Specifications Guide

Automated Lightning Warning and Notification System for the Mining Industry

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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.

Chapter 1

Critical Considerations for the Implementation of Automated Lightning Warning Systems for Mine Sites

Since 2001 Wxline has provided and improved solutions for the most demanding lightning safety and equipment protection needs. Our industry leading Strike Guard and WAVE Siren Systems are installed to protect personnel at Mines, Industrial facilities, and Construction Sites all over the world.

How does Lightning affect Mining Operations? Lightning causes significant disruption to mining operations by causing millions of dollars in damage to equipment and infrastructure every year. Lightning is responsible for deaths and personal injuries that have long-lasting impacts on the persons involved. Most mine operators understand that lightning impacts their operation and that mitigating steps are required to address this dangerous occurrence.

This guide offers tangible examples of how lightning warning systems are implemented at various types of mine sites and shows the hardware and software options available.

The fully autonomous system offered by Wxline consists of a local lightning detector that continuously monitors for lightning activity within the area of concern and a Wireless Notification System that alerts personnel of the lightning condition. Notifications can be issued with emergency services grade audible sirens or visual indications such as industrial Strobe Lights, LED Signage and Lights Stacks.

The Wxline lightning warning system does not require internet access, commercial power, cell phones, or personal computers. It is the ideal choice for remote locations with limited or unreliable infrastructure.

Each project holds special consideration for the unique characteristics of the site. The examples provided in this guide are based on the most common implementations. Wxline builds each system specific to the requirements of the project and is prepared to provide custom solutions based on the project specifications.

To ensure proper installation and operation of Strike Guard and WAVE Siren systems, it is recommended that final Commissioning and Testing be performed by a Wxline Certified Field Technician or Partnering Installation Service Provider.

For additional information about the options presented in this guide, or for personalized assistance with a project, please contact Wxline directly.

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The Strike Guard Lightning Warning System

The Strike Guard Lightning Warning System is comprised of a self-powered Lightning Sensor, a Lightning Data Receiver (also referred to as "the LDR" or "the Receiver"), and a fiber-optic communications link.

The Strike Guard Lightning Detection Sensor

The Sensor monitors cloud and cloud-to-ground lightning within 20 miles/32 kilometers and categorizes lightning threats by proximity:

Lightning within 32 km (20 miles): CAUTION
Lightning within 16 km (10 miles): WARNING
Lightning within 8 km (5 miles): ALARM
No Lightning ALARM events for 30 minutes.

Patented optical signal processing and proprietary optical-coincidence technology prevent false alarms.

Functions of the Sensor

1. Receives and processes the optical and radio emissions of lightning discharges within 20 miles of the Sensor.
2. Classifies lightning signals by estimated range to the discharge.
3. Rejects background noise.
4. Transmits serial data messages to the Lightning Data Receiver via a lightning-proof fiber-optic link.
5. Performs a periodic self-test of Sensor functions including battery charge level and transmits confidence messages to the Lightning Data Receiver to ensure that a healthy Sensor and viable communications link are available

The Strike Guard Lightning Data Receiver

When the Sensor detects lightning, it sends data in real-time via lightning-proof Fiber-Optic Cable to the Receiver, which is typically installed in a maintenance building, an office environment like the Clubhouse or Pro Shop where personnel can monitor the status.

The Receiver displays Sensor Status, Receiver Status, and CAUTION, WARNING and ALARM indicators. It features a computer-compatible output for Strike View Software and fiber-optic and contact closure relays to automate the activation of the WAVE Siren Warning System.

Functions of the Strike Guard Receiver

1. Receives serial data transmissions from the Strike Guard Lightning Sensor and decodes the lightning and status messages.
2. Provides user-set options and thresholds for issuing lightning alarms via front panel LEDs, audio transducers and contact-closure signaling.
3. The LDRv2 provides touch-screen user-interface, data logging, audible alarm, countdown-timer from Alarm, integral battery back-up and expanded output options.
4. Provides continuous operation with battery backup when commercial power fails.
5. Indicates Sensor status information and Lightning Data Receiver battery level information.

Strike View Software

Strike View Software runs on a Windows PC and receives data directly from the Strike Guard Lightning Data Receiver via Fiber-Optic Cable to RS232 Converter. Strike View expands upon the information presented by the Strike Guard Lightning Data Receiver. Lightning history reports, email and text message notifications, audible and visual lightning alarms, and the Countdown to ALL-CLEAR help users categorize lightning data, analyze storm progression, and estimate time to resume operations.

Functions of Strike View Software

1. Display lightning counts in three range categories: CAUTION (<32 kilometers), WARNING (<16 kilometers), and ALARM (<8 kilometers)
2. Enable user-set email and/or text message alerts for lightning and all-clear conditions
3. Deliver audible and visual alerts at user-set thresholds
4. Display system state indicators, lightning data logging, and histogram
5. Display countdown to "No Lightning Detected"
6. Display lightning status information and countdown timer on web browser for remote viewing. (Strike View Pro)

Strike View Pro Software

Strike View Pro Server adds advanced programming tools which enable users to provide real-time Lightning status information to internet connected devices. A built-in SFTP server allows Strike View Pro to upload the status of the system into a web directory which can be viewed on any web browser.

Unlike restrictive apps that are not compatible with some devices, Strike View Pro allows remote viewing of the on-site lightning conditions from anywhere in the world regardless of platform.

Wxline Autonomous Lightning Container

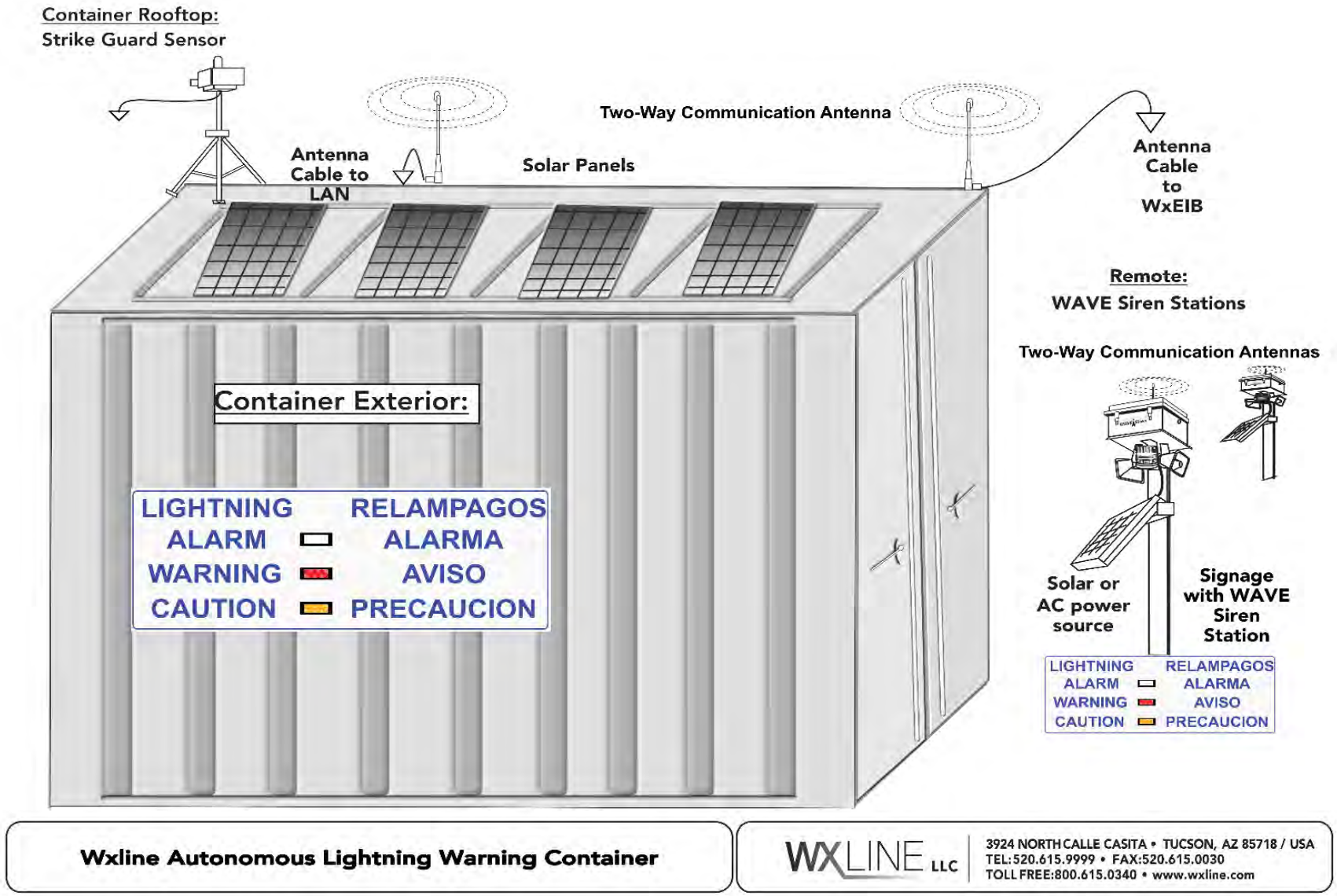


Figure 1: Wxline Autonomous Lightning Warning Container

Autonomous Lightning Warning Container Overview Parts List

Product	Part Number	Product Description	Product Image
Strike Guard Lightning Warning BASE System	Wx-CONTAINER	Strike Guard, Strike View and WAVE Transceiver Base installation system includes SG001v2, WAVE Transceiver and Bulkhead with PC and Strike View PRO with High-visibility 32 inch by 24-inch Billboard-like sign displays. The software setup includes Strike View Client and additional licenses.	
Container Power System	Wx-COPS	Complete power system and battery systems for container housing Wxline Lightning Warning System.	WXLINE

WAVE SYSTEM

The WAVE Interface Transceiver

When Strike Guard detects lightning, Mode information is sent to the Transceiver via fiber-optic communications, triggering the WAVE Transceiver to broadcast digitally encrypted messages to all WAVE Siren Stations and WAVE Sequencers. WAVE relies on RF communication to operate in noisy environments and over challenging terrain. Upon receipt of the RF signal, the WAVE Siren Stations sound audible horns and flash visible lights and the WAVE Sequencer initiates the controlled shut-down of the irrigation system. Using two-way communication, a report is sent back to the WAVE Transceiver confirming activation of the WAVE Siren Stations and Sequencers.

Functions of the WAVE Transceiver

1. Automatic or manual wireless system actuation
2. Programmable hours of operation
3. Comprehensive, automatic system status monitoring
4. Automated activation of external contact closure
5. Manual Selection of desired transmission via high capacitive touchscreen.
6. Two-way Radio Frequency communication with WAVE Siren Stations and WAVE Sequencers

Chapter 2
The Strike Guard Lightning Warning Base System Overview

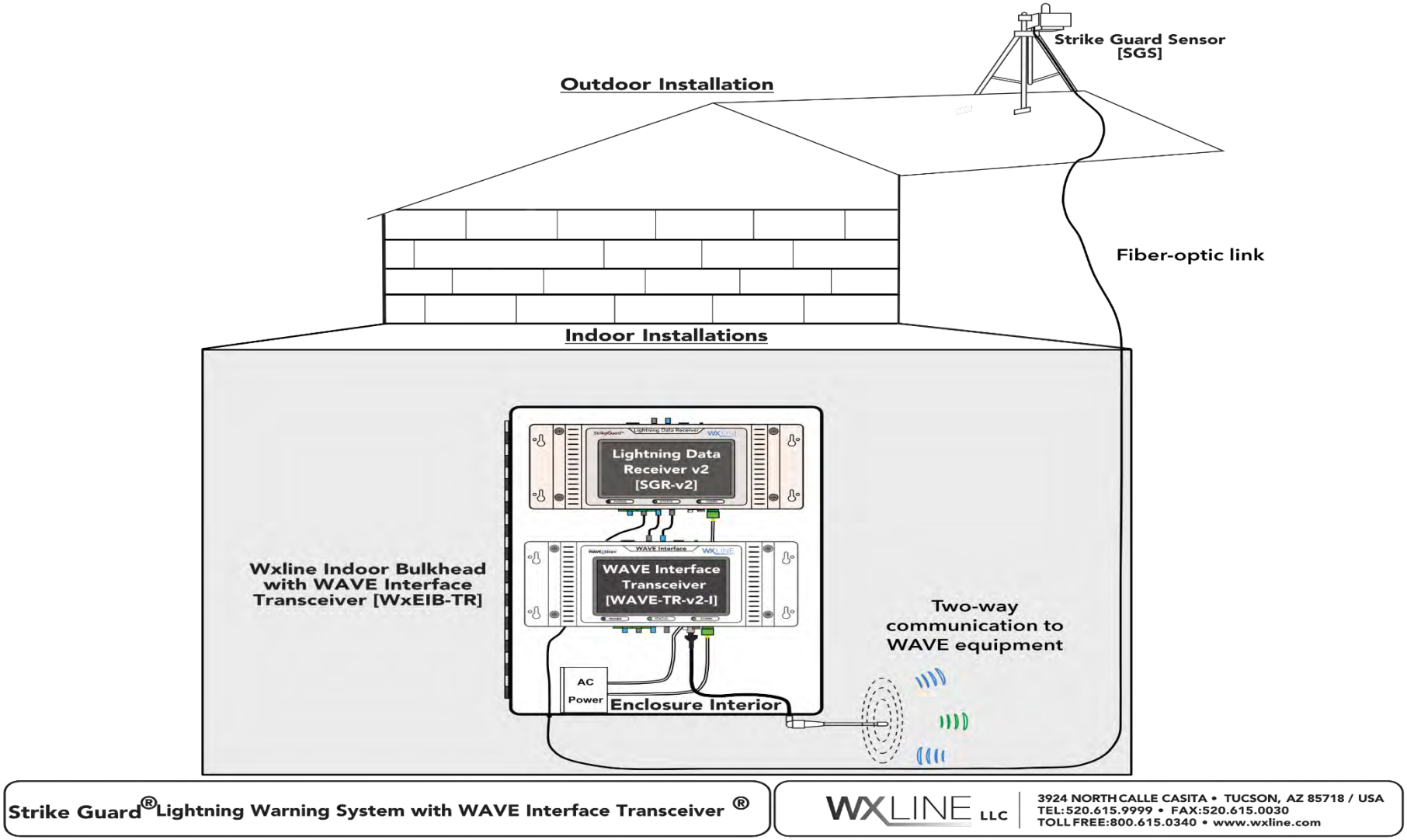
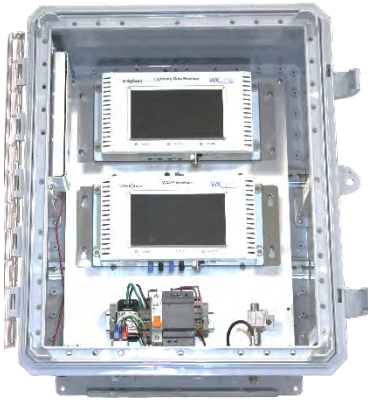


Figure 2: Strike Guard Lightning Warning System with WAVE Interface Transceiver

Parts List required Base System only:

Product	Part Number	Product Description	Product Image
Strike Guard Lightning Warning System v2	SG001-LDRv2	Strike Guard Sensor, mounting hardware, and tripod; Lightning Data Receiver v2 with alarms, 4 relays, battery back-up and PC-ready output; 30-meter simplex fiber-optic cable. Includes USB memory stick with User's Guides.	
Wxline Equipment Indoor Bulkhead with WAVE Transceiver	WxEIB-TR	Strike Guard Lightning Data Receiver (sold separately) & WAVE Interface Transceiver 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. Factory-assembled for plug-and-play functionality.	

The Strike Guard Lightning Warning System Overview with User provided PC

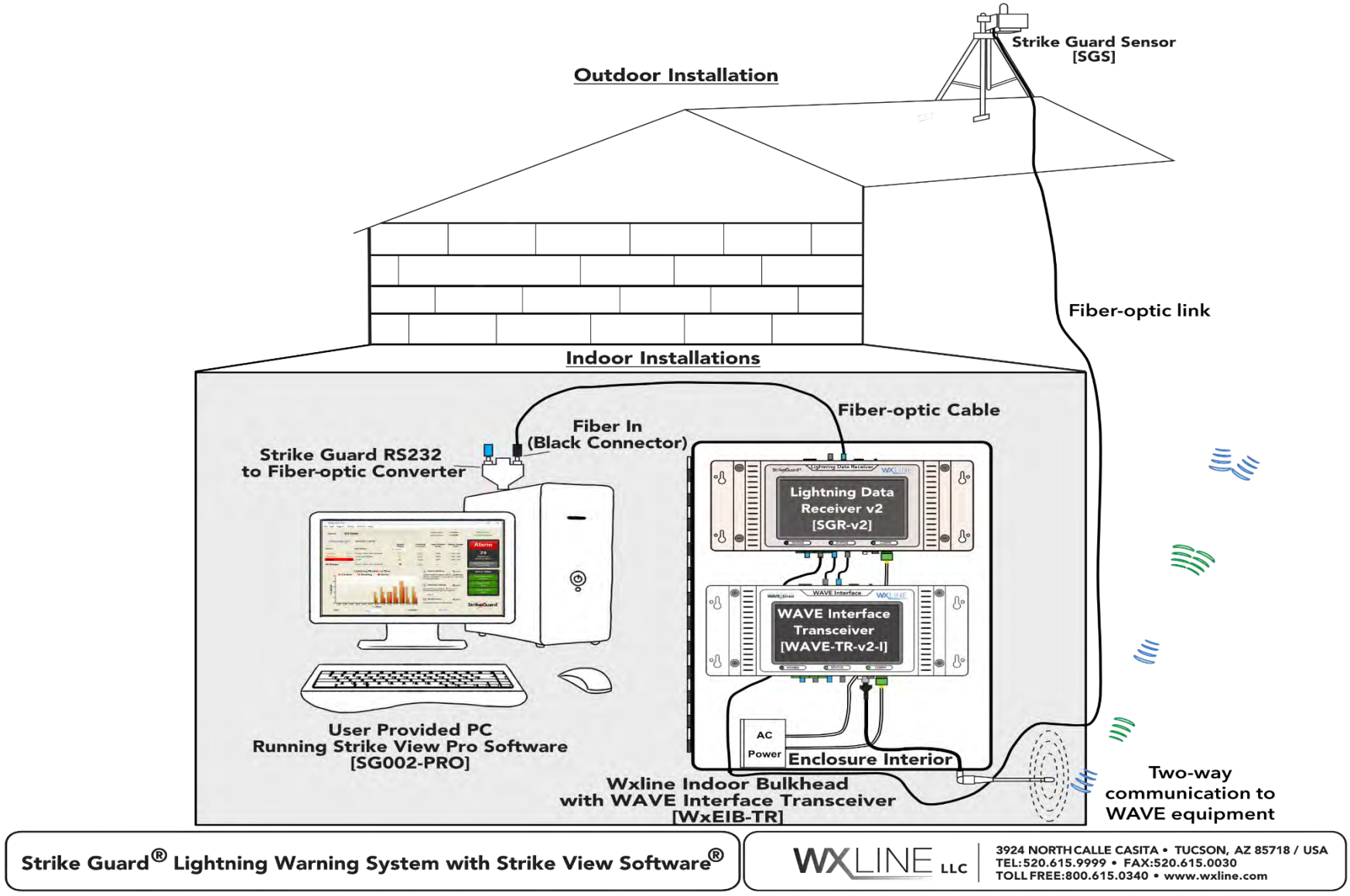


Figure 3: Strike Guard Lightning Warning System Overview

Parts List required with User Provided PC:

Product	Part Number	Product Description	Product Image
Strike Guard Lightning Warning System v2	SG001-LDRv2	Strike Guard Sensor, mounting hardware, and tripod; Lightning Data Receiver v2 with alarms, 4 relays, battery back-up and PC-ready output; 30-meter simplex fiber-optic cable. Includes USB memory stick with User's Guides.	
Wxline Equipment Indoor Bulkhead with WAVE Transceiver	WxEIB-TR	Strike Guard Lightning Data Receiver (sold separately) & WAVE Transceiver 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. Factory-assembled for plug-and-play functionality.	
Strike View Server PRO Software	SG002-PRO	Strike View Server PRO Software, Strike Guard RS232 to Fiber-Optic Converter, 10-meter simplex Fiber-Optic Cable, USB memory stick with License, User's Guides and Strike View PRO installers. Includes widget hosting.	

Base System with Wxline PC

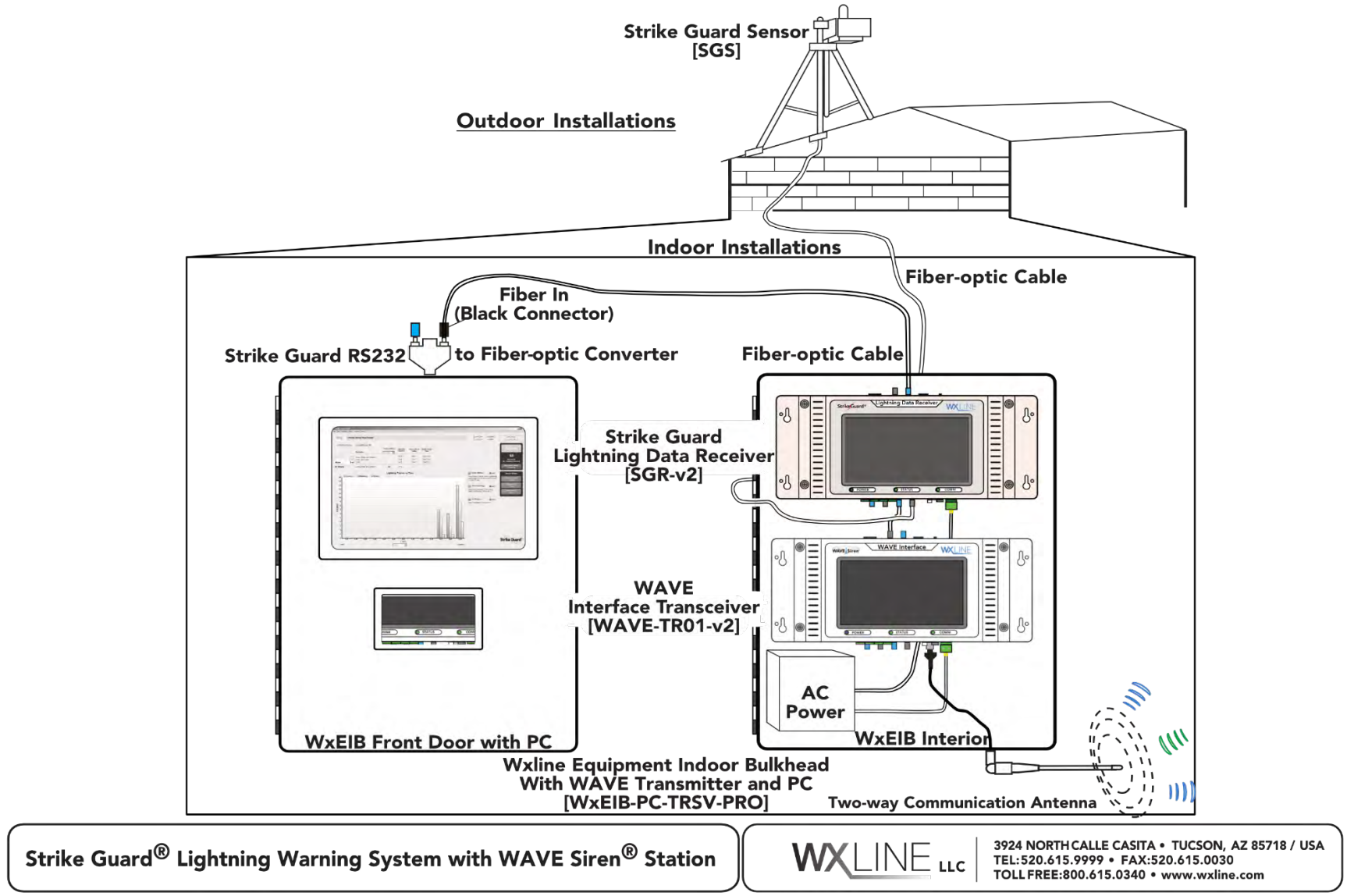


Figure 4: Strike Guard Lightning Warning System with WxEIB & PC

Part list Required for system with Wxline PC:

Product	Part Number	Product Description	Product Image
Strike Guard Lightning Warning System v2	SG001-LDRv2	Strike Guard Sensor, mounting hardware, and tripod; Lightning Data Receiver v2 with alarms, 4 relays, battery back-up and PC-ready output; 30-meter simplex fiber-optic cable. Includes USB memory stick with User's Guides.	
Wxline Equipment Indoor Bulkhead with WAVE Transceiver, Wxline PC, Strike View PRO Software	WxEIB-PC-TRSV-PRO	Strike Guard Lightning Data Receiver & WAVE Transceiver assembled and mounted in a 20 x 16 x 10-inch enclosure with flat-panel industrial Wxline PC mounted on door with the latest Microsoft Windows and Strike View PRO Software installed and registered for plug-and-play functionality.	

Chapter 3

WAVE Siren Stations

WAVE Siren Station horns are modular in design to provide audible notification specific to the desired coverage area and application. Based on coverage area and sound pressure level requirements, Siren Stations can be ordered with up to four 100 W re-entrant high efficiency compression driven horns.

Siren Stations can be activated by the end users from the Interface Transceiver via the Manual Alerts or the Manual Output pages. Two-way communication enables alert confirmation and Station status reporting on the WAVE Interface Transceiver.

Functions of the WAVE Siren Station

1. Automatic multi-stage notifications with adjustable volume controls
2. Automatic self-tests with status indicators
3. Programmable hours of operation
4. Solar- or AC-powered Siren Stations available
5. ALL-Clear notifications
6. Two-way communication with WAVE Interface Transceiver

WAVE Siren Station Options

Dual Horn, AC Power

Dual Horn with Strobe, Solar Power

Strobe only, AC Power

Power Configuration

AC Power 120v or 240v

Solar Power or Dual Power Option

Audible Notifications

1 – 4 Horns per Station
131dB Max Volume per Horn

Visual Notifications

Multi Color Strobes & Stack Lights

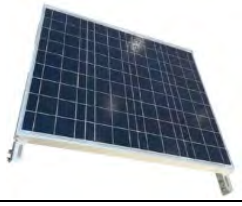
LED Sign Boards, 1, 2 & 3 stage alert option

Audible Visual Alert System

Station Configuration Selection:

Specify Quantity

Product	Part Number	Product Description	Product Image
WAVE Siren Station Single	WAVE-SS01	Multi-function, Single remote siren station with one all-weather 120-degree directional horn, radio receiver, AC-power supply with rechargeable battery backup, mounting plate, and antenna.	
WAVE Siren Station Dual	WAVE-SS02	Multi-function, Double remote siren station with two all-weather 120-degree directional horns, radio receiver, AC-power supply with rechargeable battery backup, mounting plate, and antenna.	
WAVE Siren Station Triple	WAVE-SS03	Multi-function, Triple remote siren station with three all-weather 120-degree directional horns, radio receiver, AC-power supply with rechargeable battery backup, mounting plate, and antenna.	
WAVE Siren Station Quad	WAVE-SS04	Multi-function, Quad remote siren station with four all-weather 120-degree directional horns, radio receiver, AC-power supply with rechargeable battery backup, mounting plate, and antenna.	

Product	Part Number	Product Description	Product Image
WAVE Light Stack Station	WAVE-SS0STACK	Light Stack-only station. Multi-function, Remote Station with radio receiver, battery back-up, mounting plate and antenna. Tri-colored light stack illuminates to show Strike Guard System Mode: AMBER Xenon CAUTION light indicates lightning within 20 miles; RED Xenon ALARM light indicates lightning within 10 or 5 miles; GREEN LED ALL CLEAR light indicates no lightning events have occurred within past 30 minutes.	
WAVE Strobe Station "Strobe Only"	WAVE-SS0S	Strobe-only station. Multi-function, Remote Strobe Station with one high-intensity strobe, radio receiver, AC power supply with rechargeable battery back-up, mounting plate and antenna [A second strobe can be added; requires WAVE-STROBE and WAVE Transceiver v2 or WAVE-TR01-v2-I. Specify lens color].	
WAVE Siren Station - add Solar option	add -SO Example WAVE-SS03-SO	Add solar option with quick-connect and mounting hardware to Strike Guard and WAVE package.	
WAVE Siren Station - add Strobe option	add -ST Example WAVE-SS02-SO-ST	Add high intensity Strobe light with quick-connect and mounting bracket to Strike Guard and WAVE package.	

Full System Overview for Human Safety Applications

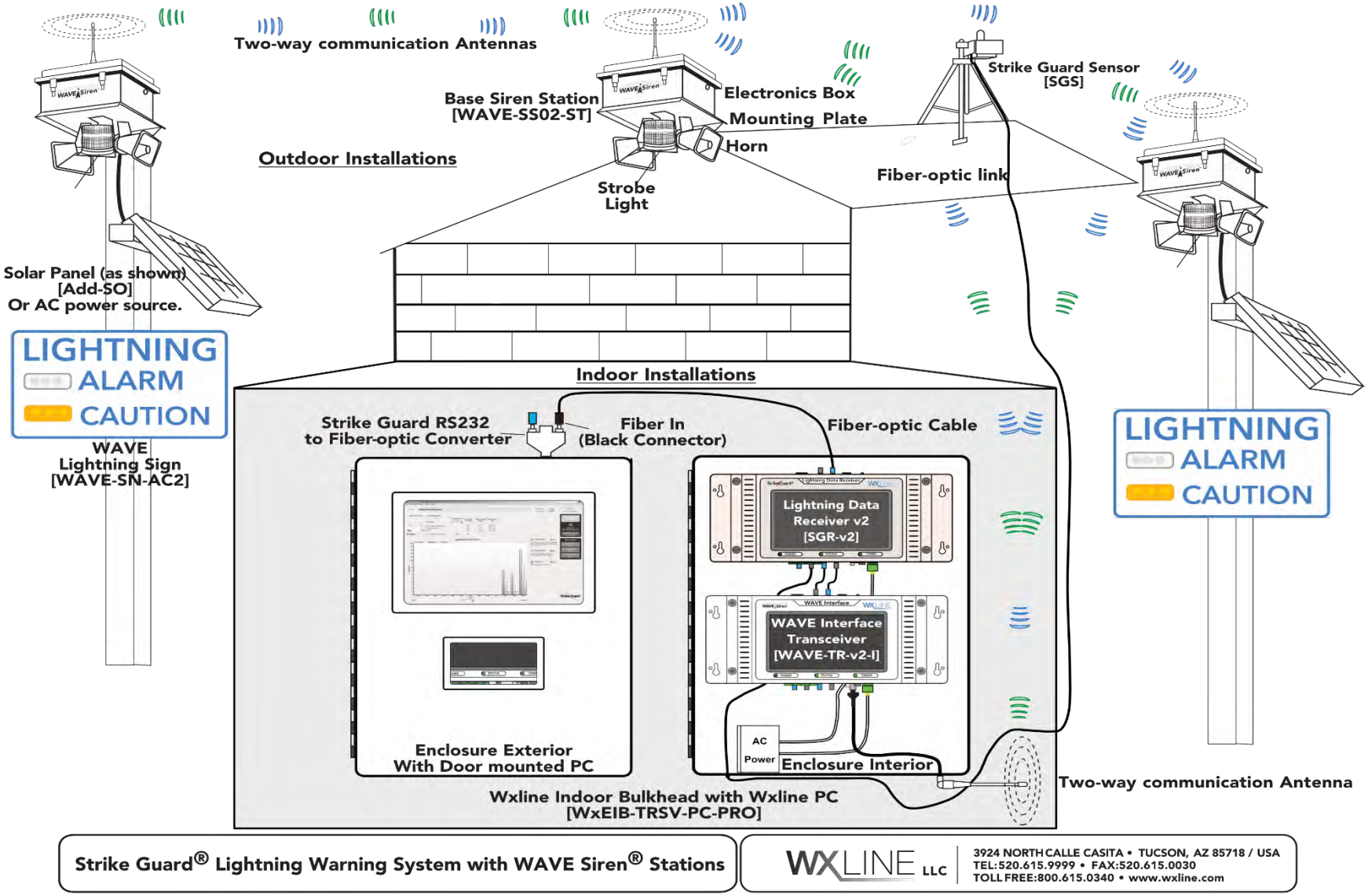


Figure 5: Strike Guard Lightning Warning System with LED Signage

Chapter 4

Site Safety Aspect

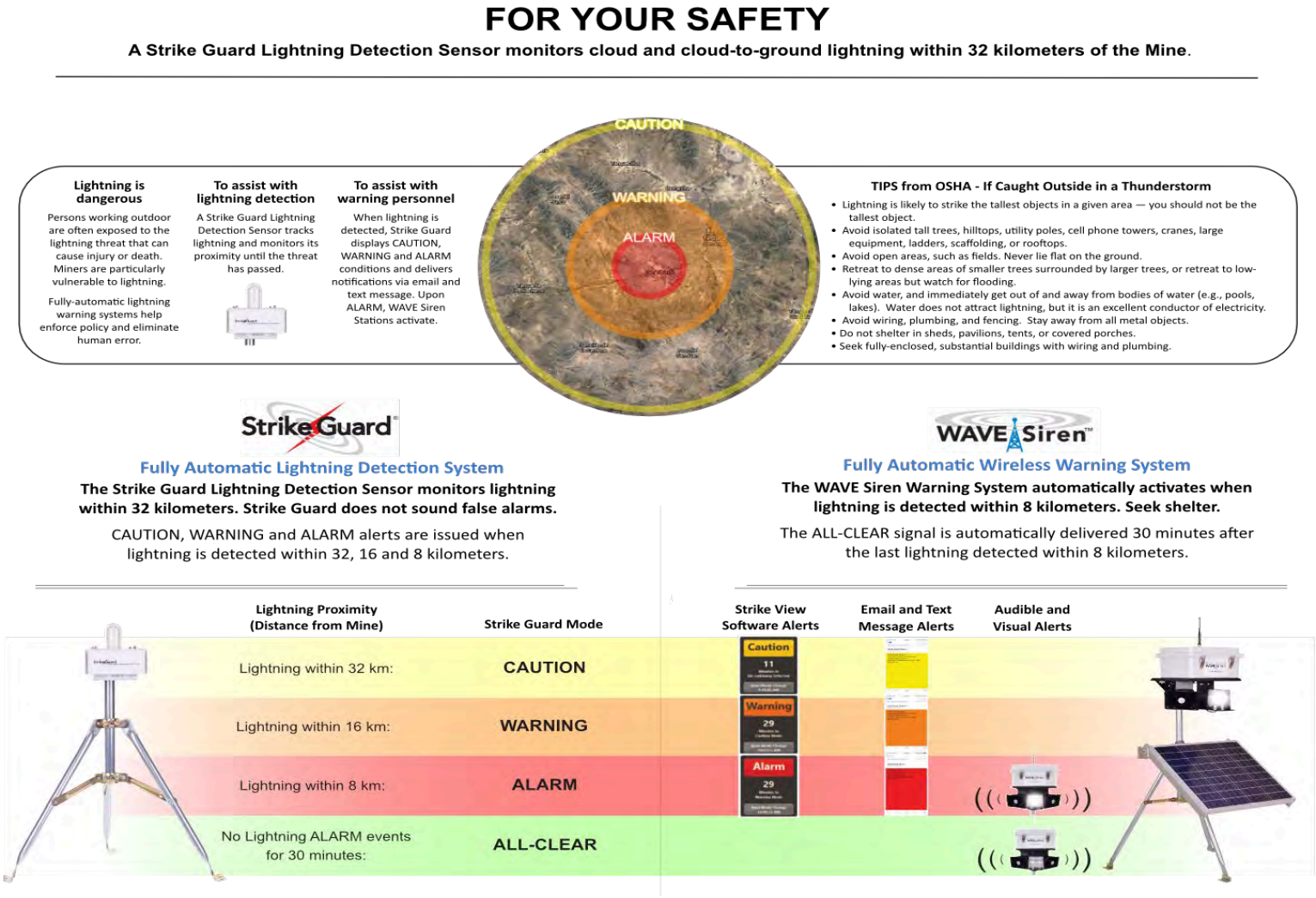


Figure 6: Mine Safety Aspect

Map of Lightning Warning System at Fruta del Norte

Figure 7: Map of Fruta Del Norte

Map of Lightning Warning System at Jerritt Canyon Mine

Installations at:

Fully-Automated Expert Lightning Warning System at Jerritt Canyon Mine

Figure 8: Map of Jerritt Canyon Mine

Map of Lightning Warning System at Camino Rojo

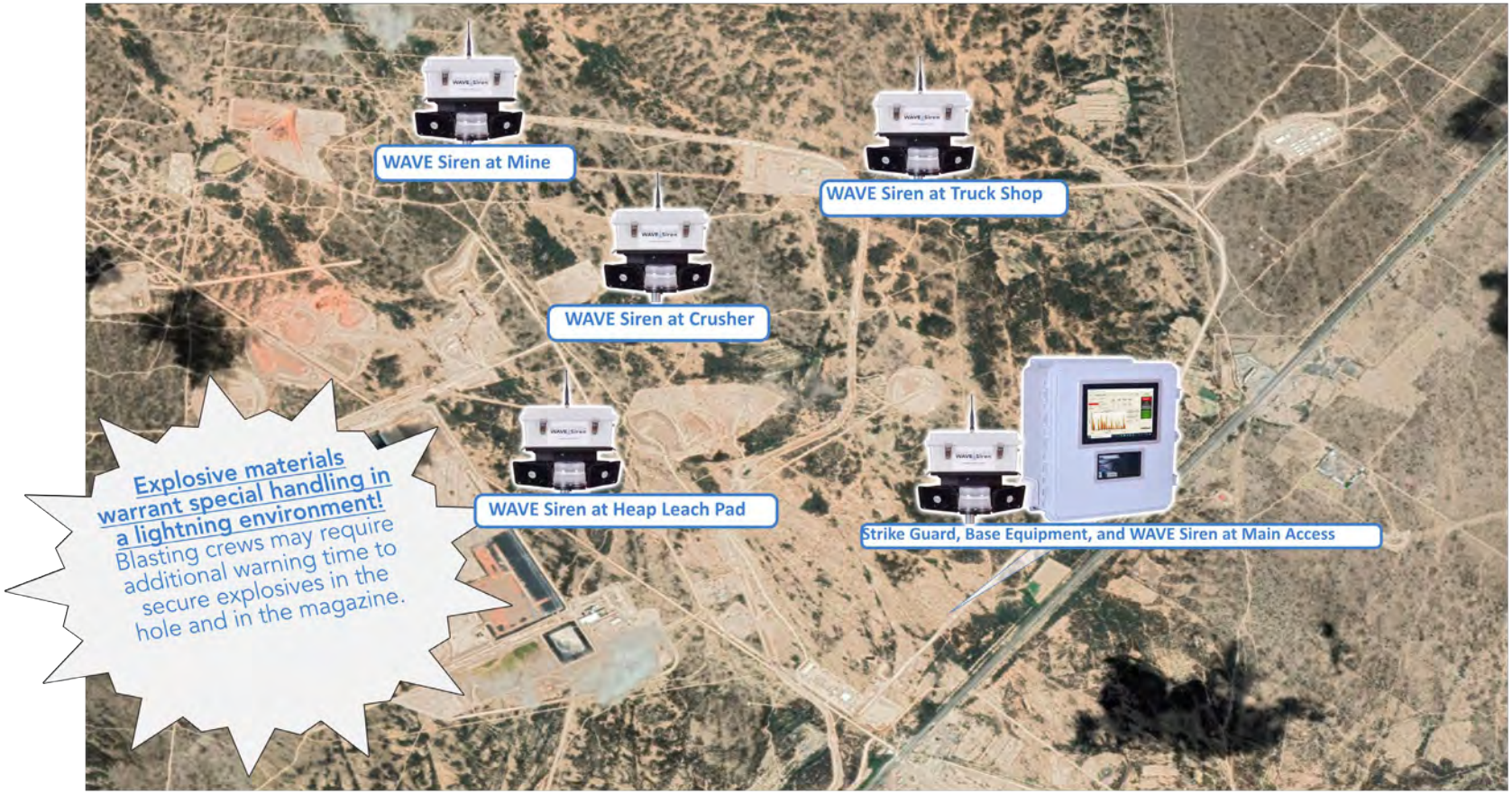


Figure 9: Map of Lightning Warning System at Camino Rojo

Map of Lightning Warning System at Damang Mine

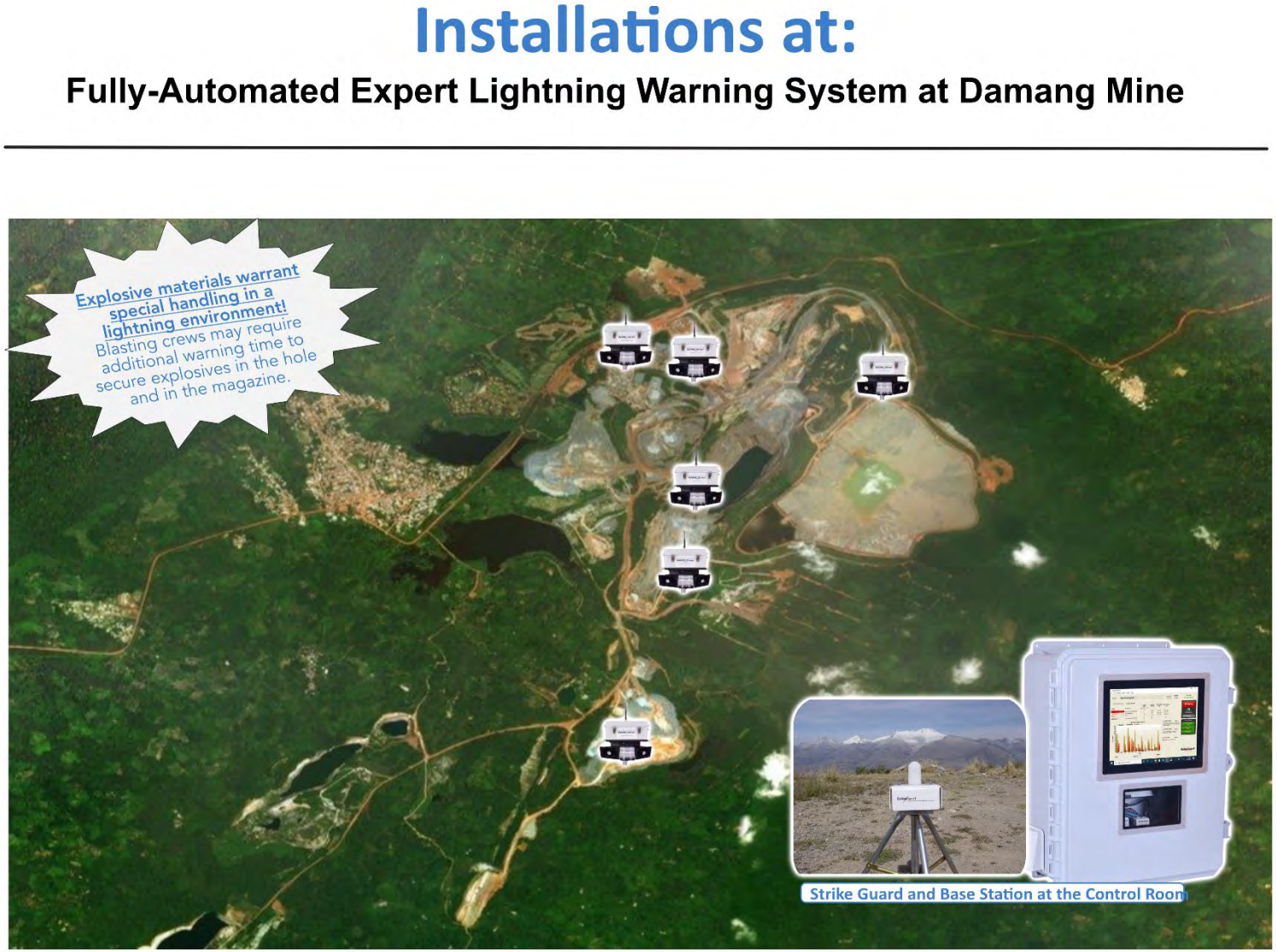


Figure 10: Lightning Warning System at Damang Mine

Chapter 5

Pump Station Critical Asset Protection System

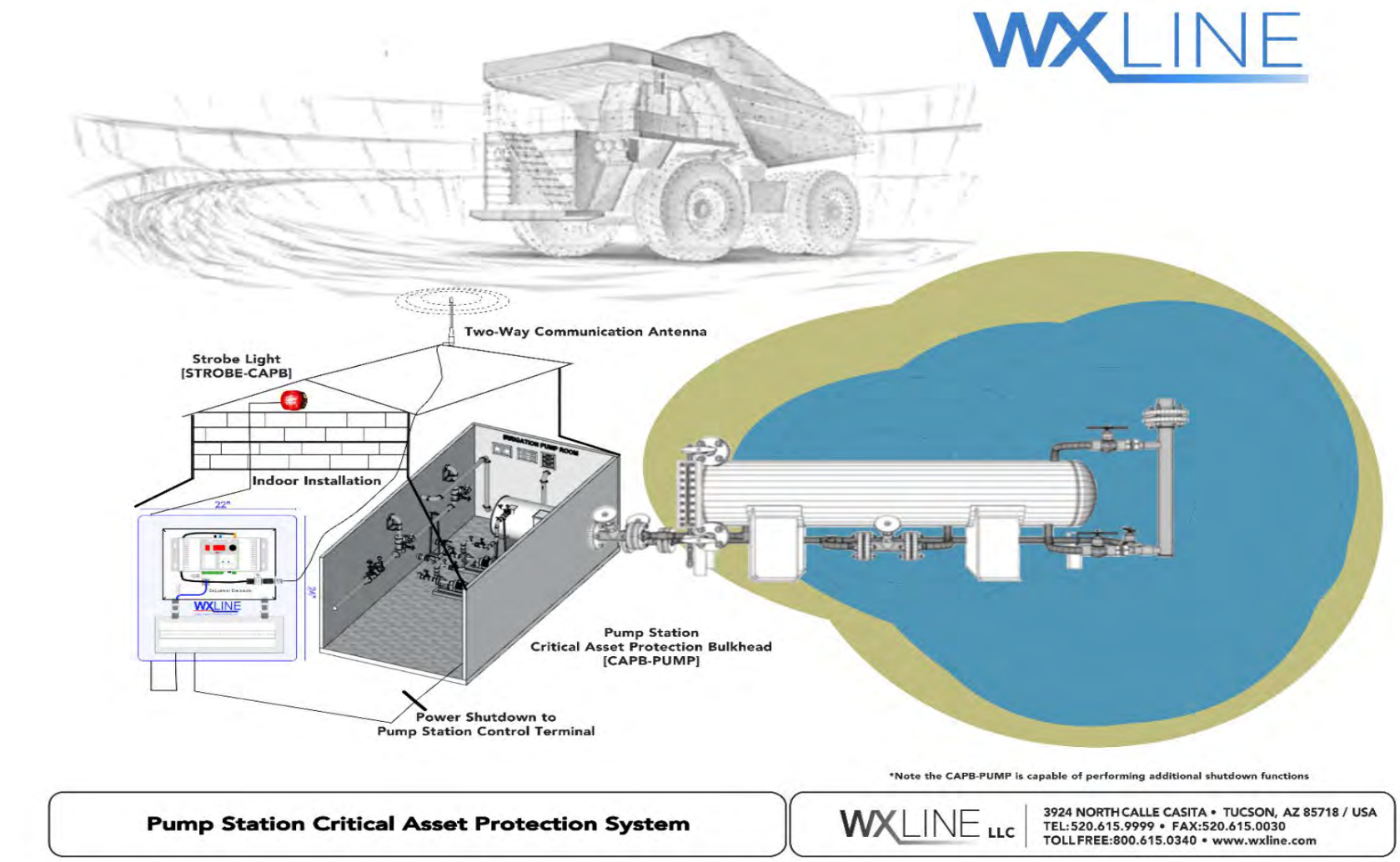


Figure 11: Pump Station Critical Asset Protection System

Pump Station Critical Asset Protection System Overview Parts List
Autonomous Lightning Warning Container

Product	Part Number	Product Description	Product Image
Strike Guard Lightning Warning BASE System	SG001-BASE	Strike Guard, Strike View and WAVE Transceiver Base installation system includes SG001v2, WAVE Transceiver and Bulkhead with PC and Strike View PRO.	
Pump Station Critical Asset Protection Bulkhead	CAPB-PUMP	WAVE Sequencer-based remote wireless- or local Strike Guard direct (wired) connect for contact-closure relay signaling to initiate automated lightning alarm shut-down/start-up of irrigation pump stations. Add STROBE- CAPB for visual indication of sequence off condition.	
CAPB Strobe Option	STROBE-CAPB	High-intensity RED Strobe illuminates to show CAPB is in protected state during Lightning Alarm Mode. Strobe flashes until ALARM expires.	

Chapter 6

System Enhancement Options:

Strike Guard with CS110 Electric Field Mill

Strike Guard with CS110 Electric Field Mill monitors cloud and cloud-to-ground lightning and the electric field within user-set parameters and provides contact-closure signaling at user-set thresholds. The CS110 Electric Field Mill measures the vertical component of the atmospheric electric field at the Earth's surface. Atmospheric electric field data is useful for assessing the local lightning hazard, especially prior to the first, and after the last, lightning discharges in a storm

The International Standard for Thunderstorm Warning Systems, IEC 62793:2016, classifies Strike Guard with CS110 Electric Field Mill as a Class A Detector capable of detecting thunderstorm evolution during all four phases of thunderstorm development. The European Standard for Protection Against Lightning - Thunderstorm Warning Systems, EN 50536, classifies Strike Guard with CS110 Electric Field Mill as a Class I Detector capable of detecting thunderstorm evolution during all four phases of thunderstorm development.

Data from the two sensors can trigger automatic warning systems and help personnel make evacuation and shutdown decisions.

Functions of Strike Guard with CS110

1. Automatic alarm triggering with user-set range categories and electric field magnitude thresholds.
2. 20-mile lightning detection range
3. Periodic sensor health and communication self-tests
4. Flexible sensor mounting options

System Enhancement Options Overview Parts List:

Product	Part Number	Product Description	Product Image
1-Stage Lightning Sign	**WAVE-SN-A1**	High-visibility 32 inch by 16 inch Billboard-like sign displays "LIGHTNING – ALARM" condition via high-intensity LED lights. Default: Clear = Alarm. Sign is added to WAVE Siren Station through quick connect cable. (Specify length - Max 25ft)	
2-Stage Lightning Sign	**WAVE-SN-AC2**	High-visibility 32 inch by 18-inch Billboard-like sign displays "LIGHTNING – CAUTION and ALARM" conditions via high-intensity LED lights. Default: Amber = Caution, Clear = Alarm. Sign is added to WAVE Siren Station through quick connect cable. (Specify length - Max 25ft)	
3-Stage Lightning Sign	**WAVE-SN-AWC3**	High-visibility 32 inch by 24-inch Billboard-like sign displays "LIGHTNING – CAUTION, WARNING, and ALARM" conditions via high-intensity LED lights. Default: Amber = Caution, Red = Warning, Clear = Alarm. Sign is added to WAVE Siren Station through quick connect cable. (Specify length - Max 25ft)	
CAPB Strobe Option	**STROBE-CAPB**	High-intensity RED Strobe illuminates to show CAPB is in protected state during Lightning Alarm Mode. Strobe flashes until ALARM expires.	

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

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