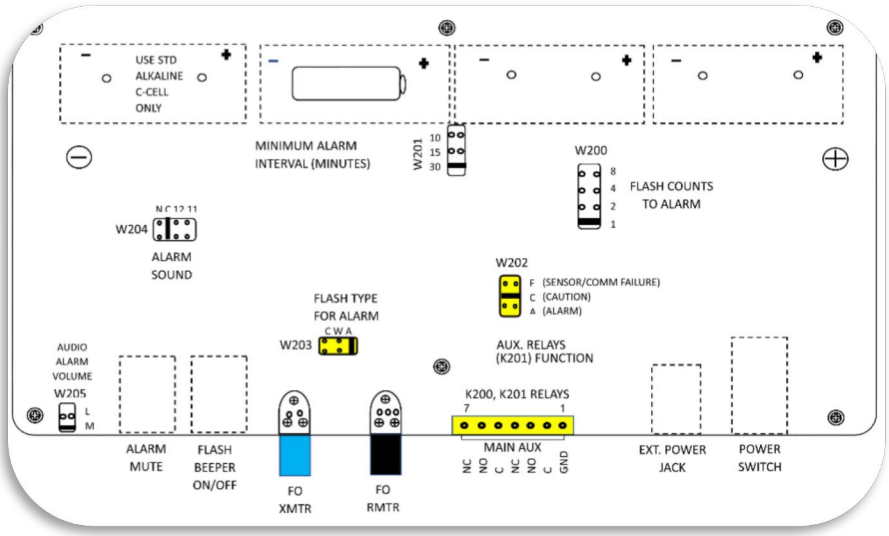


Figure 8: Radio Receiver PCB

RADIO SIGNAL RECEPTION

Weak radio signal strength may cause the Siren to miss messages from the Interface. The Interface and remote equipment are configured at Wxline to utilize hourly confidence messages. Should any of the remote units miss four consecutive messages, they will flag a communications error. The Status LED of both the Siren and the Sequencer will flash red for any error they encounter.
If there is a communication error in the WAVE Siren V2, both the external and internal status LEDs will flash red, along with the blue error LED. To display the error codes on the two seven-segment displays, press the white enter button on the WAVE Siren Station control panel. In case of a communication error, the code "13" will be displayed.

If there is a communication error in the v1 Sequencer, a communication error causes the "*D9*" LED to illuminate. This is the LED closest to the key switch (on the right).

RADIO SIGNAL TRANSMISSION

If there are communication errors in multiple remote locations, there is reason to suspect the Interface has a weak output signal. In this case, the Interface antenna and antenna cable should be inspected for physical damage, since these are both exposed to the elements of weather and climate. Replace or repair these, as necessary if visible damage is found.

Testing the interface involves sending radio transmissions from the interface through the antenna analyzer, in this case the WAVE-SWRAA antenna analyzer.

There must be a load on the radio output of the interface when transmissions are performed. This can be achieved either with the standard WAVE Interface 3ft Antenna and cable attached to the interface or with a 50-ohm dummy load.

The preferred method of testing is to include the antenna and cable resident to the Interface to gain more data and a better understanding of the health of the full system, however using the dummy load will still provide a reading on the strength of the radio output as described in watts.

The following procedure tests the Interface output to confirm there is adequate power delivered to the antenna.

Figure 9: Front of SWRAA

Figure 10: Back of SWRAA

Procedure 1: Test the interface output.

1. Disconnect the antenna cable from the Interface or bottom of the bulkhead and attach the antenna cable to the bottom right attachment on the back of the WAVE-SWRAA labeled "To Antenna or Dummy Load".

2. Connect one side the small cable included with the WAVE-SWRAA to the bulkhead or Interface and the other connector the top right hand connection point on the back of the WAVE-SWRAA labeled "To Transmitter Output".

3. Attach the power supply to the WAVE-SWRAA. The red button on the front labeled "Power" turns it on and off. When turned on the screen is illuminated amber with a black readout.

4. Using the touchscreen menu on the Interface select the SEND TRANSMITTER TESTMESSAGES (see page 26).

5. Watch the WAVE-SWRAA and take note of the readings it provides. The readings will only appear during the moments that the Interface is transmitting. Each time the Interface transmits a signal the result will show on the SWRAA. It is important that you witness and record a few messages to confirm the readings.

The Interface radio output can be tested using a dummy antenna, available from Wxline.

Figure 11: Dummy antenna

After several readings have been obtained, exit the WAVE Interface from its Test Mode and restore the antenna cable to the WAVE Interface or bulkhead.

INTERPRETING THE MEASUREMENTS:

The WAVE Interface is rated for 10 W using a 50-ohm load. Normally, an output that measures no more than 10% below its rating, or 9 W, will not noticeably affect system performance. Three readings can be observed: Forward power shown as FWD, Standing Wave Ratio shown as SWR and Reflected Power shown as REF.

Forward power represents the wattage that power of the transceiver integral to the Interface. An FWD reading of 9 or higher represents a healthy output.

The Standing Wave Ratio should be close to 1.0, the closer the better. The SWR value reveals issues in the cable or antenna that may be addressed to achieve greater transmitting strength of signal leaving the antenna.

An SWR reading over 2.1 represents a 12% loss of Effective Radiated Power, 3.0 represents a 25% loss.
Reflected Power is the power that leaves the transceiver board in the Interface, bounces back down the antenna and cable and back into the unit. This will degrade the life of the transceiver and diminish the Effective Radiated Power of the system. An ideal REF reading is 0.

INCORRECT RESPONSE IN REMOTE EQUIPMENT

If the remote equipment is responding incorrectly to the Interface messages, there are two general possibilities:

- problem in the Interface
- problem in the remote equipment

The problem can be localized by observing the remote equipment in the system respond to Interface commands. A problem at the Interface generally causes the same, incorrect behavior at multiple remote locations. Conversely, an incorrect response at a single remote site points to the equipment at the remote site as faulty.

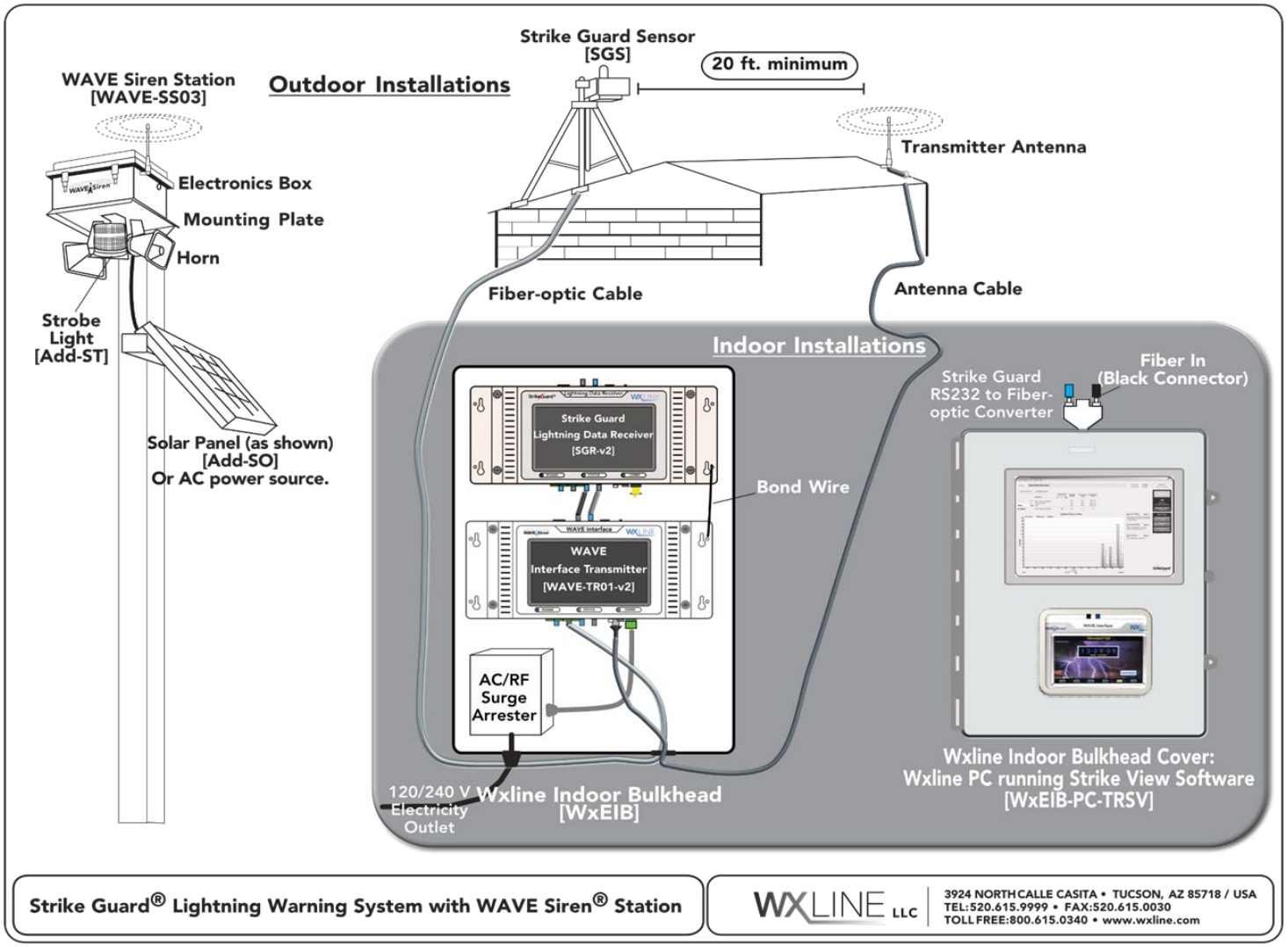


Figure 12: Strike Guard Lightning Warning System

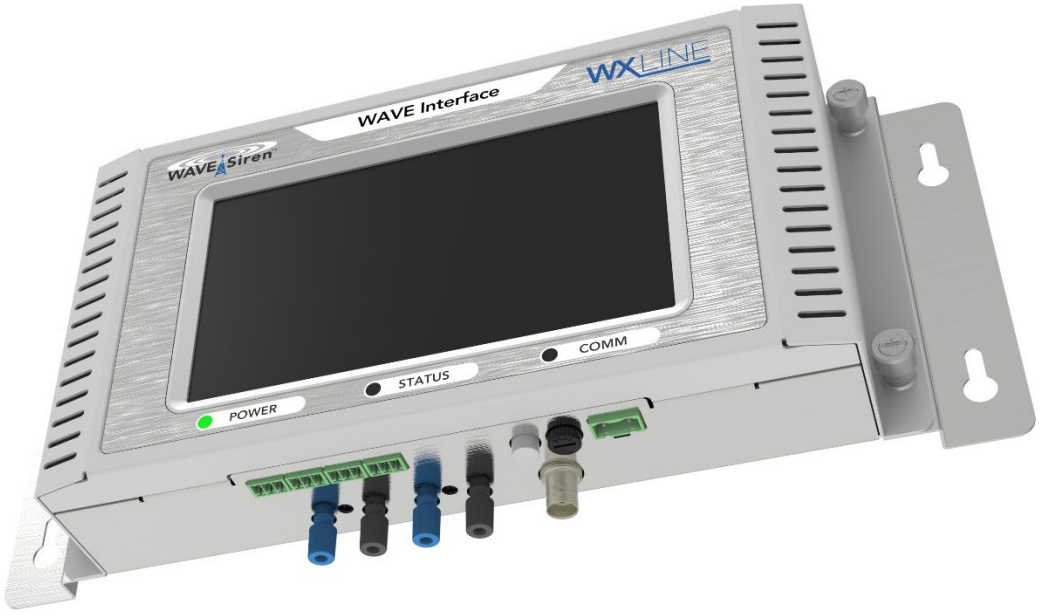
CHAPTER 9

SPECIFICATIONS

Power Requirements: 90 – 264 VAC, 50 – 60 Hz (standard)
15 – 21 VDC (solar option)

Capacitive Touch Screen

Carrier Frequency:	**27.255 MHz**
Bandwidth:	**6 KHz**
RF Modulation:	**FSK**
Transmit Time:	**1 second**
Antenna Impedance:	**50 ohms**
RF Addresses:	**65,536**
Range:	**Std. 3 ft. antenna: up to 5 miles** **18 ft. antenna: up to 10 miles**



WXLINE

Call us to discuss your specific application needs and to locate an Authorized Distributor in your area.

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WAVE Siren™

Specifications are subject to change