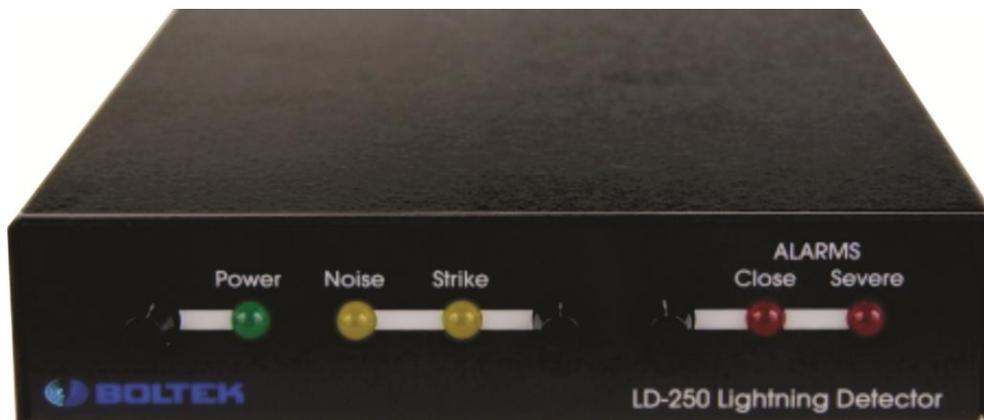




BOLTEK CORPORATION

Lightning Detection



LD-250 Lightning Detector Installation/Operators Guide

SEE DISCLAIMER ON REVERSE

BOLTEK LIGHTNING DETECTION

LD-250 Lightning Detector

Disclaimer

LD-250 lightning data is only approximate and should not be used for safety applications. Strike and storm locations indicated and alarm statuses may be erroneous and should not be used to safeguard personnel, equipment or data.

Neither Boltek Corporation nor its affiliates shall be liable to the purchaser of this product or third parties for damages, losses, costs, or expenses incurred by purchaser or third parties as a result of use, misuse, accident, or abuse.

Notwithstanding the above Boltek Corp's liability shall not exceed the purchase price of the equipment.

THIS EQUIPMENT IS NOT TO BE USED FOR SAFETY PURPOSES

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FCC Compliance Statement For United States Users

This equipment is tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio or television reception. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio and television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment. It is the responsibility of the user to use a shielded interface cable with this device. If this equipment has more than one interface connector, do not leave cables connected to unused interfaces. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

For Canadian Users

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la class B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.



WARNING

**DO NOT ATTEMPT TO OPERATE THE LD-250 OR THE LD-250
DISPLAY SOFTWARE WHILE DRIVING YOUR VEHICLE**

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Installation

The LD-250 Lightning Detector puts a live lightning map on your laptop or desktop computer. The LD-250 is suitable for use in mobile, portable or fixed installations. With two antennas you can move the unit between a fixed installation and a portable installation. When used mobile the LD-250 requires a GPS connected to the GPS/Compass NMEA port on the rear of the unit.

Your LD-250 package should contain:

- 1 LD-250 lightning detector
- 1 lightning detector antenna
- 1 antenna cable,
 - standard length 50 feet (15 meters)
- 1 AC wall adapter,
 - 120VAC to 12VDC for North America,
 - 220VAC to 12VDC for Europe
- 1 automotive lighter/accessory power cable
- 1 GPS/Compass connector to pigtail cable
- 1 DB-9 male to DB-9 female RS232 cable
- 1 USB to RS232 adapter cable
- 2 Velcro strips for mobile mounting
- 4 rubber feet for desktop mounting
- CDROM containing Windows software
- CDROM containing USB drivers
- 1 user manual (this is it)

Unpack your LD-250 and make sure all the parts are included.

Quick Start

- 1) Connect the DB-9 cable from your computer COM port (or the USB-RS232 cable from your computer USB port) to the RS232 connector of your LD-250.
- 2) Plug in the AC power adapter into the rear of the LD-250 and into an AC outlet. Turn on the LD-250. It should beep and illuminate the indicator lights for 2 seconds.
- 3) If using the USB-RS232 cable, you may need to install the drivers from the mini CDROM disc first if Windows doesn't install them automatically.
- 4) Install the Lightning Display software provided on the included CDROM, then run application after installation is completed and select LD-250 under the hardware configuration options menu.
- 5) Connect the antenna cable to both the LD-250 and the antenna. Hold the antenna a few feet from a computer monitor or television. (A laptop computer display may not produce enough noise.) The LD-250 should detect the radio frequency noise from the monitor as a constant stream of noises and/or strikes. By moving the antenna you should be able to find a position that produces strikes. Yellow strike dots should appear on the display. Rotating the antenna should change the strike direction.
- 6) Mount the antenna away from televisions, computer monitors and other sources of noise.

Installing the Antenna

The antenna is housed in a small black plastic box that must be mounted vertically on a non-metallic support. The antenna cable plugs into the bottom of the antenna housing. When mounting the antenna ensure the correct side of the antenna faces north. The cable plugs into the bottom of the antenna with the front of the antenna facing north. The front of the antenna corresponds to the top of the computer screen. If the antenna does not face north the top of the computer screen will not be north.

Provided there are no large metal objects to block the radio signals, mounting the antenna 6 feet high is ok. Mounting the antenna 12 feet high is good. 20-25 feet is better.

LIGHTNING

Receiving lightning signals does not cause lightning to strike. Your LD-250 antenna is less likely to be struck by lightning than your anemometer, since the antenna does not need to be above the roof line. Still though you must exercise common sense when choosing a location for your antenna. If you mount the antenna on a ten foot pole on the highest point on your roof, with no trees or television tower nearby you are asking for lightning to strike.

Your best protection against lightning is to mount the antenna indoors. Radio waves will pass right through a wood building. Lightning is more likely to strike a tall tree, television antenna, copper plumbing vent, satellite dish, telephone line, power lines, or CB antenna. If you do mount the antenna outdoors make sure there are plenty of ground paths for lightning nearby (such as those just mentioned), and higher than the antenna.

The LD-250 receiver board has surge suppression in its input to protect against voltages induced into the antenna cable. It is also a good idea to purchase a surge suppressor to plug your computer into. If you have a modem try to find one that will protect your phone line as well. Lightning often enters through the telephone line. Both your computer and surge suppressor will need to be grounded.

The antenna may be mounted indoors or outdoors. Try to mount the antenna as high as possible (without making it a lightning rod). Mounting the antenna high will keep it away from noise sources and will improve the maximum range.

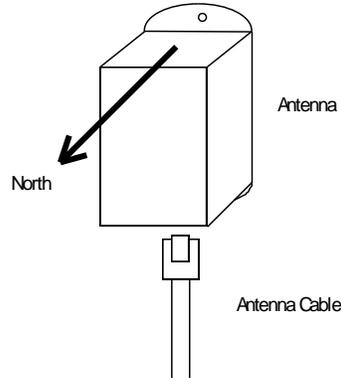
In a wood framed house, the second floor or attic is often a good location for the antenna. This places the antenna above the most common sources of interference: televisions, lights and appliances, yet leaves it in a good location to receive lightning signals. Mount the antenna to the drywall or attic rafter away from screws, nails, electrical wiring, and other metal objects. If your house has aluminum siding (vinyl siding is ok), foil-lined insulation, or any other metal coating, you might have problems receiving with the antenna indoors, as the metal may shield radio waves from the antenna.

DO NOT MOUNT THE ANTENNA SO AS TO ATTRACT LIGHTNING. The antenna does not need to be the highest object in the area to receive lightning signals.

DO NOT LOCATE THE ANTENNA NEAR AN OBJECT WHICH IS LIKELY TO BE STRUCK BY LIGHTNING. Objects such as television antennas, CB antennas, power lines, phone lines and tall trees are natural targets for lightning. Keep the antenna and cable away from anything which might be struck by lightning. Lightning can jump from one object to another in its search for ground.

INSTALLATION

The antenna may be mounted with nylon cable ties, or with nylon bolts through the mounting flanges (available at a hardware store). Do not use steel screws to mount your antenna, as the antenna must not be near any metal objects.



If mounting the antenna outdoors, care must be taken to protect the antenna connector from moisture. While the antenna is completely waterproof the antenna connector must be sheltered from rain. Place the antenna inside a non-metal housing such as a length of ABS or PVC pipe with an end cap covering the top. Keep a small opening on the bottom to allow condensation to drain out. ABS or PVC pipe, fittings and glue may be purchased from a hardware store plumbing department. Mark NORTH on the outside of the pipe to help in orienting the antenna correctly.

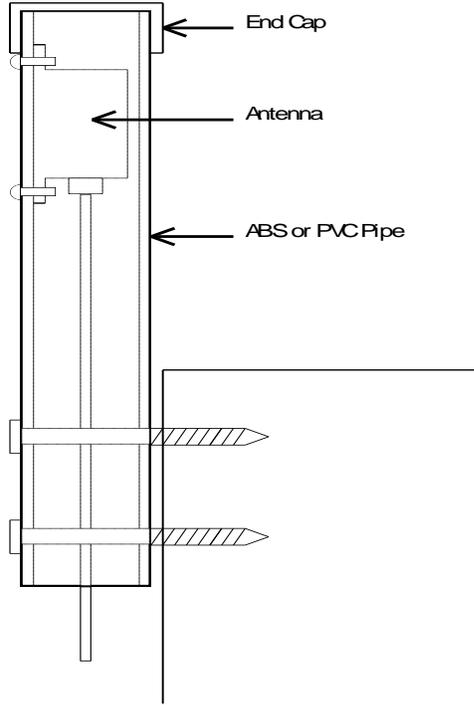
Fasten the cable to the wall or support about 6-12" below the antenna. Leave a bit of slack in the cable near the antenna so that there is no strain on the connector from the wire.

If you find the 50' antenna cable provided is not long enough you may purchase a Boltek 50' extension cable. This allows you to locate the antenna up to 100' from your computer.

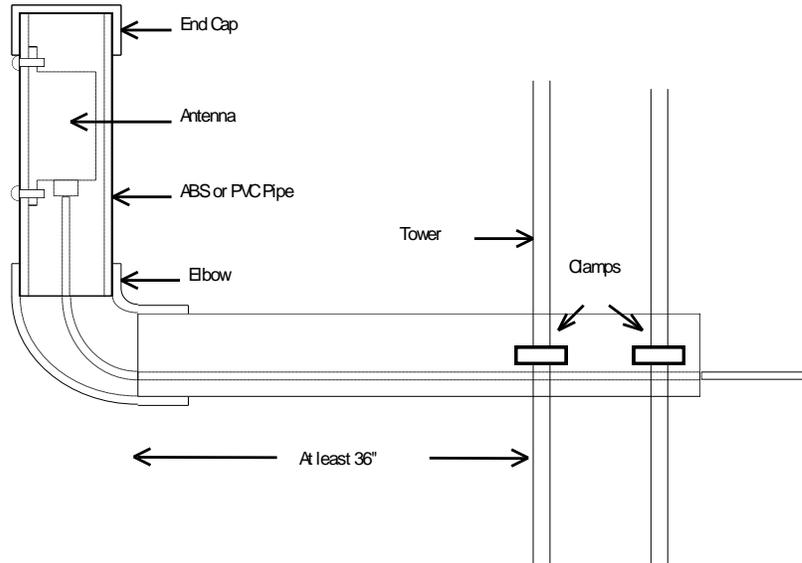
You may also purchase a replacement cable at any computer store selling network hardware. Any Category 5 cable up to 200 feet will work. See Appendix C for information on making your own antenna cable.

INSTALLATION

Antenna Mounting Suggestion - Outdoor

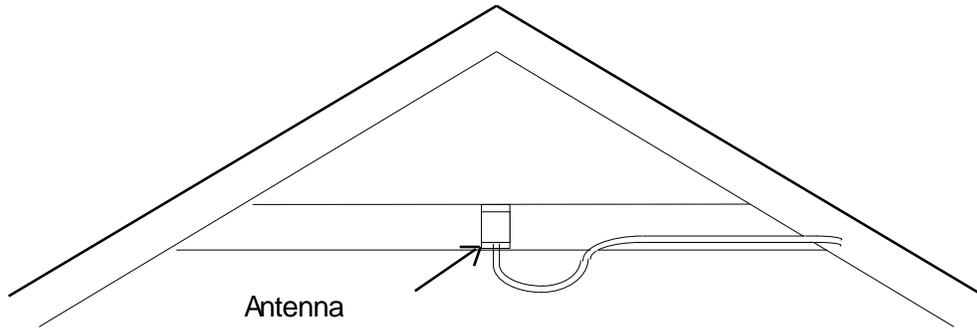


Antenna Mounting Suggestion - Outdoor



INSTALLATION

Antenna Mounting Suggestion - Attic



Antenna Mounting Examples



Here an antenna is mounted in an attic. PVC plumbing hardware is used to attach the antenna to the framing. The vertical pipe is not cemented to allow the antenna to be rotated slightly for fine-tuning direction. The front of the antenna must face exactly north.

INSTALLATION



Here an antenna is mounted in a shed using PVC plumbing hardware purchased at a local hardware store. The antenna is attached using nylon cable ties.



Here the antenna is attached to the drywall in the second floor bedroom of a house. The antenna is mounted on the wall using PVC plumbing hardware purchased at a local hardware store. The antenna is attached to the PVC pipe with nylon screws. The vertical piece of PVC pipe is not cemented so that the antenna can be rotated to fine-tune the direction.

Mount the antenna between studs to keep it away from nails and screws. Look for electrical outlets on the wall to determine if there is wiring behind the drywall. Keep the antenna away from electrical wiring, to reduce the chance of picking up noise.

INSTALLATION



Here the antenna is mounted to the side of a pole using ABS sewer pipe.

Mobile Installation

Shown are two examples of a LD-250 antenna mounted on a vehicle.



Here the antenna is mounted inside a short piece of PVC sewer pipe purchased from a local hardware store. An end cap covers the top and bottom of the pipe. The antenna is screwed to the side of the pipe with nylon screws. The bottom end cap is screwed to a magnet from a magnetic mount light.

INSTALLATION



Here the LD-250 antenna is mounted inside a short piece of PVC pipe. Again the components were purchased from a local hardware store.

USB Adapter Cable

If your computer has an available com port (a male 9 pin DB connector on the rear of the computer) you should use the RS232 cable to connect your LD-250 directly to your computer.

If your computer does not have a com (RS232) port available you should use the USB adapter cable to create an additional com port for your computer. Once the cable and driver are installed on your computer an extra com port will show up on your System Device Manager.

Installing the USB Adapter Cable:

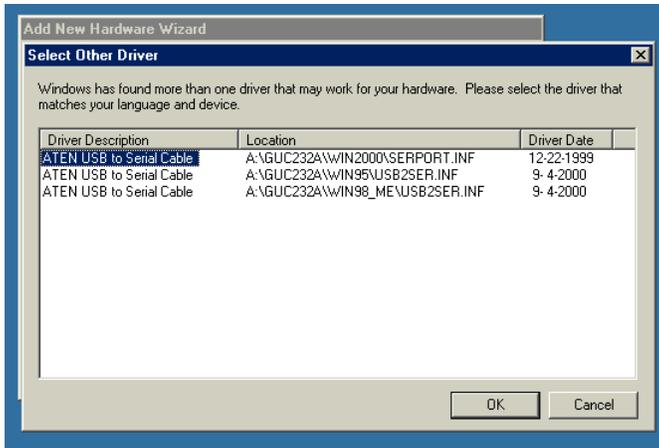
With your computer turned on plug the USB adapter cable into a spare USB port on your computer or hub. USB devices may be plugged and unplugged with the power on.

Windows will detect the new device and prompt you to install a driver:



Place the USB Drivers CDROM in your computer disk drive and click on Next. Windows will then display a list of drivers found on the disk:

INSTALLATION



Select the correct driver for your operating system by clicking on the Driver Description. For Windows 2000 select the first driver shown on the list above. For Windows 95 select the second driver. For Windows 98 and ME select the last driver shown above. Once you have highlighted the correct driver click on OK.

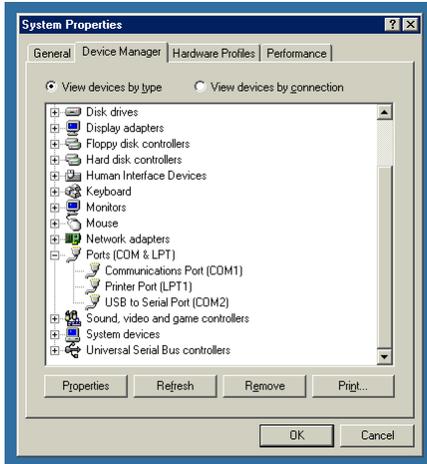
Windows will then install the selected driver and display the finished dialog below:



Click on Finish to complete the installation procedure.

Your USB adapter cable will appear as a COM port, usually COM2 or COM3. You can determine which COM port has been assigned by opening My Computer, then open Control Panel. Open System and click on the Device Manager tab.

INSTALLATION



Open the Ports section. The COM port is shown as USB to Serial Port. You will need to configure the LD-250 software to use this COM port on the LD-250's Configure Strike Processing dialog.

Operation

Mobile Operation

Normally the front of the LD-250 antenna needs to face north. In a mobile situation the orientation of the antenna would be constantly changing as the vehicle turns. The LD-250 has the ability to correct for this by using heading data from a GPS or marine compass.

As long as you are moving forward your GPS will know which direction you are traveling and, at least for an automobile, which direction your vehicle is facing. The GPS looks for change in location to calculate your heading. Since a boat can change directions without necessarily changing position (rotating on its anchor for example) a marine compass is recommended for marine applications.

GPS/Compass Connection

The LD-250 has a NMEA port on the read panel to connect to a GPS or compass for mobile operation. A GPS or marine compass connection is required for mobile use since the LD-250 needs to know which direction the antenna is pointed.

GPS /COMPASS WIRE CONNECTIONS

BLUE	NMEA data +
YELLOW	no connection
GREEN	NMEA data in –
RED	+12V to power GPS or compass
BLACK	Ground for GPS or compass
WHITE	NMEA data out (not implemented)

If your GPS does not provide a NMEA Data – connection you should connect the LD-250's NMEA Data – (green wire) to ground (black wire).

Front Panel Controls

Main Power Button

The main power button disconnects 12V power from the LD-250, the antenna, and the GPS connector on the rear of the LD-250.

Main Power Indicator

The power indicator illuminates to indicate 12V power is present at the LD-250. If the indicator does not light when the unit is turned on check your 12V power source.

Strike Indicator

The Strike Indicator emits a short flash when a lightning strike is detected. If the Strike Tone Button is pressed the detector also emits a short beep.

Noise Indicator

The Strike Indicator emits a short flash when a noise signal is detected. If the Strike Tone Button is pressed and Noise Beeps have been turned on in software the detector will also emit a short beep.

Strike/Noise Switch

When pushed in, the internal beeper will emit a short beep when a strike or noise signal is detected. When pushed out, no sound will emit from the internal beeper.

Close/Severe Alarm Switch

When pushed in, the internal beeper will emit a long beep when a close strike or severe strike rate alarm is triggered. When pushed out, no sound will emit from the internal beeper.

Close Indicator

The Close Indicator emits a long flash when a strike is detected within the set close strike range. If the Close/Severe Tone Button is pressed the detector will also emit a long beep.

Severe Indicator

The Severe Indicator emits a long flash when the strikes per minute rate reaches or exceeds the set strike rate. If the Close/Severe Tone Button is pressed the detector will also emit a long beep.

Noise

Noise signals can be either a signal that did not appear to be lightning, or a signal for which the LD-250 could not determine a distance or direction.

Noise can come from high powered devices such as A/C units, refrigerators, computers, fans, heaters, etc.

In mobile operation noise can come from inductive traffic sensors buried in the roadway, noisy overhead power lines, or noisy electronic devices.

Receiver Range

LD-250 has a range of about three hundred miles. Occasionally, strong storms farther than 300 miles away may be detected.

The receiver's maximum range will be affected by antenna height. While you can receive storms with the antenna at virtually any height, you will have maximum range with antenna mounted at least 25 feet above ground.

Other factors that could affect range are metal objects located near the antenna. Metal objects can block the radio waves from getting to the antenna, reducing the range. A large steel shed or other metal object nearby could block lightning signals, resulting in reduced range in that direction. Try to mount the antenna as far as possible from large metal objects, preferably above the object.



RS232 Commands and Messages

Commands

SQ<cr> : query squelch setting

SQ<value 0-15><cr> : set squelch setting

CA<cr> : query close alarm distance

CA<distance 0-250><cr> : set close alarm distance

SA<cr> : query severe alarm distance

SA<0-999><cr> : set severe alarm distance

NB<cr> : query noise beep state

NB<0,1><cr> : set noise beep state 0=off, 1=on

MS<cr> : query minimum GPS speed

MS<0-99><cr> : set minimum GPS speed

RS232 Messages

Strike Sentence

\$WIMLI,<ddd>,<uuu>,<bbb.b>*<cs><cr><lf>

<ddd> - corrected strike distance 0-300 miles
<uuu> - uncorrected strike distance 0-300 miles
<bbb.b> - bearing to strike 000.0-359.9 degrees
<cs> - checksum in hex
<cr> - carriage return
<lf> - line feed

Noise Sentence

\$WIMLN*<cs><cr><lf>

<cs> - checksum in hex
<cr> - carriage return
<lf> - line feed

Status Sentence

\$WIMST,<ccc>,<sss>,<ca>,<sa>,<hhh.h>*<cs><cr><lf>

<ccc> - close strike rate 0-999 strikes/minute
<sss> - total strike rate 0-999 strikes/minute
<ca> - close alarm status (0: not active, 1: active)
<sa> - severe alarm status (0: not active, 1: active)
<hhh.h> - current heading from GPS or compass
<cs> - checksum in hex
<cr> - carriage return
<lf> - line feed



Making an Antenna Cable

The LD-250 uses standard Category 5 (Cat5) 10baseT network cable for the antenna cable. You can purchase a replacement antenna cable from any computer store selling network hardware. Antenna cables may be up to 200 feet long. If you have access to a crimper for RJ-45 connectors and a source of RJ-45 connectors and Category 5 network cable you can make your own custom antenna cable. Making your own cable means you are able to pull the cable through conduits, walls, etc. before you attach the connectors. This lets you drill smaller holes for the cable and protects the connectors from damage during installation.

If you make your own antenna cable you must ensure that the wire pairing is done correctly. The connectors must not only be wired straight through (non-reversing), but the twisted pairs must be located in the correct positions. If the pairing is not done correctly there will be crosstalk between the different signals on the cable and your unit will not work properly. The correct pair locations are:

Wire position 12345678
Pair 33211244

What this means is: one pair is in the center (positions 4&5), another pair is split and surrounds the first (positions 3&6), another pair is on the left (positions 1&2) and another pair is on the right (positions 7&8).

APPENDIX C - MAKING ANTENNA CABLE

The actual color positions do not matter as long as you use the same color assignments on both ends, and you split the pairs correctly.

The wire color assignments we use is

POSITION	PAIR	COLOR
1	3	White/Green
2	3	Green
3	2	White/Orange
4	1	Blue
5	1	White/Blue
6	2	Orange
7	4	White/Brown
8	4	Brown

You can have up to 200 feet of antenna cable without using a separate antenna power supply. In special circumstances we have made custom cables up to 500 feet in length that used a separate 12VDC power supply for the antenna.

Do NOT use the pairing: 11223344. That is, wire pairs placed next to each other. This will not work.