Strike Guard Lightning Warning System

User's Guide

Strike Guard employs state-of-the-art technology to address the most demanding lightning safety and equipment protection applications.

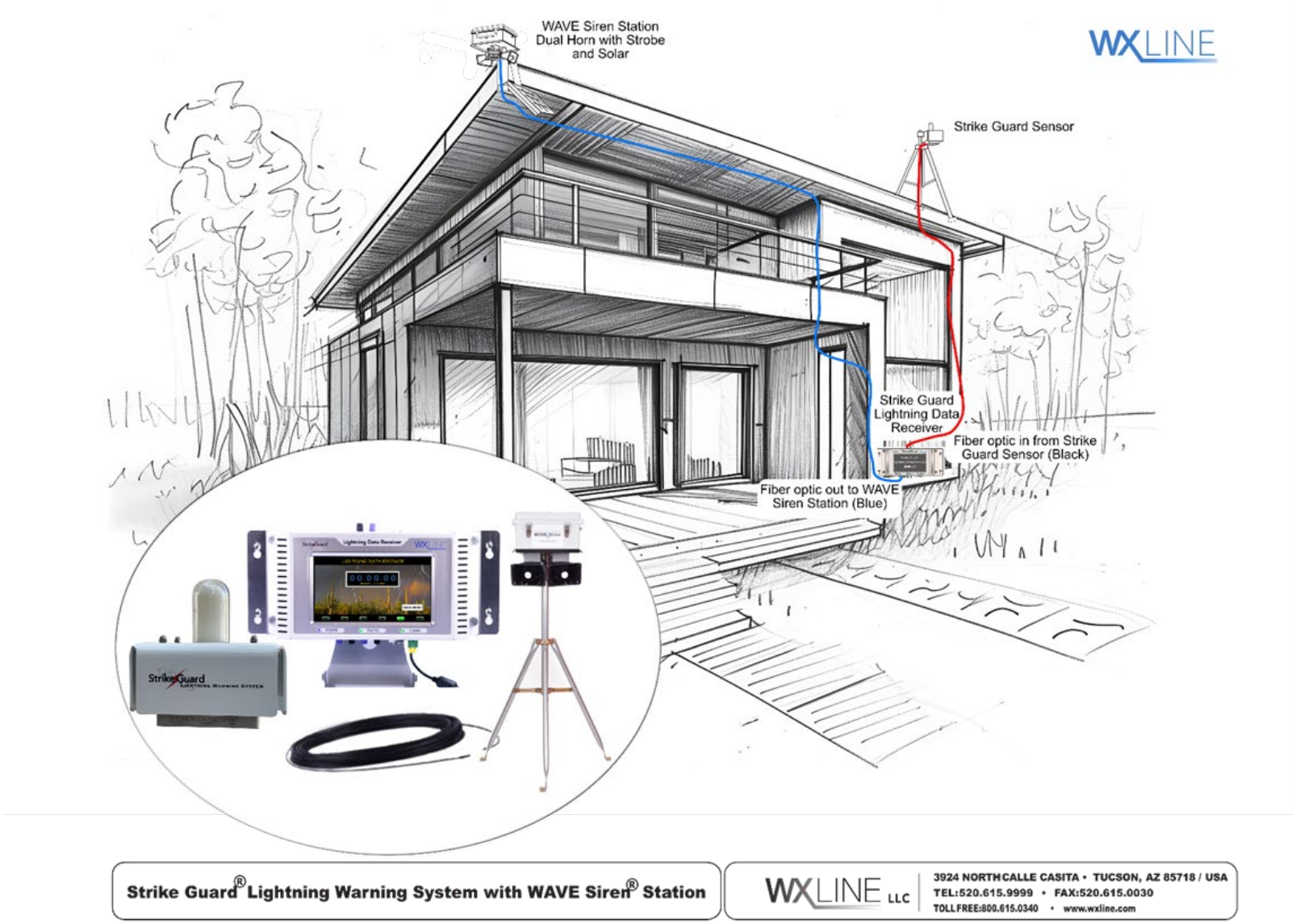

Figure 1: Strike Guard Base System (SG-WAVE)

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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

ABOUT 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 Sensor must be securely mounted in a well exposed place outdoors.

For a maximum operational safety and to achieve the highest reliability of the warning equipment in a lightning environment, the Lightning Sensor (the "Sensor") communicates via a non-conducting fiber-optic link with the Lightning Data Receiver that is mounted indoors in an office environment.

Figure 2: Lightning Warning System Equipment

There are two distinct models for the Strike Guard Lightning Data Receiver available.

The standard edition Strike Guard Lightning Warning System is designed for easy installation using a minimum of tools and specialized knowledge.

The next generation Strike Guard Lightning Data Receiver (LDR) displays detailed real-time lightning information. Expanded programmable relay and fiber-optic outputs allow for messaging from Strike Guard Lightning Data Receiver to WAVE and other systems. The LDR touchscreen display simplifies system programming and displays detailed lightning information with countdown timer from last lightning detected. Independent front-panel LED lights provide power, system, and communication status indications.

Figure 3: Lightning Data Receiver - Standard Edition

Figure 4: Lightning Data Receiver - v2

Chapter 3 explains the standard LDR. For more details on the LDR-v2 please see Chapter 4. The Strike Guard Lightning Data Receiver (LDR) receives serial data from the Strike Guard Lightning Sensor via a non-conducting, plastic fiber-optic communications link.

The LDR decodes lightning and status messages and provides the logic and timing needed to give audible and visual lightning and status information and to provide contact-closure signaling of external equipment. It was designed to be easy to install and easy to use with a short learning curve for set-up and use.

The LDR was designed for maximum reliability during local thunderstorms when lightning-caused power disturbances, power failures, and lightning surge currents tend to compromise less robust commercial equipment.

NOTE | **Unlike the Strike Guard Lightning Sensor, the LDR is not weatherproof. The LDR is specified to operate in a normal office environment. Subjecting the LDR to high humidity, high temperature, insect, and rodent habitat will shorten useful product life significantly.**

The Lightning Data Receiver is designed for use in an office environment. The design of the wall mount plate and connectors allow for a simple, straightforward installation.

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

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).**

THE STRIKE GUARD LIGHTNING SENSOR

- Receives and processes the optical and radio emissions of lightning discharges within 20 miles of the Sensor. Measurements can be displayed in kilometers or miles but will be shown in miles throughout this manual.
- Classifies lightning signals by estimated range to the discharge.
- Rejects background noise.
- Transmits serial data messages to the Lightning Data Receiver via a lightning proof, fiber-optic link.
- 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.

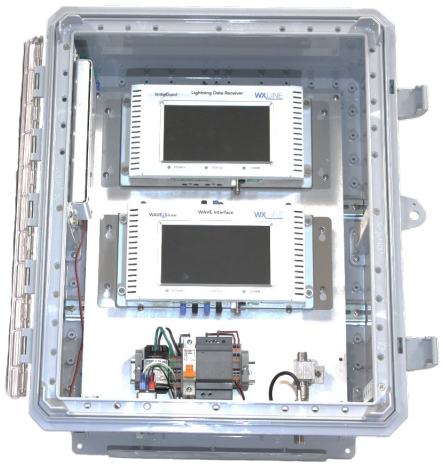


Figure 5: Depicts activation range radius – 5, 10 & 20 miles.

THE STRIKE GUARD LIGHTNING DATA RECEIVER:

- Receives serial data transmissions from the Strike Guard Lightning Sensor and decodes the lightning and status messages.
- Provides user-set options and thresholds for issuing lightning alarms via front panel LEDs, audio transducers and contact-closure signaling.
- Provides the relay contact-closures needed to activate the WAVE Siren System or to signal other equipment that uses contact-closure signaling.
- Provides continuous operation with battery backup when commercial power fails.
- Indicates Sensor status information and Lightning Data Receiver battery level information.

Unlike a human observer, the Strike Guard Lightning Warning System operates continuously and automatically. Every effort is made to ensure that the Strike Guard Lightning Warning System does not malfunction or fail during a local thunderstorm, even in conditions with very close lightning. The Strike Guard Sensor is self-powered by long-life lithium batteries that can operate a Sensor in a typical setting for over four years. To ensure total immunity from lightning disruption of communications during a local thunderstorm, the Strike Guard Sensor is connected to the Strike Guard Lightning Data Receiver via a non-conducting, fiber-optic link.

ABOUT THE STRIKE VIEW SOFTWARE

The optional Strike View Software provides lightning data display features that complement and expand on the capabilities of the LDR. For detailed information please consult the specific User's Manual.
The computer running Strike View is normally connected to the fiber-optic (FIBER OUT) transmitter (blue connector) on the Lightning Data Receiver, or directly to the Strike Guard

Lightning Sensor via fiber-optic cable and the Strike Guard RS-232 to Fiber-optic Converter (the "Converter"). Strike View provides data display, data logging functions, and Email notification.

Figure 6: Strike View options!

STORING FOR MAXIMUM BATTERY LIFE

Always store the Strike Guard Lightning Warning System package in the upright position as indicated on the outside of the factory-shipping box. When storing a Strike Guard Sensor alone, use the interior box with foam protection and make sure that the Sensor is stored in the upside-down position (with the glass diffuser pointing down). Battery power is switched off when the Sensor is turned upside down.

UNPACKING AND CONTENTS OF THIS PACKAGE

Carefully unpack the carton containing the Strike Guard Lightning Warning System components. Save the smaller inner boxes and custom foam protection in case the product is returned or stored for any reason.

NOTE | **If the Strike Guard System is shipped with a WAVE Siren System that includes a Wxline Equipment Indoor Bulkhead (WxEIB), a different packing scheme is used.**

Make sure that the following items are included in the package:

- ✓ Strike Guard Lightning Sensor
- ✓ Strike Guard Lightning Data Receiver
- ✓ 30 m (98.5 ft) length of fiber-optic cable (or custom-ordered length)
- ✓ A mounting tripod and mast
- ✓ A package of pitch-pads and ¼-inch lag-bolts for tripod roof mounting
- ✓ A package of Sensor mounting brackets and mounting hardware
- ✓ Strike View Software Installation thumb-drive

If Strike View Software was purchased, the shipment also contains:

- ✓ Strike Guard RS-232 to Fiber-optic Converter
- ✓ 10 m length of fiber-optic cable (or custom-ordered length)

NOTE | ***Instructions for Strike View Software and related accessories can be found in the Strike View Software User's Guide.***

HANDLING PRECAUTIONS

GLASS DIFFUSER

The Strike Guard Lightning Sensor has a glass diffuser dome that may break with rough handling or impact from hard tools. Use extra care in handling the Sensor. Ship and transport the Sensor in the factory foam and cardboard container.

PLASTIC FIBER-OPTIC CABLE

The plastic fiber-optic cable must be handled with care to prevent kinking or bending the fiber core. Kinks and sharp bends in the fiber will attenuate light transmission through the fiber that may prevent the system from working. Once the cable is kinked or sharply bent, it may not recover. During installation, use only light pulling forces and keep bend radii of the fiber as large as possible.

NOTE | ***Do not step on the fiber and do not lay the fiber directly on a hot roof surface. Do not allow the ends of the fiber to become fouled with dirt, roof tar, etc.***

The fiber is pre-cut and properly cleaved and tested at the factory for maximum light transmission. If, during handling, the end of the cable is damaged, scratched or otherwise fouled, please call your distributor or Wxline for assistance.

RS-232 TO FIBER-OPTIC CONVERTER

The RS-232 to Fiber-Optic Converter should be handled carefully to avoid damaging the exposed fiber-optic transmitter and receiver devices.

TOOLS AND MATERIALS YOU MIGHT NEED FOR INSTALLATION

- 7/16-inch hex nut driver
- 1/2 inch open-end wrench
- 3/8-inch hex socket wrench or nut driver
- 1/4-inch electric or battery-powered drill
- Suitable bit for drilling pilot holes for ¼-inch lag bolts and
- suitable bit to drill access hole for fiber cable to the indoors Silicone sealant or equivalent to seal fiber-optic cable access hole to the indoors

STEP-BY-STEP INSTALLATION INSTRUCTIONS

Before installing the Sensor outdoors, it is strongly advised that the system is connected, and proper function is verified while still indoors. It is usually easy to find and fix problems when the entire system is set up on a desktop. Do not route cable from the roof level to indoors until the system functions properly.

VERIFY SYSTEM FUNCTION INDOORS

Verify the system function indoors by connecting the Sensor to a Lightning Data Receiver and/or a computer running Strike View.

Verify Sensor function by holding the Sensor with the glass diffuser facing down. After holding the Sensor upside down for about ten seconds, turn the Sensor upright and watch the end of the blue fiber-optic transmitter on the side of the Sensor electronics enclosure. A brief bright burst of red light will be seen a few seconds after the Sensor is turned upright. If this normal power-on data transmission is observed, put the Sensor aside and go to the next step to verify proper functioning of the system.

Loosen the blue ferrule on the LED fiber-optic transmitter mounted on the Sensor enclosure and insert one end of the fiber-optic cable until the fiber seats. Gently tighten the ferrule to hold the fiber in place.

Connect the other end of the fiber-optic cable to the black (FIBER IN) port on the Lightning Data Receiver. Without removing the cover and after loosening the ferrule on the black (FIBER IN) port of the Lightning Data Receiver, insert the fiber until it seats and gently tighten the ferrule to hold it in place.

Connect the power supply for the Lightning Data Receiver to an AC power receptacle and connect the output connector of the power supply to the POWER IN jack on the Lightning Data Receiver. Now, toggle the lever of the Lightning Data Receiver power switch to the ON position and note that the blue External Power LED on the front panel flashes about once every two seconds. One or more of the status LEDs typically flash red. These are normal indications.

With the Sensor connected to the Lightning Data Receiver and with the Lightning Data Receiver turned ON, turn the Sensor OFF by holding it and turning it upside down for about ten seconds. After ten seconds in the upside-down position, turn and hold the Sensor in the upright position with the optical diffuser facing upwards. Hold the Sensor in this position for at least ten seconds and observe the front panel of the Lightning Data Receiver. If all equipment is functioning properly and the fiber-optic cable is properly installed, all the red-flashing LEDs extinguish and only the blue LED flashes once every two seconds (approx.). This is the normal indication. If this indication is not observed on the first try, proceed to the next step, and reattempt this initial test. Call Wxline if problems persist at this step.

To repeat the indoor system checkout before installation, switch power OFF to the LDR to affect a complete LDR reset. Check the fiber-optic cable connections and ensure that the fiber is fully seated in the fiber-optic transmitter on the Sensor and fully seated in the fiber-optic receiver on

the Lightning Data Receiver. Now repeat Step 5. When normal system function is verified, install the system. Leave all equipment as is and go to the next step.

Refer to the RS-232 to Fiber-optic Converter (the "Converter") User Guide and install the Converter on an unused RS-232 communications port of a computer. The Converter has a 9-socket (female) connector that will mate directly to any 9-pin D subminiature connector such as the COM1 or COM2 or other serial ports on a computer. A short, straight-through (NOT null-modem) adapter cable may be used to mount the Converter to a serial port on a computer.

NOTE **If an RS-232 port is not available and the computer has only USB serial communicati ports, refer to the Strike View Software User's Guide for instructions on installation USB to RS-232 Adapter.**

Follow the Strike View installation procedures as outlined in the Strike View Software User's Guide or in the Quick Reference Guide in Chapter 7 of this guide. Once the computer is restarted after installation, initiate the Strike View Software application. Connect the fiber-optic cable supplied with Strike View Software between the blue FIBER OUT port of the Lightning Data Receiver and the black FIBER IN port of the RS-232 to Fiber-optic Converter using the same techniques for proper fiber-optic cable connections described in **HANDLING PRECAUTIONS**. Ensure that the ends of the fiber are fully seated in the fiber-optic devices. When the Strike View application is running the system is ready to be tested.

With the Lightning Data Receiver turned ON and with Strike View Software running and with all fiber-optic connections in place, pick up the Strike Guard Lightning Sensor and turn it UPSIDE DOWN for at least 10 seconds. Now turn the Sensor right side up and set it on the desktop. Note that the status window in the lower right-hand corner of the Strike View Software screen changes with the receipt of the first status messages from the Sensor. Look for the screen area in the lower right-hand corner to change from:

If all results are normal to this point, then proceed to the selection of an appropriate site for the Sensor.

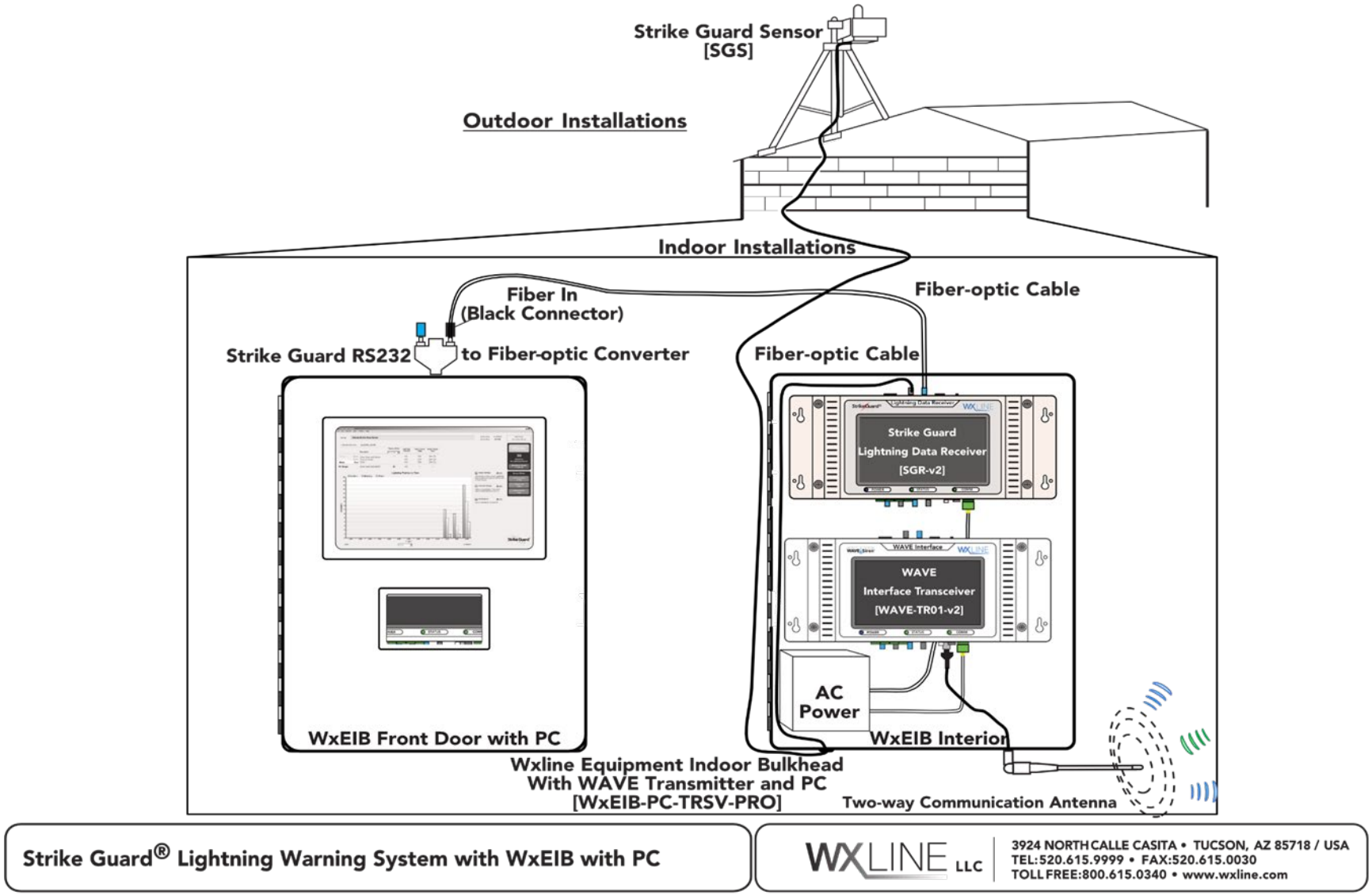


Figure 7: Strike Guard Lightning Warning System with WxEIB with PC

CHAPTER 2

STRIKE GUARD LIGHTNING SENSOR

SELECTING AN APPROPRIATE SITE FOR THE SENSOR

Look for a site for the Sensor that has as many of the following features as possible. Problems may arise if the following guidelines are not followed in a general manner.

1. The Sensor mounting site should be within easy fiber-optic cable reach of the Lightning Date Receiver.
2. The Sensor mounting site should have a good view of the atmosphere in all directions. Trees and buildings and other tall objects should not exceed 10 degrees above the horizon of the Sensor.
3. The Sensor mounting site should be at least 25 ft (8 m) away from radio transmitting antenna and the Sensor should never be mounted in the beam of a directional transmitting antenna.
4. The Sensor mounting site should be at least 20 ft (6 m) away from roof-mounted HVAC equipment.
5. The Sensor mounting site should be at least 10 ft (3 m) away from any chimney or roof-mounted exhaust fan or vent.
6. The Sensor mounting site must be as far as possible from outdoor light fixtures. The Sensor should never be mounted so that an outdoor light fixture directly illuminates or shines on the Sensor.
7. The Sensor mounting site should be secure and free from casual human interference and intentional vandalism.
8. The Sensor should not be mounted within 10 ft (3 m) of a roof-mounted lightning air terminal or lightning rod.

NOTE | **The Sensor is self-powered and DOES NOT REQUIRE A GROUND CONNECTION. No electrical work is required to install the Strike Guard Sensor.**

MOUNTING THE LIGHTNING SENSOR – TYPICAL ROOFTOP EXAMPLE

The primary goals of Sensor mounting are:

- Security from tampering and vandalism
- Good exposure to the whole sky
- Rigidity and freedom from vibration – if the Sensor vibrates on its mounting it will NOT function properly.

Carefully route and gently pull the fiber-optic cable from the chosen Sensor site to the location of the Lightning Data Receiver. Before the tripod is mounted, it is recommended that fiber-optic cable is run from the roof to the Lightning Data Receiver since the cable comes in a precut length. Adjust as needed in the tripod location based on available cable length. Always handle the fiberoptic cable with great care. Do not step on the cable and use only light pulling forces. Keep all bend radii in the cable as large as possible and never smaller than 5 in (13 cm). Do not lay the cable on hot roof tar and do not lay the cable over sharp edges on a roof. Having excess cable at one or both ends is not a problem. Coil excess cable in a large circle and tie it loosely. Never use hard clamps or fasteners directly on the fiber - use a soft buffer to isolate the fiber from hard fasteners.

NOTE **If the fiber-optic cable is bent or kinked during installation, it is best to immediately replace it with good material rather than to compromise the system with a fiber that is attenuating or not passing adequate light. Do not attempt to splice broken or kinked fiber.**

Mount the tripod and secure the mast. The two-foot tripod supplied with this shipment is intended for mounting on a flat roof or it can straddle the peak of a pitched roof. The tripod needs to be mounted securely to resist wind forces and to prevent vibration of the Sensor. Spread the legs of the tripod and test fit the eighteen-inch-long mast supplied so that about six inches of mast protrudes above the top collar of the tripod. Now mount the tripod on the roof using the ¼- inch lag bolts and pitch pads supplied. The mounting mast should be vertical within a few degrees to ensure proper operation of the Sensor.

Use a ½-inch nut-driver to tighten the six collar bolts on the tripod (three on the top collar and three on the bottom collar) against the mast to secure it in the tripod and double check that the mast is approximately vertical and completely secure against vibration and loosening. After the mast is verified to be roughly vertical and after the six collar bolts are tightened, use a ½-inch open-end wrench or a small crescent wrench to tighten the six jam nuts against the top and bottom collars. After the feet of the tripod are secured, small adjustments to the collar bolts can be made to make the mast vertical. Make sure all hardware on the tripod is secure and snug.
Verify that the fiber-optic cable run is properly installed by sending self-test confidence data from the Sensor to the LDR. Note that the Sensor is automatically and immediately turned ON when it is put in the normal upright position with the glass diffuser dome facing upwards. When the Sensor is turned upside down, it is OFF. On power-up, the Sensor performs diagnostic tests and sends serial data status messages. Normally, the Sensor sends an arbitrary PASS self-test message about one second after power up. Approximately twelve seconds after power-up, the Sensor sends the results (PASS or FAIL) of the first self-test after power up. From then on, the Sensor will send a self-test message at intervals of about 1 hour.

Verify that the fiber-optic cable run is properly installed by sending self-test confidence data from the Sensor to the LDR. Note that the Sensor is automatically and immediately turned ON when it is put in the normal upright position with the glass diffuser dome facing upwards. When the Sensor is turned upside down, it is OFF. On power-up, the Sensor performs diagnostic tests and sends serial data status messages. Normally, the Sensor sends an arbitrary PASS self-test message about one second after power up. Approximately twelve seconds after power-up, the Sensor sends the results (PASS or FAIL) of the first self-test after power up. From then on, the Sensor will send a self-test message at intervals of about 1 hour.

If the fiber-optic cable run proves good, then fasten the Sensor to the mast using two mounting saddles and ¼-20 bolts and washers supplied. Fit each of the bolts with a flat washer. Mate the two saddle brackets with flat sides out so that they form a pipe clamp in the middle. Run the two stainless steel bolts through the saddle brackets and into the captive ¼-inch hardware on the side of the Sensor's outer enclosure. Do not yet attach the Sensor to the mast.

NOTE

Avoid over-tightening the bracket bolts.
To test the fiber-optic cable and connected equipment during installation, the Sensor may be triggered to send the power-up message. Since the Sensor's optical data transmissions are done in the red part of the optical spectrum, red light can be seen (even in daylight) coming out of the fiberoptic transmitter on the Sensor or the receiving end fiber-optic cable when installed. To trigger the power-up message, leave the Sensor in the off position (facing down) for ten seconds to ensure the Sensor is fully off before turning it on again (facing it upright). The red light will be visible immediately upon righting the Sensor.
It is helpful to have a second person available during this final test to avoid having to go up and down from the Sensor site (usually a rooftop) to verify that the Receiver and/or Strike View Software receive a self-test message.

When running Strike View Software on a computer it is important to test the complete system and fiber-optic cable installation before finalizing installation of the Sensor.

To test communication between Strike Guard Sensor and Strike View Software, ensure that:

- Strike View Software has been loaded and is running on a computer
- The fiber-optic Converter is properly mounted, and the fiber-optic cable is properly secured in the (black) receiver device on the fiber-optic Converter
- A status change is indicated on the Strike View main screen when the Sensor is powered-up.
- The Sensor is now communicating with the Receiver and Strike View Software

Securely mount the Sensor to the mast and tripod. With the two saddle brackets mounted loosely on the Sensor using the ¼-20 bolts and washers, hold the Sensor over the mast and open the saddle clamps so that it slips onto the mast. Position the Sensor to expose no more than about one inch of mast above the saddle brackets. Use a 7/16-inch nut driver to tighten the stainless-steel bolts so that they evenly squeeze the saddle clamps down on the mast. Torque the two nuts snugly and evenly but do not over-tighten the ¼-20 bolts. The stainless-steel saddle brackets deform when over-tightened.

PROBLEMS OR QUESTIONS

If you have problems or questions, do not hesitate to call Wxline or your distributor. Most problems can be quickly solved with a short phone consultation.

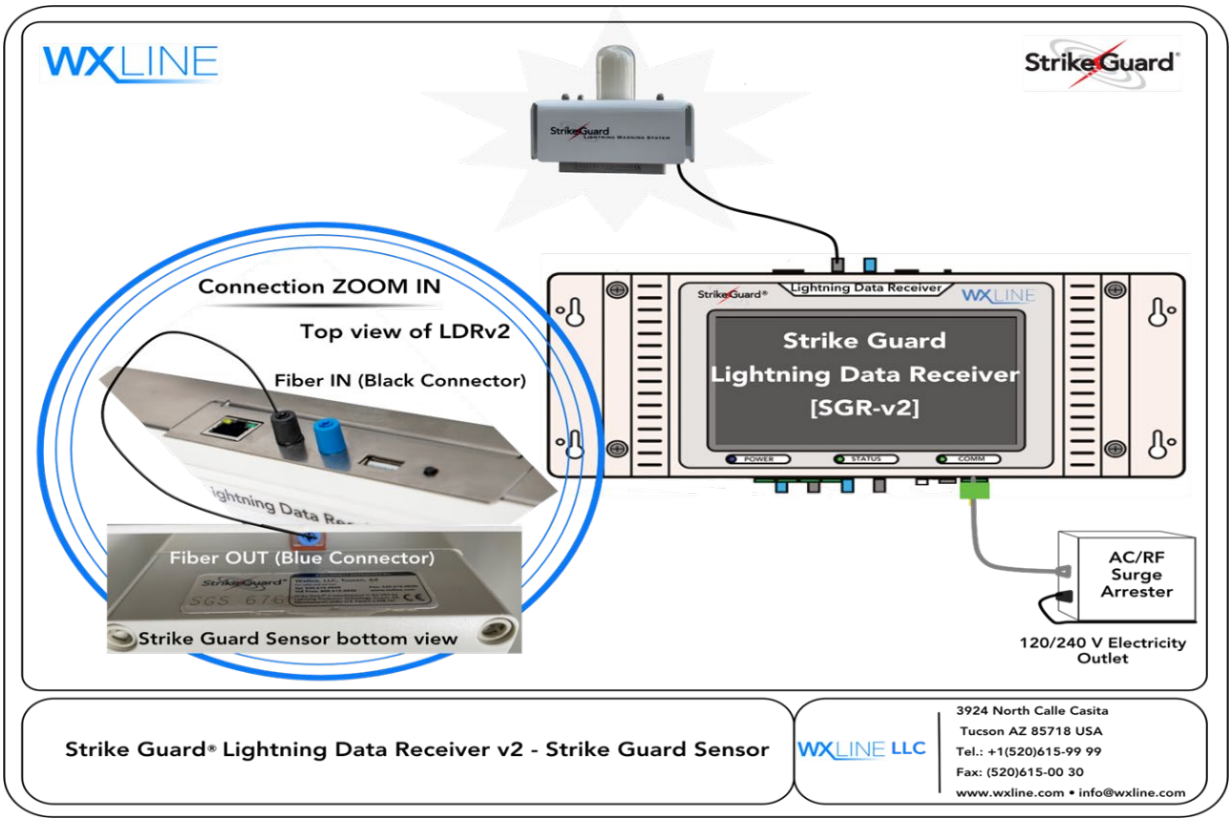


Figure 8: Strike Guard LDRv2 to Strike Guard Sensor fiber optic connection

CHAPTER 3

STRIKE GUARD LIGHTNING DATA RECEIVER STANDARD (LEGACY) VERSION

Figure 9: Strike Guard Lightning Data Receiver Standard Version

The standard (legacy) edition is designed for robust functionality with indicator lights displaying status. The settings for the standard LDR are typically done at the factory and require minimal user input.

Built-in battery backup provides auxiliary power for the standard LDR to ensure continued operation through typical power outages. This is achieved using four C-cell alkaline batteries for the legacy LDR. The batteries are recharged automatically when primary power is restored. Primary power is 90-240 VAC, or optionally from a solar panel.

LIGHTNING DATA RECEIVER POWER LED

The LED labeled POWER blinks blue when the LDR is running on commercial AC power. When there is a failure of commercial AC power or when the DC power supply used with the LDR fails or is disconnected, the LDR will instantly revert to running on internal batteries at which time the POWER LED will blink red.

LOW BATTERY INDICATION AND PROTECTION FEATURES

The 4 alkaline C-cells used for battery backup of the Lightning Data Receiver Standard edition will provide more than one hundred hours of hold up time. However, when the batteries are discharged below a safe operating level, all relay operations are inhibited, as are all contact closure signaling of other equipment such as a WAVE Transmitter. Critical circuit functions, relay states and proper relay operation cannot be assured at low battery voltage especially in a lightning environment with fluctuations of commercial AC power.

When the Receiver Battery Low LED blinks red on the front panel, the LDR may continue to function normally in some respects, but all relay operations will be inhibited. Proper operation of an LDR standard version in a lightning environment can only be assured with an adequate supply of back up battery power. Relay operation is inhibited when the LDR Battery Low LED blinks red even when there is normal AC power available.

To avoid operating the Lightning Data Receiver in low battery condition:

- ✓ Change the batteries on a regular basis - at least once every 2 years.
- ✓ Be careful to never touch the terminals of the batteries with fingers or hands, and double check the polarity of all the cells to ensure correct installation.
- ✓ Only install new fresh batteries.
- ✓ Only install batteries of the same manufacture - do not mix cells from different manufacturers or manufacturing dates.
- ✓ Pay close attention to the Power LED on the front panel of the Lightning Data Receiver. If this LED blinks red for an extended period, the batteries will be in a discharged state and maximum battery holdup time for the next extended power outage will not be available.

NOTE **Change the batteries after extended power outages to ensure maximum battery hold up time. After an extended power outage, make sure the Power LED on the front panel is blinking blue again indicating that AC power is restored. If this LED does not blink blue after AC power is restored, check to make sure the DC power supply connections are correct and check to make sure that the DC power supply is functioning properly.**

EXTERNAL AC POWER AND CHASSIS BONDING JUMPER

The source of external AC (90-240 VAC, 50-60 Hz) power should be a wall outlet near the LDR. If external equipment is controlled by contact-closure signaling and used in conjunction with the LDR, make sure that the LDR and any external equipment are powered from the same AC power outlet. Use an AC power "plug-strip" if necessary to ensure operation of the LDR and external equipment from the same AC power outlet.

NOTE **Because the LDR has internal battery-backup, it is not necessary to run it from an uninterruptible power supply.**

Only use the power supply provided with the LDR. Contact your distributor if the blue External Power LED on the front panel does not illuminate when the power supply is plugged into a functioning AC wall outlet and when the power supply output connector is plugged into the jack labeled POWER IN on the LDR front panel.

A short, heavy, wire-gauge jumper cable assembly is supplied with the LDR. This or a similar bonding cable must be used to connect the LDR with the WAVE transmitter chassis. Failure to install this jumper greatly increases the probability of damage to the equipment due to electrical overstress during a local thunderstorm.

NOTE **When installed in a WxEIB, there is no need for a bonding wire between the LDR and WAVE Transmitter chassis.**

POWER-UP BEHAVIOR

To conserve power and to give the best possible visual indications of status, the LDR "blinks" Light Emitting Diodes (LEDs) instead of illuminating them continuously. With AC power supplied on power-up, the Standard LDR will blink the blue External Power LED and the red No Communication LED - this is an indication that the Receiver is functioning normally.

One or more other red status LEDs may be flashing on power up. With the reception of the first PASS SELF TEST message from the Strike Guard Sensor, the No Communication LED will turn off along with any other status LEDs that were flashing on power up. If external AC power is not supplied on power-up, then the External Power LED blinks red along with No Communication LED. Other status LEDs may also blink.

NOTE **Sensor status indications are not valid immediately after powerup of the LDR.**

ABOUT JUMPER-SET OPTIONS

The Standard Strike Guard Lightning Data Receiver offers several shorting-jumper-set options to allow the user to select certain preferred features. These jumper-set options are preset at the factory to conservative values that are appropriate for many lightning warning settings.

Always turn the power switch OFF and remove the external power cord to the LDR before opening the LDR. For equipment and personal safety, turn the power switch OFF and remove the external power connector before:

- Changing batteries
- Changing jumper settings
- Connecting wires to the control connector

Damage or electronic upset may occur if equipment is serviced when powered. To prevent electrostatic discharge damage to components on the LDR printed circuit board, always hold the stainless-steel cover of the LDR in one hand while using the other hand to change jumpers, reducing the risk of electrostatic discharge between your hand and the circuit board.

JUMPER-SET OPTIONS FOR THE STANDARD LDR

1. W204, ALARM SOUND

These options set the type and volume of sound that is emitted by the LDR under ALARM conditions.

• • N (NONE)
• • C (CONTINUOUS)
• • 12 (INTERMITTENT 2)
• 11 (INTERMITTENT 1) (FACTORY SETTING)

2. W205, ALARM VOLUME

These options set the volume level of the sound that is emitted by the LDR under ALARM conditions.

• • L (LOUD)
• M (MUFFLED) (FACTORY SETTING)

Audible sounds produced by the LDR are loudest when the Receiver is running on external power. Alarm and flash beeper volume will be reduced slightly when the unit is running on battery power.

3. W203, ALARM CATEGORY THRESHOLD OPTIONS

These options set the range-estimate category of lightning that will be counted and used for putting the LDR into ALARM.

• • C (CAUTION) ANY LIGHTNING WITHIN 20 mi STARTS ALARM, ACTUATES MAIN RELAY, ETC.
• • W (WARNING) ANY LIGHTNING WITHIN 10 mi (ALARM OR WARNING) STARTS ALARM, ACTUATES MAIN RELAY, ETC.
• A (ALARM) ONLY LIGHTNING WITHIN 5 mi (ALARM) STARTS ALARM, ACTUATES MAIN RELAY, ETC. (FACTORY SETTING)

The blinking Caution LED is controlled by a timer that is re-triggered, i.e., extended in time, by the detection of any lightning within range of the Sensor. The nominal minimum Caution Time Interval is approximately 35 minutes. For example, if only one lightning message of the CAUTION category is received, then the front panel Caution LED will flash for approximately 35 minutes. The Caution Time Interval is fixed and is set to always be longer than the longest Alarm Time Interval setting of 30 minutes.

Lightning flashes in the Alarm category are most likely to have occurred within 5 miles of the Sensor. Lightning flashes in the Warning category are most likely to have occurred within 10 miles of the Sensor. Lightning flashes in the Caution category are most likely to have occurred within 20 miles of the Sensor.

Setting the Alarm Category Threshold to Caution ensures the greatest number of lightning alarms, maximum downtime, and the greatest margin of safety. Setting this option to Warning typically gives a medium level of downtime and moderate level of safety. Setting this option to Alarm typically gives the least number of lightning alarms, minimal downtime, and the lowest level of lightning safety.

4. W201, MINIMUM NOMINAL ALARM TIME INTERVAL OPTION

This option sets the interval in the Alarm Timer. The Interval is the minimum time required for an active Alarm to expire. The expiration of the Alarm Timer is relative to the last lightning detected in the Alarm Category. The Alarm Timer is reinitialized or reset by each successive event in the selected Alarm Category.

• • 10 minutes	NOT RECOMMENDED FOR HUMAN SAFETY
• • 15 minutes	NOT RECOMMENDED FOR HUMAN SAFETY
•⌒• 30 minutes	(FACTORY SETTING)

NOTE *All LDR time intervals such as the Caution Time Interval and the Alarm Time Interval are the nominal value +/- 10%.*

Setting this option to 10 minutes gives the least margin of safety and setting it to 30 minutes gives the greatest margin of safety.

5. W200, FLASH COUNTS TO ALARM

This setting provides the ability to automatically hold off issuing audible, visual and contact-closure signaling of external equipment until a certain number (one, two, four or eight) flashes occur in the selected Alarm Category.

• • 8	} NOT RECOMMENDED FOR HUMAN SAFETY
• • 4	
• • 2	
•⌒•1	(FACTORY SETTING)

Setting this jumper to a count higher than one will typically delay the announcement of hazardous conditions and will reduce the time that people must secure activities and seek safe shelter. The Flash Counts to Alarm setting is active and running as soon as any lightning occurs. The Flash Counts to Alarm counter is reset at the end of every active Alarm Interval and at the end of every active Caution Interval. For example, if the Alarm Time Interval is set to 10 minutes, and the Flash Counts to Alarm option is set to 4, then at the end of the 10-minute active Alarm Interval, four more flashes in the Alarm Category Threshold are required to start another active Alarm Interval.

Setting this option to one gives the greatest margin of safety and setting this option to eight gives the least margin of safety.

6. W202, AUX RELAY FUNCTION SELECT

The Auxiliary Relay allows for additional relay signaling or external device triggering based on system failure or lightning conditions.

- • F (FAIL) This setting actuates the auxiliary relay on Sensor Battery Low or Sensor Test Fail, or No Communication conditions. The relay will not return to a normal state until all Sensor-related failure conditions have cleared. Note that FAIL selection will actuate on LDR power up (because No Communication is received from the Sensor) and will be reset with the first PASS SELF TEST message or other valid message from the Lightning Sensor.
- • C (CAUTION) This setting actuates the auxiliary relay on detection of any lightning for the duration of the re-triggerable Caution Time Interval.
- A (ALARM) Actuates on selection in W203. Setting this jumper to A or ALARM duplicates the main relay function in the auxiliary relay with the same time interval as the main relay. (FACTORY SETTING).

CONNECTIONS TO THE CONTROL CONNECTOR

CONTROL CONNECTOR FOR CONTACT-CLOSURE SIGNALING OF EXTERNAL EQUIPMENT

J202 control connector contact assignments as viewed from the component side of the printed circuit board with typical QPS and WAVE Siren System wiring:

QPS & WAVE SYSTEM WIRING DIAGRAM

RELAY	MAIN RELAY K200			AUX RELAY K201		
CONTACT	1	2	3	4	5	6
FUNCTION	NC	NO	C	NC	NO	C
WAVE SIREN	Orange & White	Green & White	Orange			
QPS SIREN	Green	Red	Black			

NC = NORMALLY CLOSED / NO = NORMALLY OPEN / C = COMMON CONTACT

NOTE **To prevent damage from local electrical disturbances typically associated with a thunderstorm, bond the WAVE Transmitter, QPS Transmitter, or other connected equipment to the LDR. A bond wire should connect the LDR's chassis with the metal chassis (or ground) of the connected equipment. This bond wire should be short and straight.**

SOME NOTES ON OPERATION

A Sensor Battery Low message will cause the Sensor Battery Low LED to turn on. It will also cause the Sensor Self-Test Fail LED to turn on because the Sensor Battery Low condition inhibits the Sensor self-test and hence is a Self-Test Failure.

A Sensor Self-Test Fail message will cause only the Sensor Self-Test Fail LED to turn on. Selection of Fail for the AUX RELAY means that No Communication, Battery Low or Self-Test Fail conditions will cause relay actuation until all failure conditions are cleared. These features allow enhanced failure indication by the AUX RELAY.

For example, if No Communication is the only failure condition, the AUX RELAY will be actuated by the occurrence of the No Communication condition and will be cleared by the first valid message from the Sensor provided it is neither a Self-Test Fail nor a
Sensor Battery Low message.

CHANGING BATTERIES FOR THE STANDARD LDR

The LDR provides long-term, primary 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 LDR uses common alkaline C-cell batteries just like those used in consumer products like flashlights and portable radios. Alkaline C-cells are available at most drug, grocery, and hardware stores.

Batteries should be changed soon after the LDR shows the Battery Low condition on the front panel or every 2 years whichever comes first. Do not confuse the Sensor Battery Low indication with the Receiver Battery Low indication. For the longest battery life and best performance, always buy and use new, fresh alkaline C-cells from the same package. Do not mix old cells with fresh cells. Never touch the contacts of batteries that are being installed. Properly recycle old batteries. Use only standard (non-rechargeable) low-cost alkaline C-cell batteries available at any drug or hardware store.

NOTE

Do not use Lithium C-cells. Do not use Nickel-Cadmium (NiCad) C-cells. Rechargeable alkaline C-cells are acceptable for use but may offer less Amp-hour capacity, i.e. less back-up time than alkaline primary cells.

All relay actuation is prevented after the Battery Low condition is detected and indicated. The LDR will continue to give normal audible and visual indications after Battery Low is indicated but all contact closure signaling will cease – thus WAVE Siren functions will not occur.

For proper safe operation of the Strike Guard Lightning Warning System, it is essential to have a functioning battery back-up system available. The LDR relays cannot be controlled reliably in thunderstorm conditions without good batteries.

Failure to change the LDR batteries every 2 – 3 years increases the chances of battery leakage, which can severely damage the main computer board of the LDR.

Turn the LDR power switch OFF and remove the external power supply connector before changing batteries.
Because the LDR uses premium-quality battery holders, the batteries are held tightly in place. Do not use sharp metal tools to pry batteries out of the holders. Make sure that the battery polarity is correct on every battery before installation. All + terminals are oriented towards the same end of the LDR, and the battery polarity is indicated in the molding on the battery holders as well as in the white silk screen legend on the printed circuit board artwork.

When each battery is properly oriented, push each battery into place until it seats.

If an LDR is stored for more than 2 years, install fresh batteries before use. With fresh batteries, the expected battery life is approximately 3 years of no battery run time or about 150 hours of battery operation time, whichever comes first.

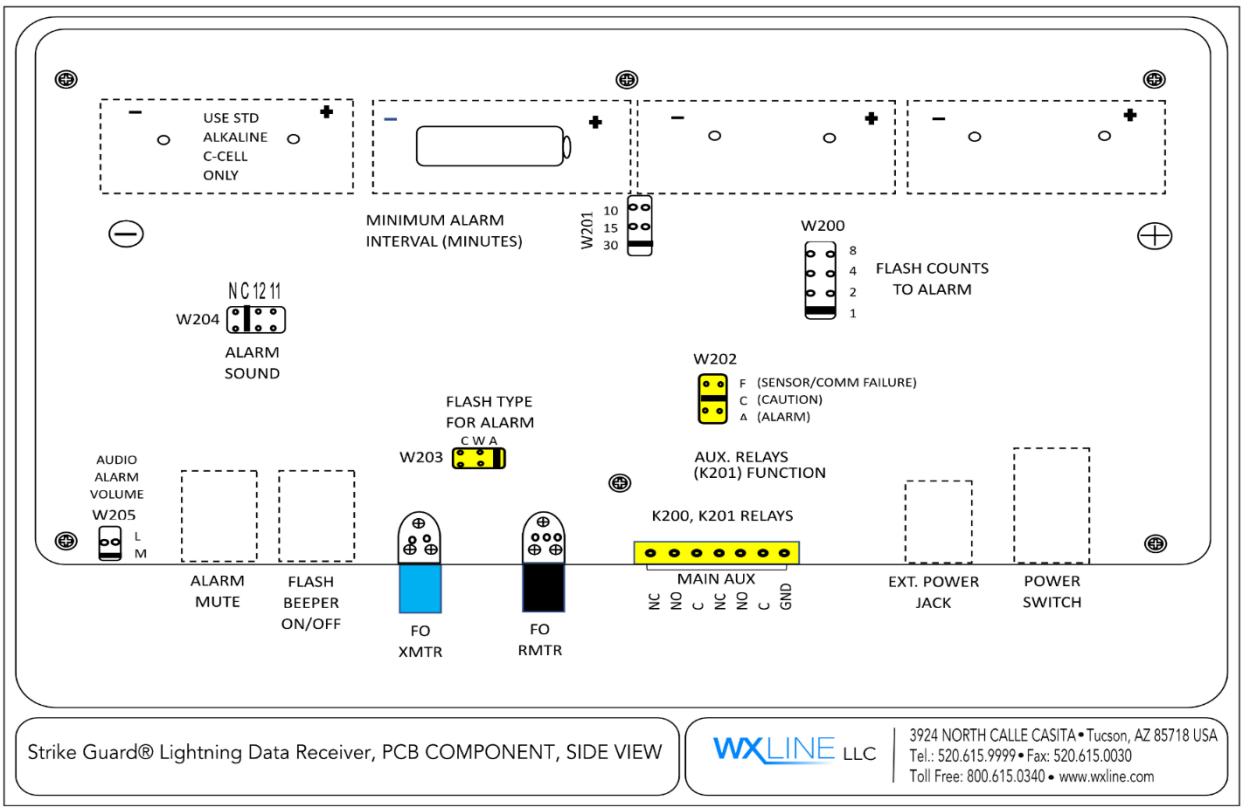


Figure 10: Lightning Data Receiver PCB Component

CHAPTER 4

LIGHTNING DATA RECEIVER v2

The next generation Strike Guard Lightning Data Receiver (LDR-v2) displays detailed real-time lightning information. Expanded programmable relay and fiber-optic outputs allow messaging from Strike Guard Lightning Data Receiver to WAVE and other systems. The LDR-v2 touchscreen display simplifies system programming and displays detailed lightning information with countdown timer from last lightning detected. Independent front-panel LED lights provide power, system, and communication status indications.

Built-in battery backup provides auxiliary power for the LDR to ensure continued operation through typical power outages. This is achieved using a pair of lead-acid batteries for the LDR-v2. The batteries are recharged automatically when primary power is restored. Primary power is 90-240 VAC, or optionally from a solar panel.

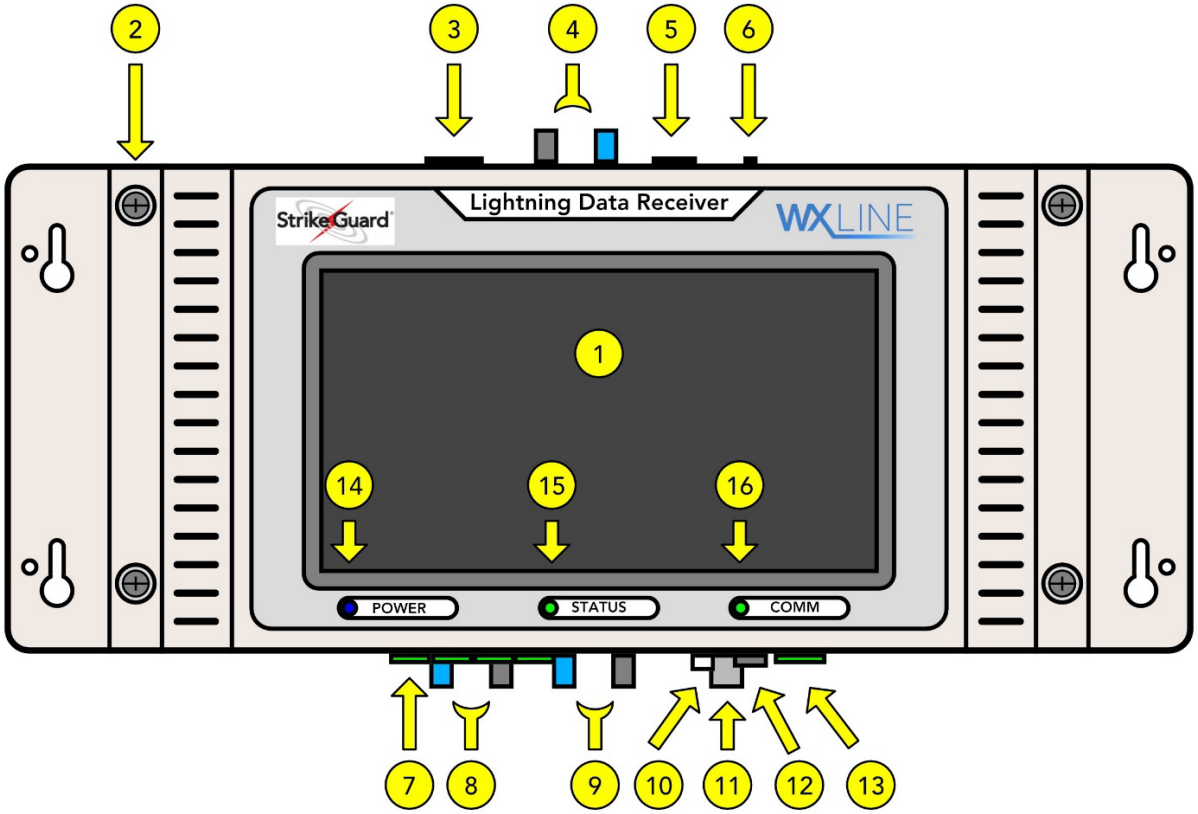
NOTE

Change the batteries after extended power outages to ensure maximum battery hold up time. After an extended power outage, make sure the Power LED on the front panel is blinking blue again indicating that AC power is restored. If this LED does not blink blue after AC power is restored, check to make sure the DC power supply connections are correct and check to make sure that the DC power supply is functioning properly.

Do not store the LDR-v2 with the lead acid batteries installed. If an LDR is stored for more than 2 years, install fresh batteries before use. With fresh batteries, expected battery life is approximately 3 years of no battery run time or about 150 hours of battery operation time, whichever comes first.

STRIKE GUARD LIGHTNING DATA RECEIVER AT A GLANCE

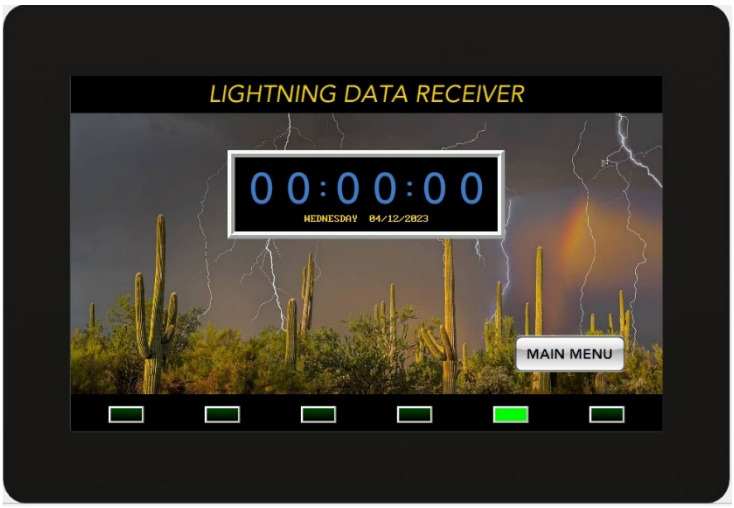
Figure 11: LDR-v2



1. LCD Capacitive Touch Screen Control Panel
2. Lightning Data Receiver 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 = Data Receiver disabled)
16. Comm LED (GREEN = normal operation, BLUE = transmitting)

LIGHTNING DATA RECEIVER FEATURES v2

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 LDR 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 LDR status, configuration, and user menus. Configuration via user menus is described in detail in Chapter 5, Operating the Lightning Data Receiver.

POWER BUTTON

The white POWER Button provides a means of powering the LDR 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 LDR cover:

- Status
- Power
- Comm

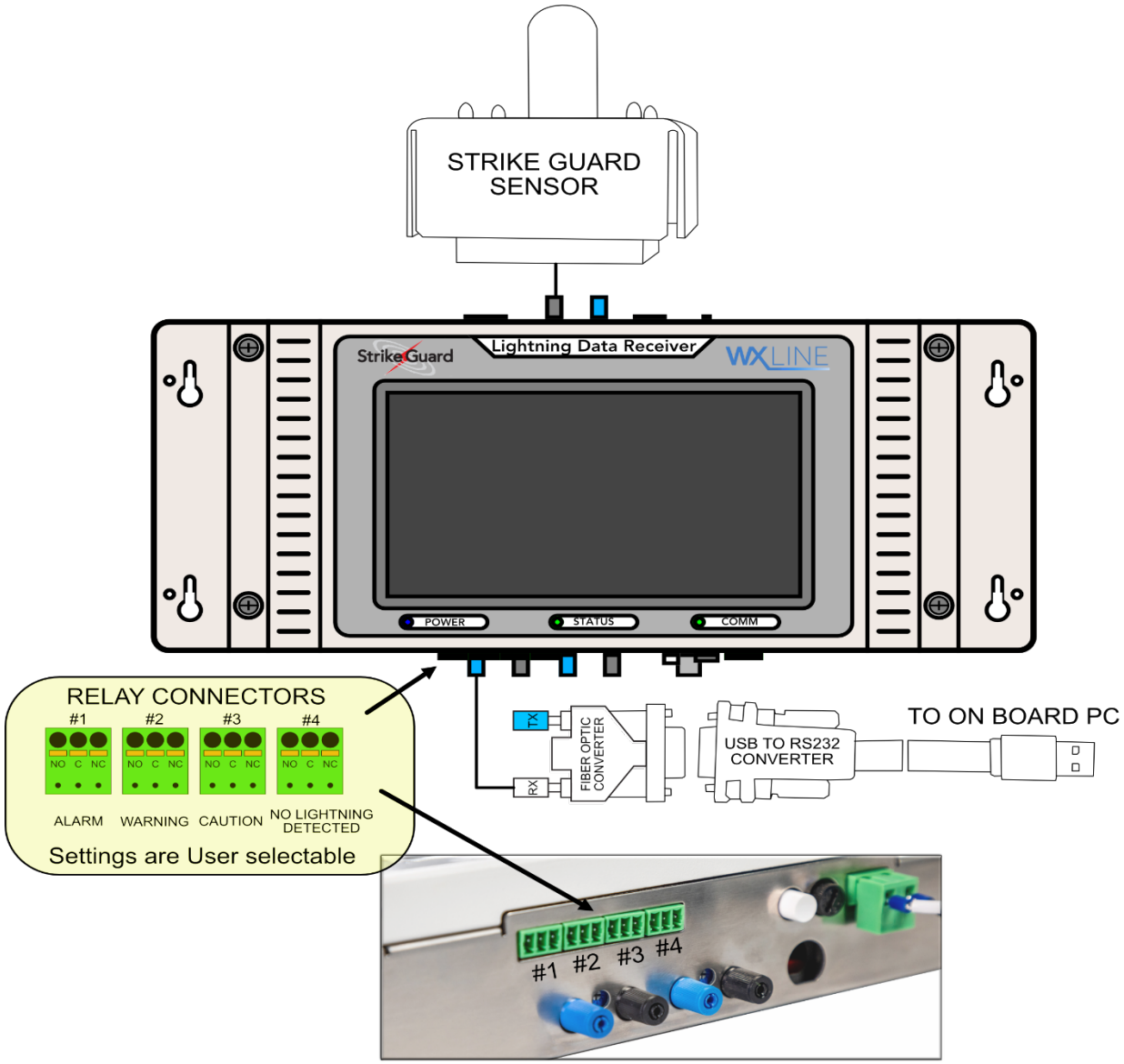
The Status LED illuminates green during normal operation and illuminates red when the transmitter is disabled. (Figure 1)

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 red when communication with the sensor is lost.

STRIKE GUARD LDRv2 EXTERNAL RELAY CONNECTIONS



RELAY	Relay 1 Alarm			Relay 2 Warning			Relay 3 Caution			Relay 4 No Alarm Detected		
CONTACT	1	2	3	1	2	3	1	2	3	1	2	3
FUNCTION	NO	C	NC	NO	C	NC	NO	C	NC	NO	C	NC

NO = Normally open, C = Common NC, = Normally Closed

The relays are typically factory set as per the table above but can be programmed differently according to requirements. Load on relays should not exceed 1 Amp or 30 Volts DC.

CHAPTER 5

OPERATING THE LIGHTNING DATA RECEIVER v2

The LDR receives serial data transmissions from the Strike Guard Lightning Sensor and decodes the lightning and status messages.

MENU OPTIONS AND NAVIGATION

Access to the LDR 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.

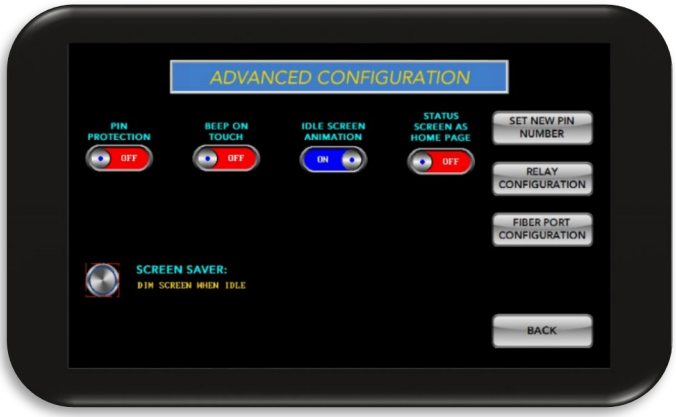
The Lightning Data Receiver main menu page is the access point to all the available features:

LDR CONFIGURATION

- Press "SYSTEM CONFIGURATION" from the Main Menu.
- Press "LDR CONFIGURATION" from the System Configuration Menu.
- Press "ALERT TIME OUT" from the LDR Configuration Page to change the desired amount of time that the LDR remains in an alert state after detecting lightning. The timer choices range from 2 – 120 minutes, with 30 minutes being the default and recommended selection.

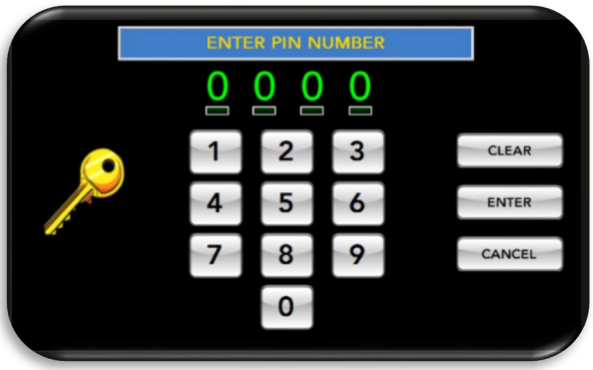
- Press "ALARM ACTIVATION" from the LDR Configuration Page to change the lightning strike distance that will activate an alarm state. The alarm can be set to activate when lightning is detected within 5 miles (8km), 10 miles (16km), or 20 miles (32 km).
- Press "LDR ALERT TONE" to choose which tone is produced by the LDR during an Alarm state.
- Toggle "BEEP ON STRIKE" to enable or disable audible alerts when a lightning strike is detected.

ADVANCED CONFIGURATION:



- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Toggle the "PIN PROTECTION" to enable or disable the pin protection for the interface requiring the input of a pin number to access the LDR menus.
- Toggle "BEEP ON TOUCH" to enable or disable the audible tone when touching a button on the touch screen.
- Toggle "IDLE SCREEN ANIMATION" to enable or disable the scanning animation on the bottom of the home screen.
- Toggle "STATUS SCREEN AS HOMEPAGE" to enable or disable the use of the status page as the home page when the LDR is idle.
- Press "SCREEN SAVER" to select the touch screen behavior when the LDR is idle. "Screen Saver Off" will maintain full touch screen brightness. "Dim Screen When Idle" will reduce screen brightness to approximately 25% when the LDR is idle. "Screen Off When Idle" will turn off the touch Screen when the LDR is idle and will return to normal brightness when the screen is touched.
- Press "SET NEW PIN NUMBER" to change the pin number if Pin Protection is enabled.
- Press "RELAY CONFIGURATION" to access the Relay Configuration pages.
- Press "FIBER PORT CONFIGURATION to access the Fiber Port Configuration page.
- Note: The capacitive touch screen has a design life of 50,000 hours before reaching a state of half of the original brightness. Dimming the screen when idle, or shutting off the screen when idle will greatly improve screen life and prevent image burn in.

SETTING A NEW PIN NUMBER:



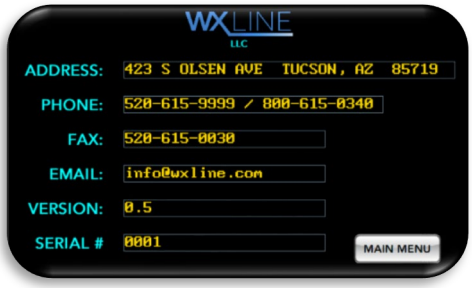
- Press the "SYSTEM CONFIGURATION" button from the main menu page.
- Press the "ADVANCED CONFIGURATION" button from the System Configuration Menu page.
- Press the "SET NEW PIN NUMBER" button from the Advanced Configuration Page.
- Enter a new 4-digit pin number on the keypad.
- Press "ENTER" to set the new pin number and return to the Advanced Configuration Page. Press "CLEAR" to clear the keypad entry and re-enter the new pin. Press "CANCEL" to stop the input of a new pin number and return to the Advanced Configuration Menu.

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

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.

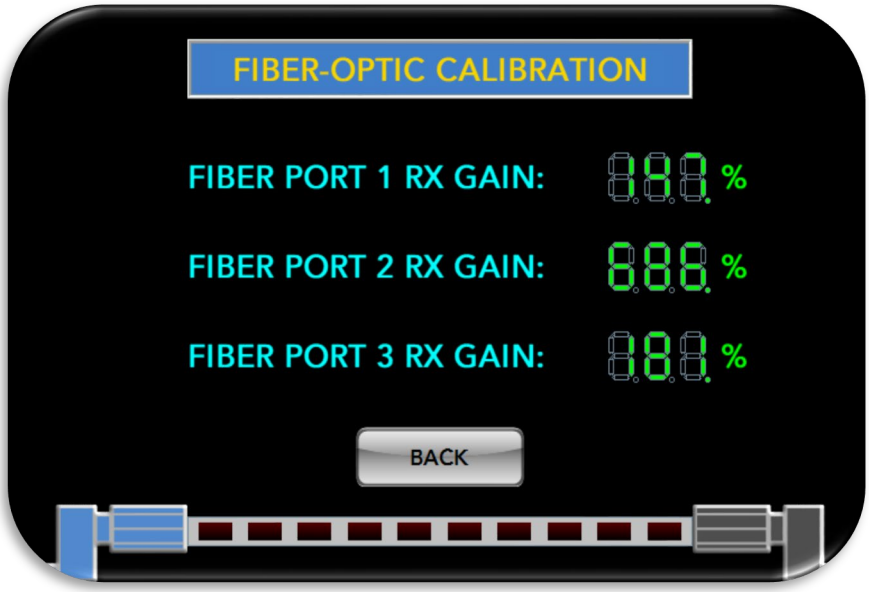
NOTE | *The clock displays the hours in military format. Each day begins at 00:00:00 and ends at 23:59:59.*



CONTACT US:

Press "CONTACT US" from the Main Menu. Wxline contact information, serial number, and firmware version is displayed. Press "BACK" to return to the Main Menu.

FIBER PORT CONFIGURATION:



- Press "SYSTEM CONFIGURA-TION" from the Main Menu.
- Press "ADVANCED CONFIGURA-TION" from the System Configuration Menu.
- Press "FIBER PORT CONFIGURA-TION" from the Advanced Configuration Menu.
- Press the "FIBER PORT X" buttons to configure the fiber-optic port.

  "Off" - disables the port.
- "Sensor In / FOSM Alarm Out" – Strike Guard sensor data in, outputs signal to optional Fiber-Optic Strobe Module during an alarm condition.
- "Sensor In / FOSM Warning Out" – Strike Guard sensor data in, outputs signal to optional Fiber-Optic Strobe Module during a warning condition.
- "Sensor In / FOSM Caution Out" – Strike Guard sensor data in, outputs signal to optional Fiber-Optic Strobe Module during a caution condition.
- "Sensor In / Strike View Out" – Strike Guard sensor data in, output sensor data to PC running Strike View software.
- "Repeater / SG simulator" – repeats any fiber data, outputs Strike Guard Sensor simulation codes.
- "WAVE Interface Link" – duplex fiber-optic communication with the WAVE interface.
- Press "FIBER-OPTIC STROBE MODULE" to select the desired behavior of the optional Fiber-Optic Strobe Module (FOSM).
- "Off" disables any signal to the FOSM.
- "Always On 24/7" will allow operation of the FOSM during the configured alert condition.
- "On With Strobe Schedule" will allow operation of the FOSM during the configured alert state only if the Strobes are within hours of operation.
- Press "FIBER PORT CALIBRATION" to calibrate the gain on the fiber-optic ports.

RELAY CONFIGURATION:

- Press "SYSTEM CONFIGURATION" from the Main Menu.
- Press "ADVANCED CONFIGURATION" from the System Configuration Menu.
- Press "RELAY CONFIGURATION" from the Advanced Configuration Menu.
- Press "CONFIGURE" from the Relay Configuration Summary page.
- Press the "SELECT" buttons to choose which relay to configure.
- Press the "ADJUST" buttons to choose the relay activation event.
- Press "SET RELAYS" to set the relay activation events and return to the Relay Configuration Summary page.
- Press "CONFIRM" to return to the Advanced Configuration Menu.

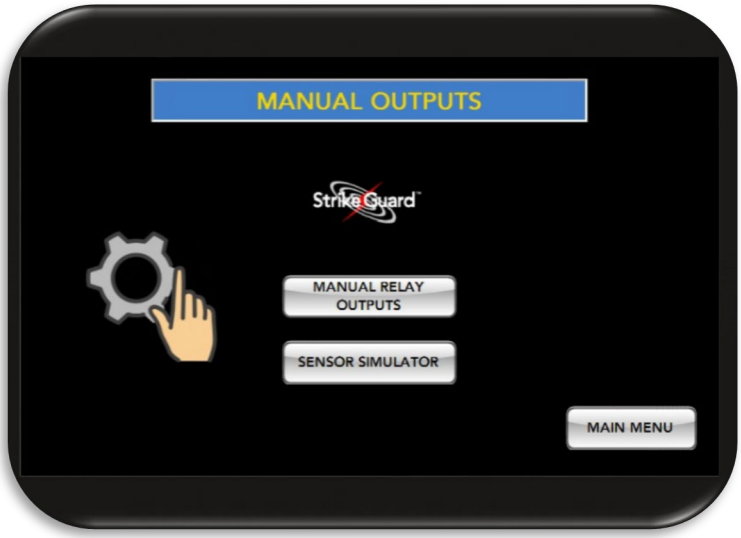
FIBER PORT CONFIGURATION:

- 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 if off and is used if connected to a Lightning Data Receiver via a RJ45 communication cable.
- Press the "BACK" button to return to the advanced configuration menu.

MANUAL RELAY OUTPUTS



- Press "MANUAL OUPUTS" from the Main Menu.
- Press "MANUAL RELAY OUTPUTS" from the Manual Outputs menu.
- Press the "RELAY X" buttons to close or open the selected relay. A green indicator light will illuminate when the selected relay is activated.
- Press "RELAYS OFF" to deactivate all relays.
- Press "BACK" to return to the Manual Outputs menu.

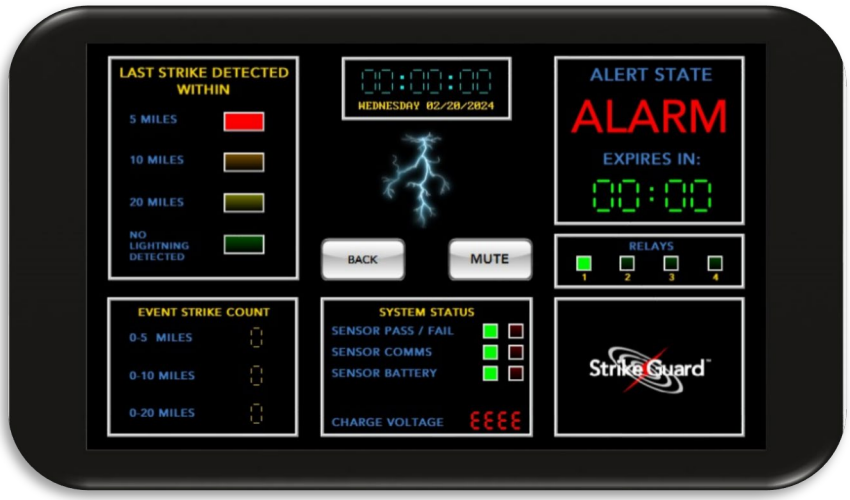
Please see page 24 for external relay connection details.

STRIKE GUARD SENSOR SIMULATOR:

- Press "MANUAL OUTPUTS" from the Main Menu.
- Press "SENSOR SIMULATOR" from the Manual Outputs menu.
- Press the desired Sensor Code button to send a simulated fiber-optic sensor code.
- Press "BACK" to return to the Manual Outputs Menu.

SYSTEM STATUS:

- Press "SYSTEM STATUS" from the Main Menu.
- Press "BACK" to return to the Main Menu.
- Press "MUTE" to mute the audible alarm condition tone.



- The "Last Strike Detected" indicator lights will blink according to the distance of the last lightning strike detected by the Strike Guard lightning sensor.

- The "Event Strike Count" box counts the number of lightning strikes detected based on distance during a lightning event, starting from first strike detected to no lightning detected.

- The "System Status" box displays the status of the Strike Guard lightning sensor as well as the charging / battery voltage of the LDR.

- The "Alert State" box displays the current alert condition of the LDR as well as the expiration time of the current alert condition.

- The "Relays" indicator lights will illuminate when the coordinating relay has been activated.

- A lightning animation will be observed when the LDR is in an active lightning alert condition.

SYSTEM LOG:

- Press "LOGS" from the Main Menu.
- Press "COMMUNICATION LOG" to view the last 15 messages received from the Strike Guard Sensor or the WAVE Interface.
- Press "STRIKE HISTORY" to view detected lightning strike history.
- Press "ALARM LOG" to view the entry and exit of the last alarm condition, the last lightning strike detected, and the last system start up time.
- Press "BACK" to return to the Logs menu.

MAIN ALERT PAGE:

- Press "STATUS PAGE" to view the system status, including detected lightning information.
- Press "MUTE" to mute the audible alarm alert tone.
- An alert count down timer displays when the current alert state will expire.

CHAPTER 6

ACHIEVING TOP PERFORMANCE AND LONGEST LIFE FROM THE STRIKE GUARD LIGHTNING WARNING SYSTEM

There are no user-serviceable parts inside the Strike Guard Sensor, and we do not recommend breaking the seal of the Sensor for any reason as in doing so, there is increased likelihood that the seal will not be re-made properly. Loss of good seal in the Sensor usually results in rapid and complete failure of the Sensor due to excessive water ingestion.

ANNUAL INSPECTION AND CLEANING

Every year, or more often in severe environments, the Sensor enclosure and diffuser should be cleaned with a soft cloth, water, and a light detergent. Do not clean the Sensor by spraying water on it. Thoroughly remove any soap or detergent film from the diffuser and enclosure with clean water. Do not allow liquid water to contact the fiber-optic transmitter or the enclosure seal.

In some locales, the diffuser and enclosure stay clean and are washed by rainfall but in other places, the enclosure and diffuser can build up a film of dirt, salt, and organic matter that obscures good viewing through the diffuser. In cleaning, do not use any type of abrasive material and do not use organic solvents such as alcohol as they may affect and degrade the diffuser and the diffuser seal.

Inspect the exposed length of fiber-optic cable for kinks, bends and crushing damage. Replace the entire length of the cable with new material if any damage is found. Check the security and rigidity of the tripod mount and check the tightness of all the hardware used to mount the Sensor. The Sensor mount must be rigid and free from vibration in the wind. Inspect the tripod and mounting hardware for excessive corrosion damage and replace damaged hardware.

Check the seals of any roof or wall penetrations by the fiber-optic cable and remake these seals if any degradation is noticed.

PERIODIC MAINTENANCE

RE-CLEAVE FIBER-OPTIC CABLE

Remove the fiber-optic cable at both ends and re-cleave each end using a 1mm plastic fiber-optic cleaving tool (available from Wxline) or use a hand-held (new) single edge razor blade.

REPLACING BATTERIES IN THE LIGHTNING DATA RECEIVER (legacy LDR)

Replace the alkaline C-cells in the Lightning Data Receiver every 2 to 3 years even if the Low Battery indication is not showing to prevent battery leakage from damaging the circuit board. Replace the alkaline C-cells only with the same type and carefully check to ensure that battery polarity is correct on all cells. Never allow fingers to touch the battery contacts or the battery holder contacts.

REPLACING BATTERIES IN THE LIGHTNING DATA RECEIVER v2

Replace the two 6v lead-acid batteries in the Lightning Data Receiver Standard edition every 1 to 2 years even if the Low Battery indication is not showing to prevent battery leakage from damaging the circuit board. Replace the lead-acid batteries only with the same type and carefully check to ensure that battery polarity is correct on all cells. Never allow fingers to touch the battery contacts or the battery holder contacts.

FACTORY RECALIBRATION, REFURBISHMENT, AND UPGRADE

The Sensor suffers degradation from the weather and environment (heat, humidity, salt spray, etc.) and should be serviced by the factory on a regular basis. Although battery failure on the Sensor may not occur for over 5 years, 5 years is generally too long to wait for dealing with other aspects of Sensor wear and reliability, especially for those located in harsh environments.

NOTE **Because the Lightning Data Receiver is mounted in an office environment, it generally does not need periodic maintenance as frequently as the Sensor.**

Every 3 to 4 years, the Sensor should be returned to the factory for complete factory recertification involving recalibration, refurbishment, and installation of any upgrades. Critical measurement and safety equipment such as the Strike Guard Lightning Warning System must be periodically serviced and certified to ensure proper operation.

Procedures included in the factory recertification of the Sensor are the following:

- Thorough cleaning of the enclosure, inspection for corrosion damage, replacement of worn or corroded parts
- Inspection of the optical diffuser and diffuser seal and replacement of the diffuser and diffuser seal
- Inspection of the fiber-optic transmitter and replacement of fiber-optic transmitter and gasket assembly
- Replacement of the lithium primary batteries, retesting of all electronic functions, installation of the latest version of software
- Replacement of desiccant

Procedures included in the factory recertification of the Lightning Data Receiver are the following:

- Cleaning of the enclosure and circuit board
- Retesting of all electronic functions including relay function and repair of any malfunctions
- Installation of the latest upgrades and software version
- Cleaning of battery holder contacts and replacement of batteries

CHAPTER 7

LIGHTNING WARNING SYSTEM QUICK REFERENCE INSTALLATION GUIDE AND CHECKLIST

This document is a supplement to more comprehensive Strike Guard User's Guides. Please refer to the applicable Strike Guard documents for detailed information and instructions.

NOTE **Perform Step 1 through Step 8 in an indoor environment to ensure the proper function of all system components before proceeding with the permanent installation.**

☑ **Check boxes after completing steps.**

☐ STEP 1 Unpack all Strike Guard components and lay them out in a suitable area. Compare the components received against the items listed on the Wxline, LLC Quality Control Check / Warranty Registration form. Immediately notify Wxline of any discrepancies in items ordered and items received. Complete the appropriate fields on the form and fax it to Wxline (Fax: 520-615-0030).

☐ STEP 2 Remove the front cover from the LDR by taking off the four brass thumbscrews. Handle the cover carefully and place it face down (board up) upon a soft surface. In the designated office environment, level and affix the back plate of the LDR against a wall with the serial number label facing upwards. Locate the LDR as close to equipment to be controlled as possible to minimize the length of control and bond wiring.

☐ STEP 3 Assemble the power supply for the LDR. Connect the output connector of the power supply to the power input connector (J200) of the LDR. Ensure that the LDR is powered from the same AC power source as the equipment that the LDR will control. Plug the power supply into a surge protected power strip.

NOTE *The plastic fiber-optic cable must be handled with care to prevent kinking or bending. Kinks and sharp bends in the fiber may prevent the system from working. Replace fiber-optic cable that is kinked or sharply bent. Use light pulling forces on the fiber and keep bend radii as large as possible. Do not step on the fiber and do not lay the fiber directly on a hot roof surface. Non-metallic electrical conduit is recommended for fiber protection.*

☐ STEP 4 Loosen the ferrule on the black fiber-optic device labeled FIBER IN and insert one end of the fiber-optic cable. Make sure that the fiber-optic cable fully seats in the ferrule and use only light finger force to tighten and do not over-tighten the ferrule.

NOTE *Consult Section 5 of this User's Guide to change the factory alarm and relay-contro settings for the LDR. The factory settings are consistent with widely accepted modern lightning safety guidelines.*

☐ STEP 5 Affix the front cover of the LDR against the back plate using the brass thumbscrews.

NOTE | **All toggle switches on the LDR throw from left to right.**

 STEP 6 Turn the LDR ON using the toggle switch labeled Power. The blue LED indicating External Power and the red LED indicating No Communication should blink. Other status LEDs on the LDR may also blink on initial power-up.

 STEP 7 Loosen the ferrule and insert the other end of the fiber-optic cable into the blue fiber-optic device on the Sensor. Hold the Sensor in the upside-down position (glass diffuser pointing down) for ten seconds to turn the Sensor OFF.

 STEP 8 Now bring the Sensor to the upright position (glass diffuser pointing up) to turn the Sensor ON. When the Sensor is turned ON, it will immediately send a confidence message and about ten seconds later, it will perform a self-test and send a self-test message. Upon receiving a valid message from the Sensor, the LED labeled NO COMMUNICATION should quit blinking indicating that the entire communication link is working.

 STEP 9 Select a proper mounting place for the Sensor at which the Sensor has a relatively unobstructed view of the sky. Minimize background noise by not mounting the Sensor near transmitting antennas, electric motors and outdoor light fixtures. Ensure that the location selected is well within the length of fiber-optic cable supplied or available (100 meter maximum). The tripod and mast supplied are best suited for typical rooftop installations. Mount the tripod on a stable surface. Use the 6 lag bolts and pitch pads supplied to secure the feet of the tripod to the roof. Use the 6 pinch bolts and lock nuts on the tripod to hold the mast tight and vertical to within a few degrees.

 STEP 10 Run the fiber-optic cable from the tripod to the LDR. See the note on handling fiber-optic cable under Step 3 of this Section. A 30-meter link (97.5 feet) is supplied with a standard Strike Guard system. Protective plastic caps are installed on fiber-optic cable that is prepared and shipped by Wxline. Remove plastic caps from the ends of the cable only after pulling and running fiber to protect the ends of the fiber from degradation.

 STEP 11 To perform a test of the complete fiber-optic communication link, Sensor and LDR, turn the LDR off and go to the next step.

 STEP 12 Turn the LDR ON and verify the blue power LED and the No Communication LED blinking. While holding the Sensor upside down, loosen the ferrule on the blue fiber-optic device on the Sensor and fully insert the end of the fiber-optic cable on the roof. Continue to hold the Sensor upside down to keep the Sensor off. Using light finger force, tighten the ferrule and secure the fiber-optic cable in the Sensor. Now turn the Sensor to the upright position. Check to see that the red LED indicating No Communication on the LDR is not blinking. If the link is good and all equipment is working normally, only the blinking blue Power LED will be visible. This is the normal operating condition and indication.

To repeat this test at any time, reset the LDR by turning it OFF and then ON again. Turn the Sensor upside down for ten seconds to turn it OFF. Turn the Sensor upright and hold it upright for at least 10 seconds to allow confidence and self-test messages to be sent to the LDR.

NOTE | **Sensor status indications are not valid immediately after powerup of the LDR.**

 STEP 13 Fasten the Sensor to the mast using the two saddle brackets, ¼-20 bolts, and flat washers. Uniformly tighten the two mounting bolts using a 7/16-inch nut-driver (preferred) or a short hex wrench.

Use of mounting hardware not supplied by the factory may damage the Sensor enclosure. Over-tightening the ¼-20 mounting bolts may deform the saddle brackets.

 STEP 14 Guide the fiber-optic cable along one of the legs of the tripod making sure that there is no tension on the last section of fiber as it enters the Sensor. Gently fasten the fiber to the tripod using UV-resistant nylon cable-ties. Check both ends of the fiber-optic cable to make sure that fiber is fully seated and that ferrules are tightened. Check all Sensor and tripod mounting hardware to make sure it is snug.

Now the Strike Guard Lightning Warning System is installed and operating.

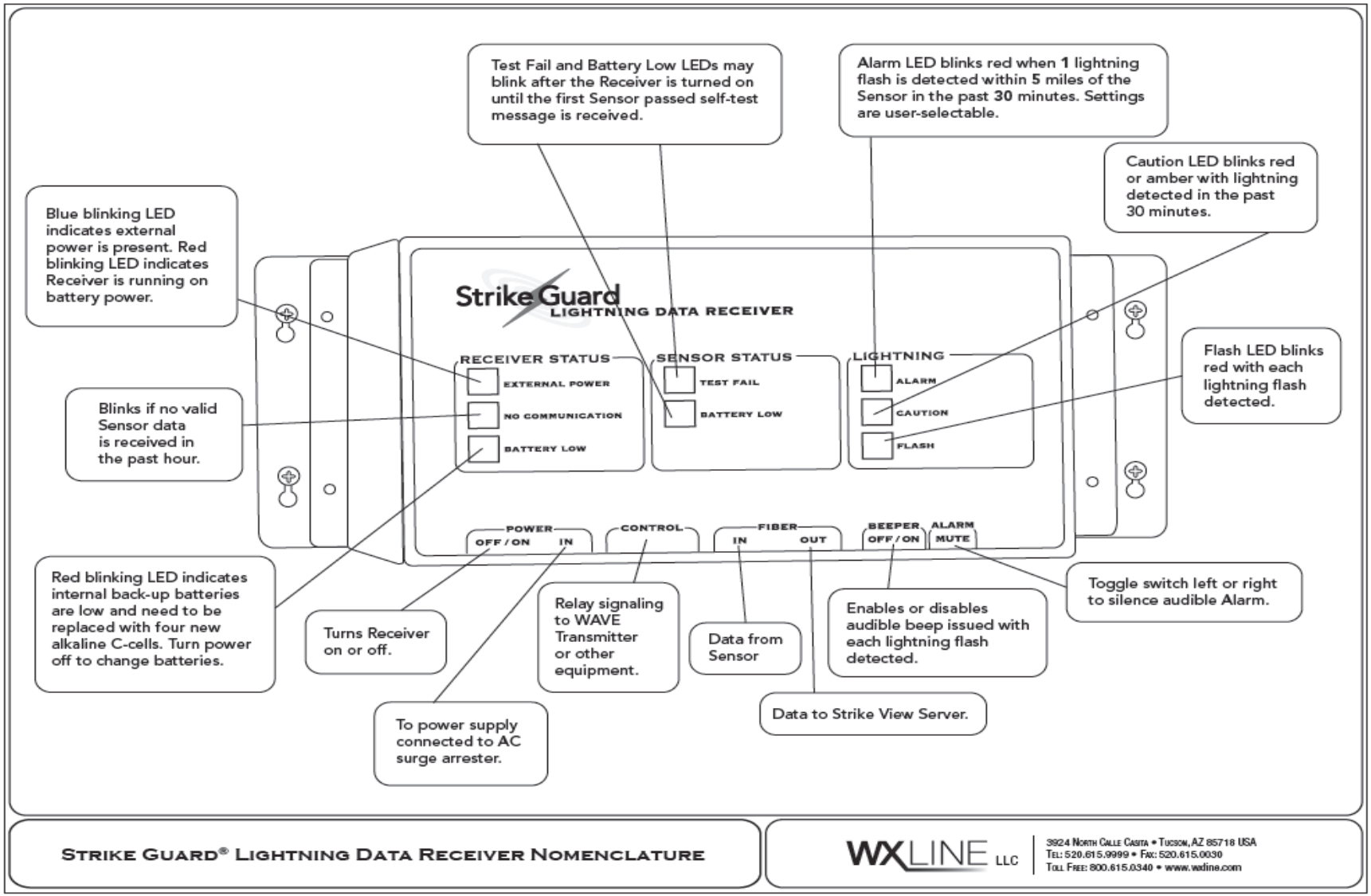


Figure 12: Lightning Data Receiver Nomenclature

CHAPTER 8

CONNECTING EQUIPMENT TO THE LIGHTNING DATA RECEIVER QUICK REFERENCE GUIDE AND CHECKLIST

☑ **Check boxes after completing steps.**

☐ STEP 1 Remove the front cover from the LDR by taking off the four brass thumbscrews. Handle the cover carefully and place it face down (circuit board up) upon a soft surface.

☐ STEP 2 Locate the 7-position screw-terminal block labeled J202 on the printed circuit board. Make connections to the main and auxiliary relays according to the contact assignments given below. The terminal block contacts can accept wire up to 18 gauge. A 1/8 inch flat-bladed screwdriver is required to secure wires in the terminal block.

J202 control connector contact assignments as viewed from the component side of the printed circuit board with typical Siren System wiring:

QPS & WAVE SYSTEM WIRING DIAGRAM

RELAY	MAIN RELAY K200			AUX RELAY K201		
CONTACT	1	2	3	4	5	6
FUNCTION	NC	NO	C	NC	NO	C
WAVE SIREN	Orange & White	Green & White	Orange			
QPS SIREN	Green	Red	Black			

NC = NORMALLY CLOSED / NO = NORMALLY OPEN / C = COMMON CONTACT

WAVE protective bond wire connections:

The Blue and Blue/White wire from the WAVE Transmitter is circuit and chassis ground and it must be connected to contact 7 of J202 of the LDR.

QPS protective bond wire connections:

The black wire is a circuit and chassis ground from the QPS Master Control Transmitter, and it must be made common with the circuit and chassis ground (terminal 7 of J202) of the LDR as shown above.

☐ STEP 3 Connect the wires to the appropriate terminals and implement the protective bond wire connections called for above.
The Lightning Data Receiver is designed for use as a continuous real-time threat indicator and controller that is connected and powered all the time.

NOTE **The relays in the Lightning Data Receiver may change state momentarily when Receiver power is turned on and off, resulting in undesirable or improper control functions. To prevent improper lightning warning function and improper control signaling, the Receiver should be powered continuously, except for periods of routine maintenance.**

The on-board batteries will reliably maintain relay states during failures of commercial power (150 hours typical back up time for fresh alkaline batteries).

Legacy - legacy							
RELAY	MAIN RELAY K200			AUX RELAY K201			
CONTACT	1	2	3	4	5	6	7
FUNCTION	NC	NO	C	NC	NO	C	Ground
WAVE SIREN	Orange & White	Green & White	Orange				Not Used
QPS SIREN	Green	Red	Black				

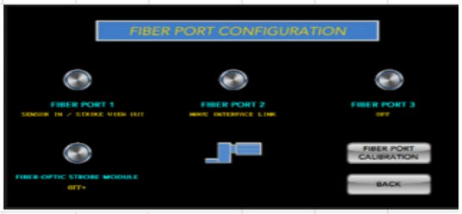
Legacy to Interface							
RELAY	MAIN RELAY K200			AUX RELAY K201			
CONTACT	1	2	3	4	5	6	7
FUNCTION	NC	NO	C	NC	NO	C	Ground
WAVE SIREN		Green & White	Orange		Orange & White	Orange	Not Used
QPS SIREN	Not Compatible						

INTERFACE

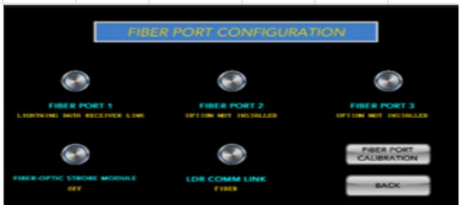
LDR-v2 to legacy transmitter

RELAY	1		
CONTACT	1	2	3
FUNCTION	NC	NO	C
QPS SIREN	Not Compatible		

LDR-v2 to Interface



WAVE Interface



CHAPTER 9

STRIKE VIEW SOFTWARE QUICK REFERENCE INSTALLATION GUIDE AND CHECKLIST

Strike View Software expands on the capabilities of the Strike Guard Lightning Data Receiver. Strike View provides data display, data logging functions, and Email notification.

NOTE **Strike View only ingests and processes Sensor data and status messages. In standard configuration, no information is passed from the computer running Strike View to the Lightning Data Receiver and no information about the settings or status of the Lightning Data Receiver is passed to the computer running Strike View. The LDR cannot be controlled or programmed using Strike View or a computer.**

Strike View Software is a suite of three software applications:

1. Strike View Server
2. Strike View Client
3. Strike View Simulator

Strike View software is provided on a USB thumb drive, or via online download. A software installation wizard guides the user through the installation process for each application.

☑ **Check boxes after completing steps.**

☐ STEP 1 Ensure that the computer for use with Strike View meets the minimum hardware requirements indicated in the manual and that it has an available RS-232 serial or USB port. USB port connections require a USB to RS-232 Adapter available from Wxline

☐ STEP 2 To connect the computer to the Lightning Data Receiver, first remove any protective caps on the fiber-optic cable supplied. Connect the fiber-optic cable supplied with Strike View Software between the blue FIBER OUT port of the Lightning Data Receiver. Ensure that the end of the fiber is fully seated in the fiber-optic device.

☐ STEP 3 Loosen the black ferrule and fully insert the computer end of the fiber-optic cable into the black fiber-optic receiver (labeled IN) on the Strike Guard RS-232 to Fiber-Optic Converter (the "Converter"). Ensure that the end of the fiber is fully seated in the fiber-optic device. Plug the Converter into the 9-pin serial port of the computer.

☐ STEP 4 Install the Strike View Software Package(s) on the computer. Registration of Strike View must be completed within 14 days after installation. To register software, obtain the Registration Code by contacting Wxline.

NOTE **Strike View Simulator does not require registration and is intended for evaluation and testing purposes.**

 STEP 5 When launching Strike View for the first time, the software prompts the user to set up the COM port.

The RS-232 to Fiber-Optic Converter can be directly attached to a computer with a 9-pin serial port and is typically designated as COM1.

A USB to RS-232 Adapter (the "USB Adapter") attached to a Windows computer is typically designated as COM3 or higher.

A USB Adapter attached to a Mac computer is typically designated as "USB-port."

If open, close the Strike View Server and continue with Step 6.

 STEP 6 To test that the correct COM port has been designated, open Strike View Simulator. Run Strike View Simulator in Simulation Mode by switching the Data Mode to "Simulation" within System Settings area.

Look into the blue fiber-optic transmitter on the Converter while pressing the P key several times (waiting at least 2 seconds between each key stroke).

If pulses of red light are seen after each keystroke, then the correct port has been selected.

It may be difficult to see red light coming from the Converter if the Converter is mounted to the back of the computer. However, the light from the fiber-optic transmitter is bright enough to be seen reflected on a sheet of white paper held near the opening of the blue fiber-optic transmitter on the Converter.

If red light pulses are not seen in the test above, select a different serial COM port and repeat the previous test until you get a positive result.

COM port settings are modified by selecting the "COM Port" button in Strike View Simulator Settings, right of the Data Mode pull down menu.

Note the COM port that works with the Converter.

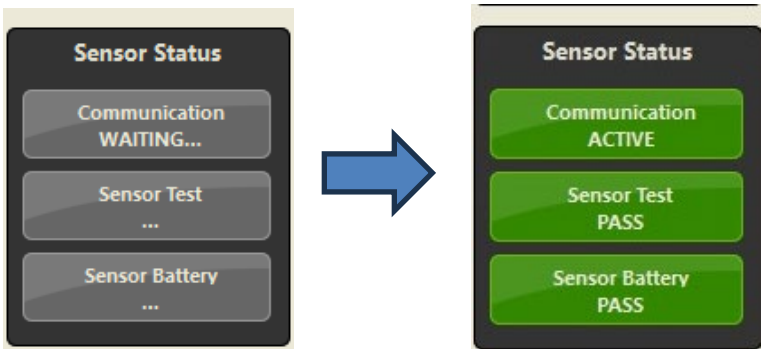
 STEP 7 Close the Strike View Simulator and then open the Strike View Server Application. Click "Not Yet" when asked to register.

Be certain to correctly specify the COM port setting within Strike View as instructed in Step 6 above.

Strike View Server has six possible System Modes, each with a corresponding color: Awaiting Sensor Message, No Lightning Detected, Caution, Warning, Alarm, and Failure Modes.

Awaiting Sensor Message Mode is the first mode shown upon initial startup of Strike View Server. Awaiting Sensor Message Mode changes to No Lightning Detected Mode if no data is sent from the Strike Guard Receiver except Sensor Status information. If Sensor Status information is not received within 2 hours of operation of Strike View Server, Failure Mode is indicated.

 STEP 8 With Strike View Server running, the screen area in the lower right-hand corner will change with the first valid Sensor Self-Test Pass message from:



Since it may take up to 60 minutes for the Sensor to perform the next self-test resulting in the indications mentioned above, it may speed the installation process to trigger a Sensor self-test by turning the Sensor upside down (glass diffuser pointing down), waiting ten seconds or more, and then returning the Sensor to the upright position. This process of turning the Sensor off and then on causes the Sensor to send a self-test message to the LDR and then to the Converter connected to the computer.

The Lightning Warning System must be fully installed and working, and the Lightning Data Receiver must be powered and ON to function as a fiber-optic repeater for Strike View.

No Lightning Detected Mode remains in effect provided that no data is sent from the Strike Guard Receiver except routine Sensor Status information. If lightning data is sent from the Strike Guard Receiver to the computer, Strike View Server Mode changes to Caution, Warning, or Alarm Mode based on the proximity of the lightning flash detected.

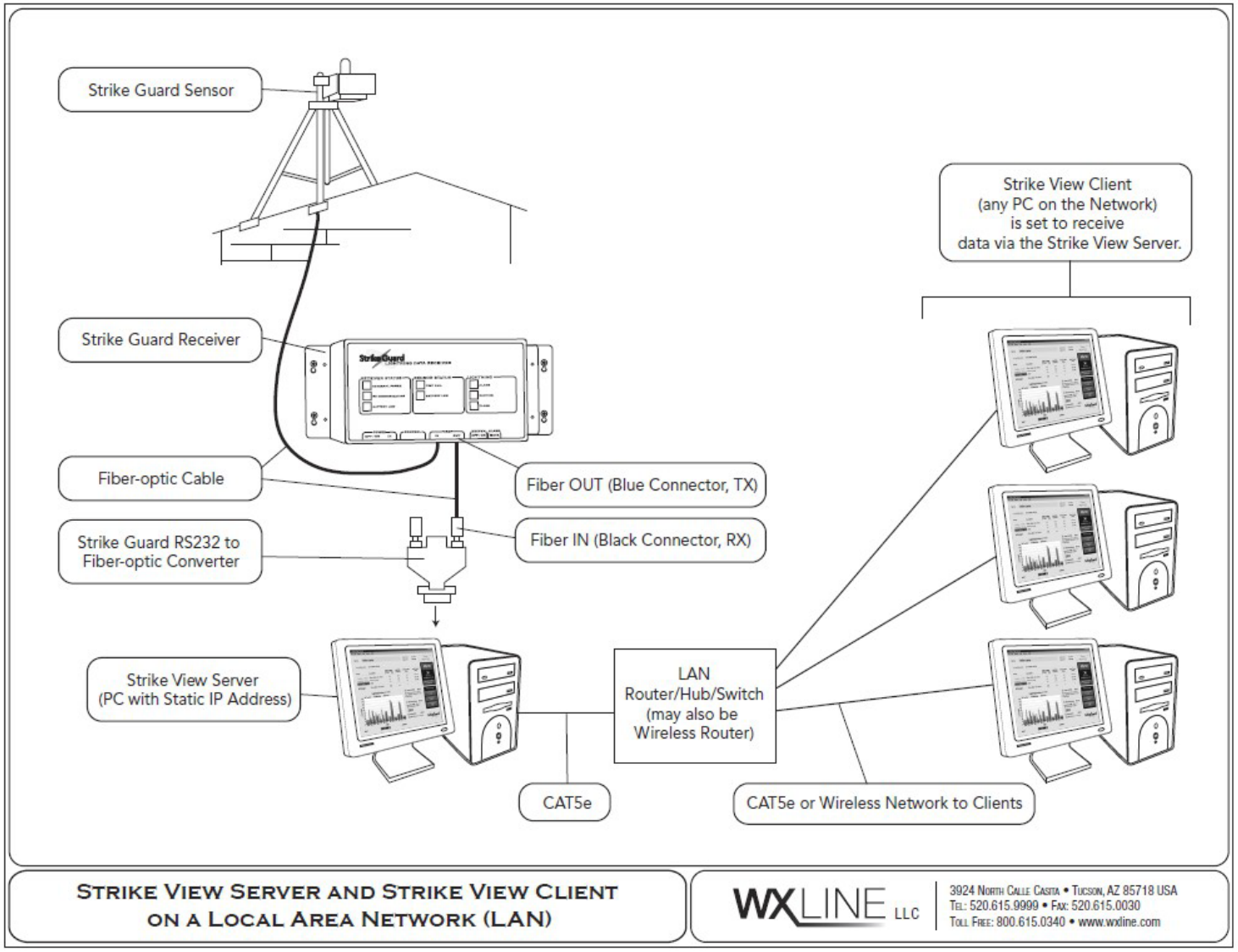


Figure 13: Strike View Server & Client on LAN

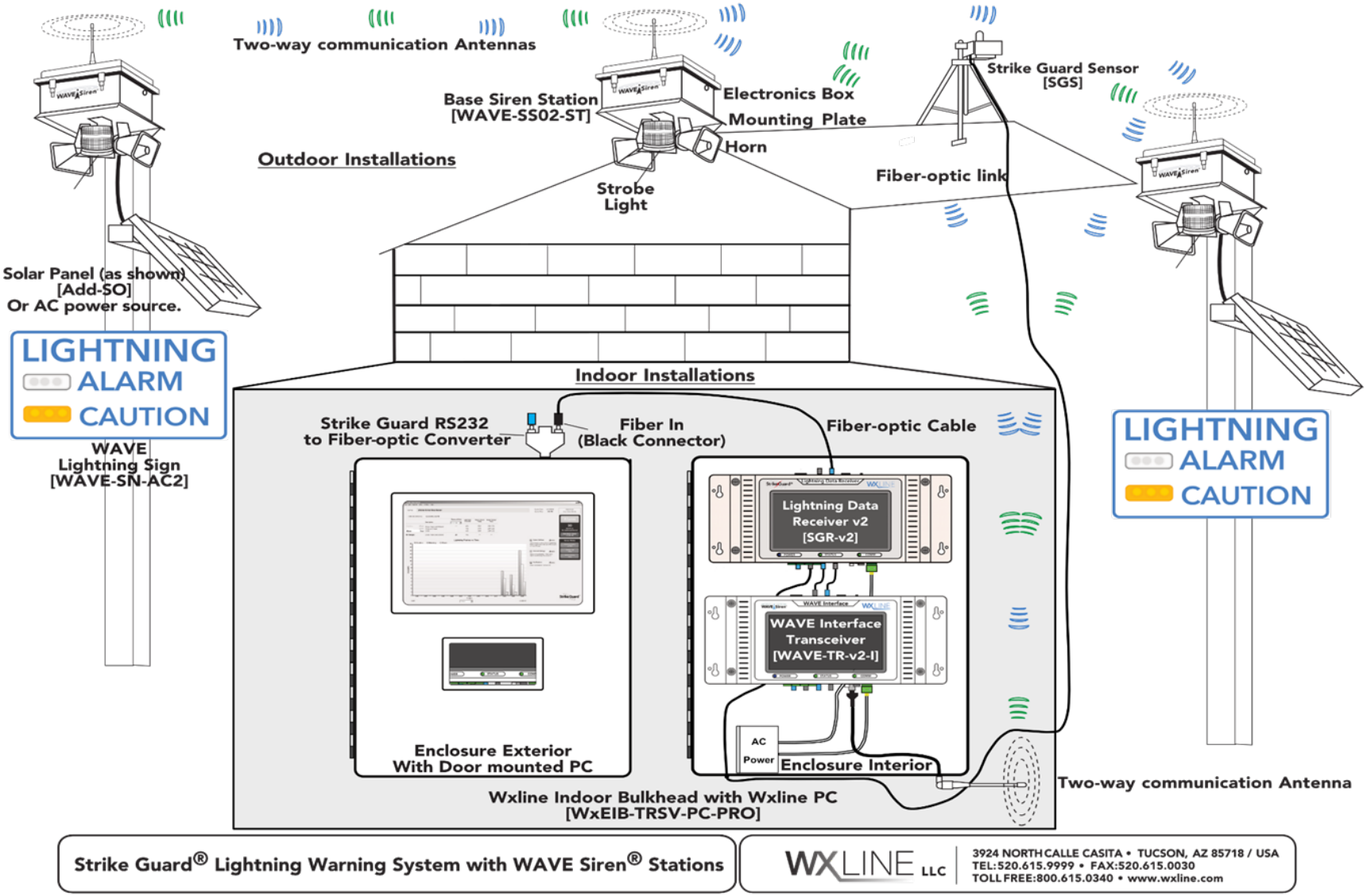


Figure 14: Strike Guard Lightning Warning System with WAVE Siren Stations

WXLINE

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

Tel: +1.520.615.9999 • Fax: 520.615.0030 • www.wxline.com • info@wxline.com

Wxline Service, Shipping and Receiving
423 South Olsen Avenue, Tucson, AZ 85719 USA

Wxline Corporate Mailing Address
3924 North Calle Casita, Tucson AZ 85718 USA

WAVE Siren™

Specifications are subject to change.