



Scan with phone camera
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PRODUCT MANUAL
V 1.0

VOLTEK 2™

Power Line Warning + Range Limiting System



UNITED SAFETY INC
3220 US HIGHWAY 93 S
STE 2
KALISPELL, MT 59901

VOLTEKSYSTEMS.COM
800.755.4854
406.249.9830
MADE IN THE USA

SYSTEM INFO

Product:

Model #:

Serial #:

E-Stop/hydraulic shutdown feature Installed?
(Do not use on cranes or equipment carrying unsecured or swinging loads)

YES NO

Accessories/options included with this system:

Antenna Configuration (circle any applicable option)

linear antenna remote sensor
wire reel antenna other

Notes:

OWNER INFO

Owner/Company Name: _____

Contact Name: _____ Phone/Email: _____

Installed on: (Equip type) _____ Equip/Vehicle #: _____

Installed date: _____ Installed by: _____

For maintenance or other
info please contact:

Phone/email:

For emergencies contact:

Phone/email:

FOR EMERGENCIES: DIAL 911

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IMPORTANT INFORMATION-PLEASE READ

A quick message from United Safety Incorporated

Voltek Systems™ products are just one piece of a well rounded safety program. We believe that it takes education, implemented safety procedures and technology all working together to prevent job-site injuries and damage. We are here to provide any resources we can, however it is ultimately up to you, the operator, to maintain a safe work environment. If you have any questions or need additional resources, feel free to contact us at any time. Thank you and have a safe and productive day!

--Randall Johnson, Director of Operations

(406) 249-9830

randall@volteksystems.com





Please read and acknowledge before using.

Failure to follow operating instructions could result in death or serious injury. Please read and follow all instructions and guidelines before using this product.

United Safety Incorporated and its distributors cannot be held responsible for improper or neglected maintenance, improper installation, or behavior that violates State, Federal and/or international laws and guidelines.

THIS IS AN ASSISTIVE AND INTERACTIVE DEVICE-it cannot guarantee operator safety.

Do not use this product or machinery within 20' from overhead power lines.

Do not operate any part of your equipment directly above or below overhead power lines.

Contact with high voltage can result in serious injury or death. Observe general safety precautions when near high voltage power lines.

If product is damaged or collides with obstructions, remove unit immediately and return to the manufacturer for repair or replacement. Operating a damaged unit could lead to system failure.

This device is to be used only to detect 50-60 Hz, alternating current (AC), OVERHEAD power lines greater than 5000V. By using United Safety Incorporated products you understand and agree the dangers of operating machinery or equipment near overhead power lines and are familiar with any associated risks.

In no event shall United Safety Incorporated or its distributors be liable for any direct, indirect, punitive, incidental, special consequential damages, to property or life, whatsoever, arising out of or connected with the use or misuse of our products.

This product does not measure or indicate distance. Power line proximity alarms measure relative strength of electromagnetic fields surrounding overhead power lines. Proximity alarms are interactive devices provided to assist you, the user, in avoiding contact with overhead power lines.

It is the goal of United Safety Incorporated to provide you with the best safety products available, however it is imperative that the operator takes time to become fully aware of any potential hazards. We work to provide you with an extra measure of safety, however it is ultimately up to you to maintain a hazard-free job-site.

FOR EMERGENCIES DIAL 911

Specifications

Dimensions: L 6.63", W 5.25", H 1.63" (without mounting system/brackets)

Mounting options - in flanges with pre-drilled holes (standard) - 3rd party mounting brackets (provided by RAM mounts multiple options)

Weight: 1.2 lbs

Material (enclosure): UV Stabilized ABS

Water/dust resistance: IP65

Drop resistance: 3'

Display type: multi-color LED

Built-in speaker/siren rating: +/- 72 dB

External speaker/siren rating: 100+ dB

Required operation voltage: 12-24V DC

Wireless transmission protocol(s): Xbee 2.4Ghz and 4G LTE/5G CDMA or GSA (depending on SIM card)

Event recording capacity: 30 days

Type of detection: E-field component of EMF based on 50-60Hz frequencies

Rated minimum voltage detection @ 20' OSHA standard-power lines less than 350kV*:

7.2kV (with 10' linear antenna installed according to manufacturer's recommendations)

Compatible accessories: WS, Spotter, Limit Switch, External Siren, Linear wire antenna, Voltek analytics and setting web app

Rated maximum voltage detection: unlimited (750kV+)

* (1926.1408(a)(2)(ii) "...Ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet to the power line by implementing the measures specified in paragraph (b) of this section."

Features

- Control and monitor all settings and events remotely from your phone, tablet, or computer with the Insight™ App (subscription required)
- Durable water and dust resistant main enclosure
- Self checking antenna alerts the operator is antenna is damaged or disconnected
- Simple installation
- Adjustable detection sensitivity to adapt to almost any situation
- Progressive warning zone to give operator ample time before “shutdown”
- Simple and easy to use controls
- SHUTDOWN feature can break continuity in an E-stop, PTO or electric-over-hydraulic control circuit to stop or shutdown equipment (not recommended for equipment carrying heavy or free-swinging loads)
- Built-in speaker/siren for audible alerts for equipment with enclosed cabs
- Optional external siren for open cab equipment
- Works with linear wire antenna or wireless transmitter antenna (Voltek WS™)

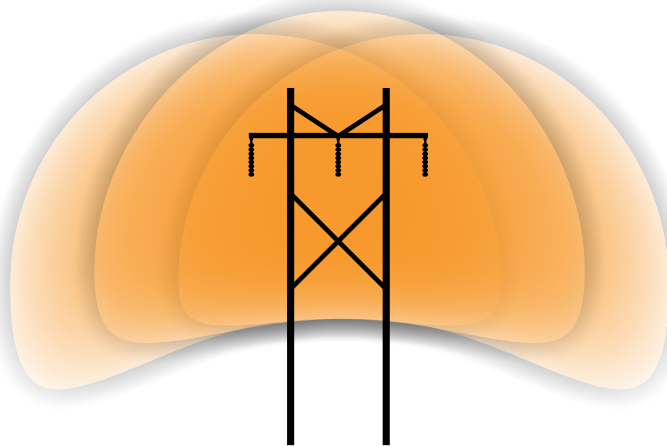


Understanding E-field

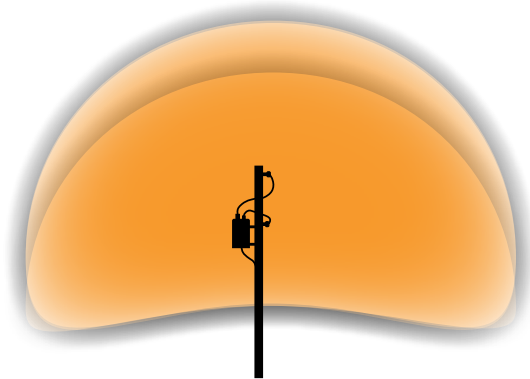
Above-ground AC power lines produce an electromagnetic field (EMF). The size, intensity, and shape of the EMF is dependent on factors such as: distance, voltage, amperage, number of, or configuration of power lines. Although the EMF will be different depending on these factors, the characteristics of the EMF is relatively stable at any one location. An EMF is created by each energized conductor (see image below). The Voltek™ detects the non-magnetic properties of the EMF referred to as the E-field.

Approximation of an EMF field cross section based on common power line configurations.

NOTE: The ground acts as a shield-diminishing the EMF slightly directly underneath the power lines.

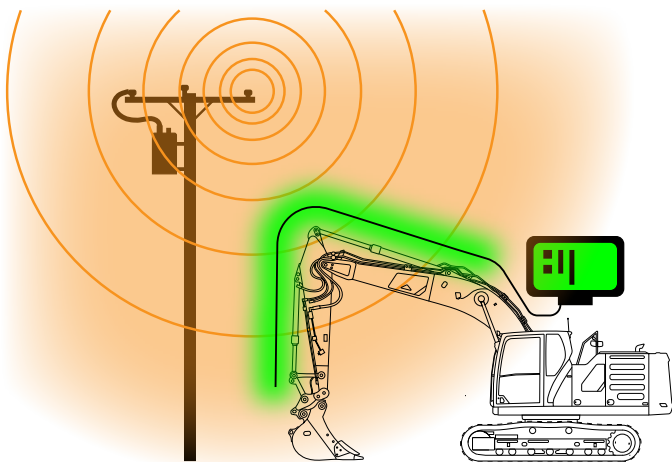


EMF created by 138kV, 3 conductor transmission line

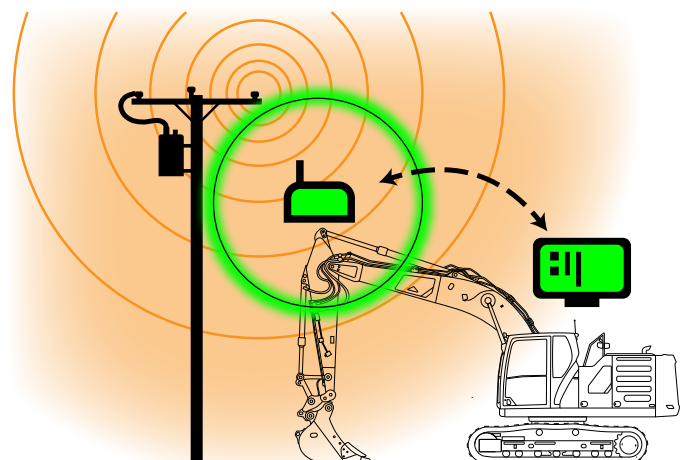


EMF created by 7.2 kV, 2 conductor Distribution line

The Voltek™ uses a sensor to detect the intensity of the E-field and then relays that information to the operator. Since the E-field varies from location to location, the sensitivity settings and antenna configurations can be adjusted to compensate accordingly.



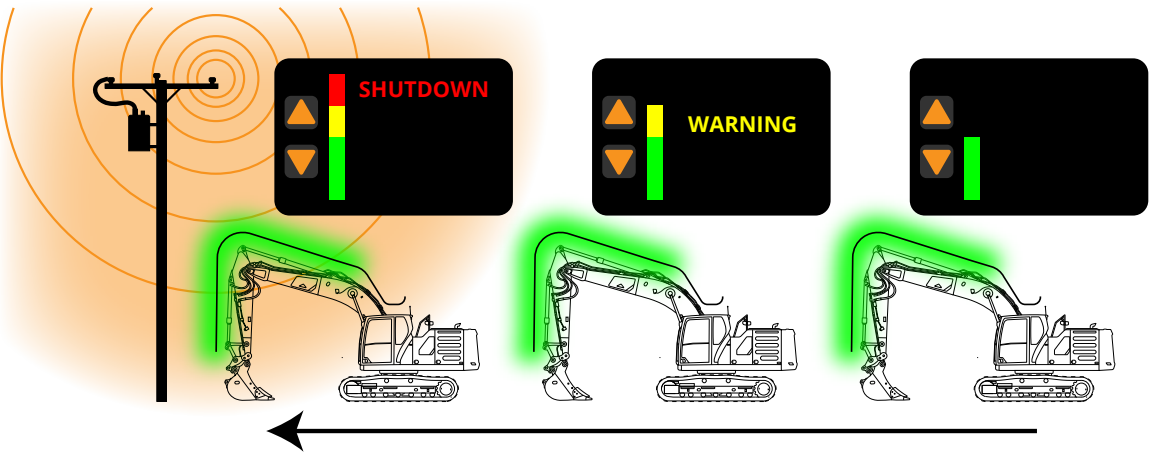
Excavator with wire antenna (linear detection)



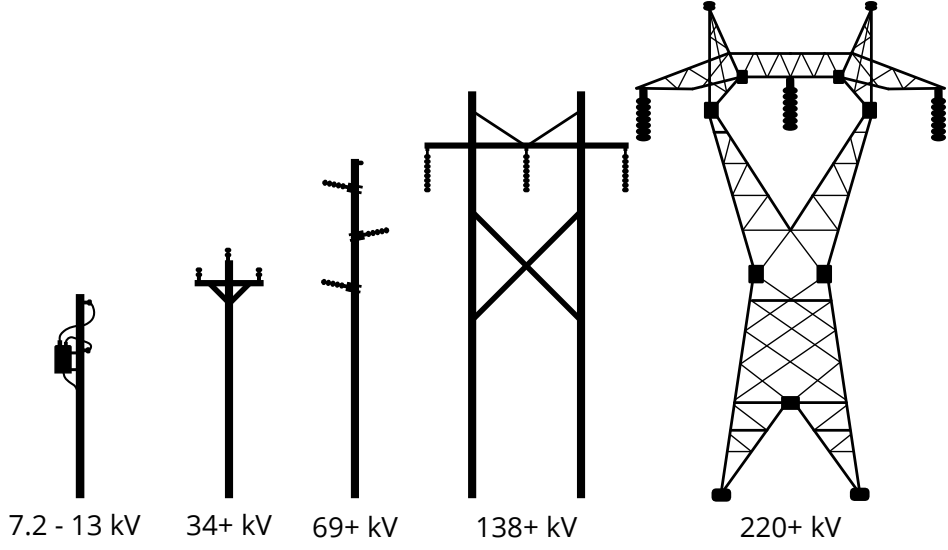
Excavator with wireless sensor (spot detection)

How it works

An excavator equipped with a Defender starts up and begins to operate within detection distance of an overhead power line. The Voltek™ defaults to maximum sensitivity and alerts the operator of a nearby power line. As the excavator travels toward the power line, the E-field gets stronger and the indicated reading goes up.



The sensitivity of the system is adjustable and can be increased or decreased depending on the situation and needed parameters. Do not operate equipment at a distance of less than 20'.



Voltages of power lines based on structure type
(This diagram is for visualization only)

The Voltek™ is designed to work with any standard power line configuration rated at 7.2kV and above. Every situation or job site is different from the last-requiring a wide detection range to be able to adjust accordingly. The sensitivity range of the Voltek™ can be quickly adjusted to work with you,

Important Terms

“WARNING”: A power line poses a potential hazard and is dangerously close. “Warning” is displayed and an alarm sounds intermittently.

“SHUTDOWN”: A potential power line strike is imminent if preventative action is not taken. “Shutdown” is displayed and a constant alarm tone sounds. If the system is integrated into your E-stop of hydraulics, the machine is stopped or shut down.

This feature is not recommended for cranes or any equipment lifting free-swinging loads.

E-field: A force emitted from an electrically charged conductor. E-field is one component of an EMF (Electromagnetic field).

Proximity: In regards to usage with E-field detection, this term is used to indicate that a power line is nearby. This term is used as a descriptive term and does not indicate or suggest a specific measured distance.

Linear Detection: The ability of the system to detect an E-field uniformly along a wire antenna placed on a boom, mast or other length of equipment. In regards to the Voltek™, the antenna used to detect E-field is referred to as a *linear wire antenna*.

Spot Detection: The ability of the system to detect E-field from one specific location.

Conductor (live conductor/electrical conductor): An object or type of material that allows the flow of charge (electric current) in one or more directions. The linear wire antenna

Shielded antenna, cable or conductor: A cable that has a common conductive layer around its conductors for E-field/EMF shielding - does not pick up EMF. The portion of cable that leads from the Voltek™ in the cab to the antenna on the boom of your equipment is shielded cable in order to give more accurate E-field readings.

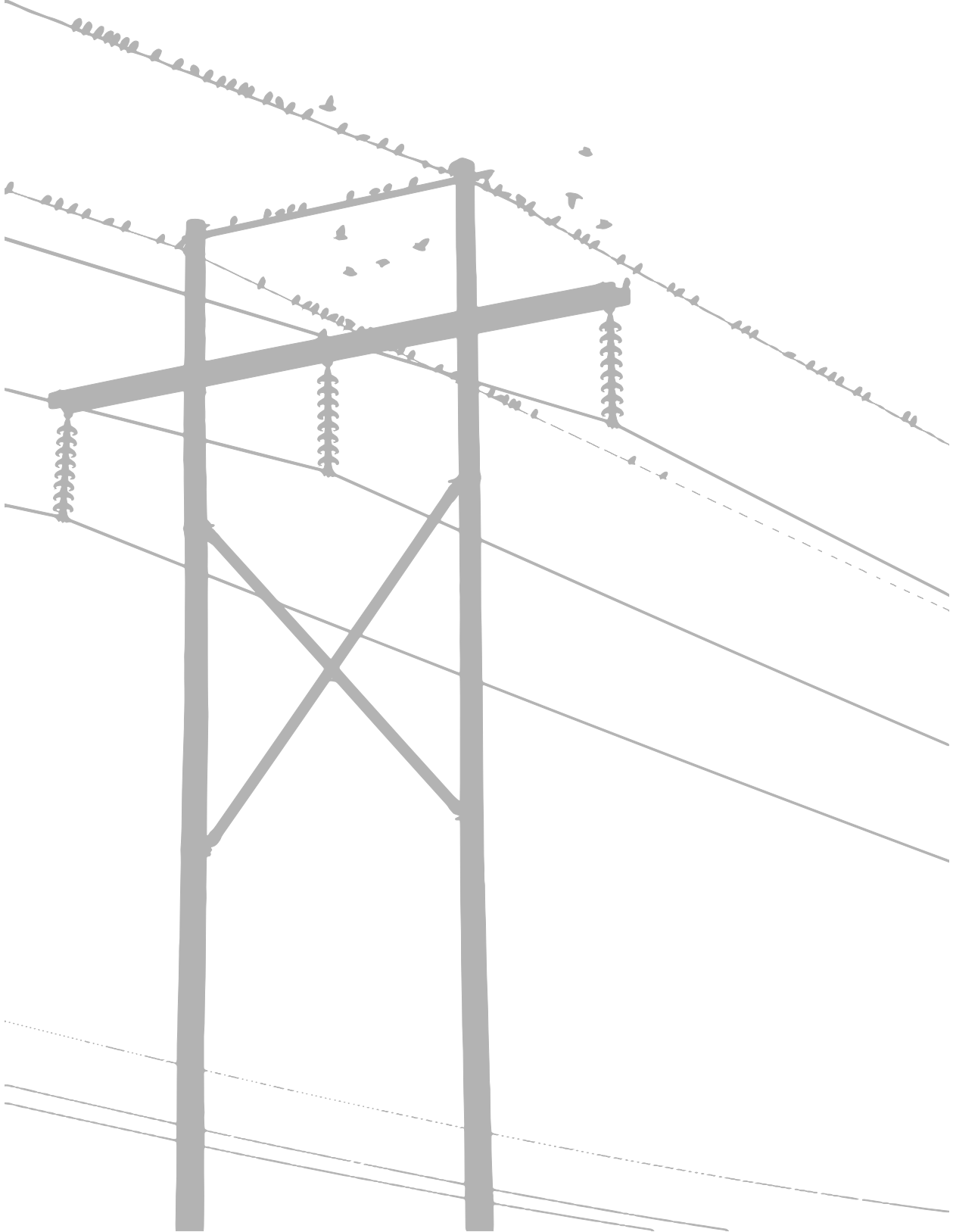
Unshielded antenna, cable or conductor: A cable that does not have a metallic or conductive protective layer and is susceptible to EMF properties

The antenna cable (linear wire antenna) installed on your equipment is unshielded in order to detect the E-field.

Unshielded antenna: A cable that does not have a metallic or conductive protective layer and is susceptible to EMF properties

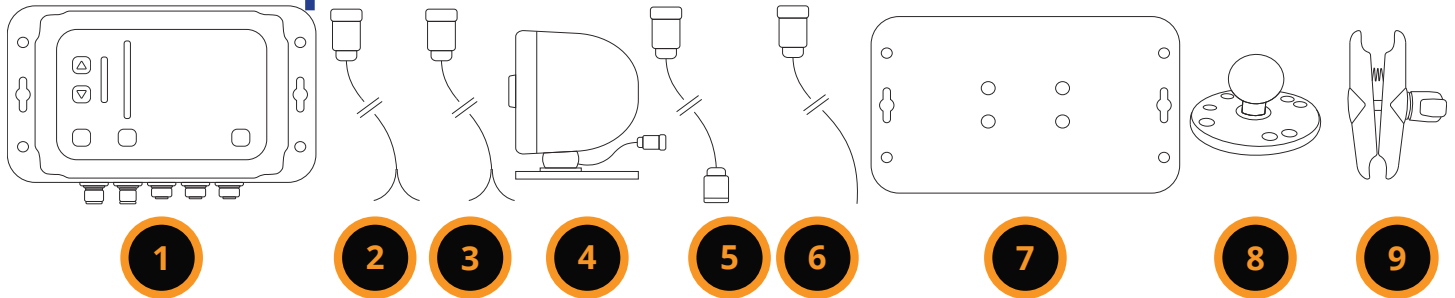
Distribution power line: Power lines used over shorter distances and lower voltage electricity transportation. Commonly used within and urban area.

Transmission power line: power lines used to transport high voltages from where it is generated to where it can be used and distributed



09 | INSTALLATION

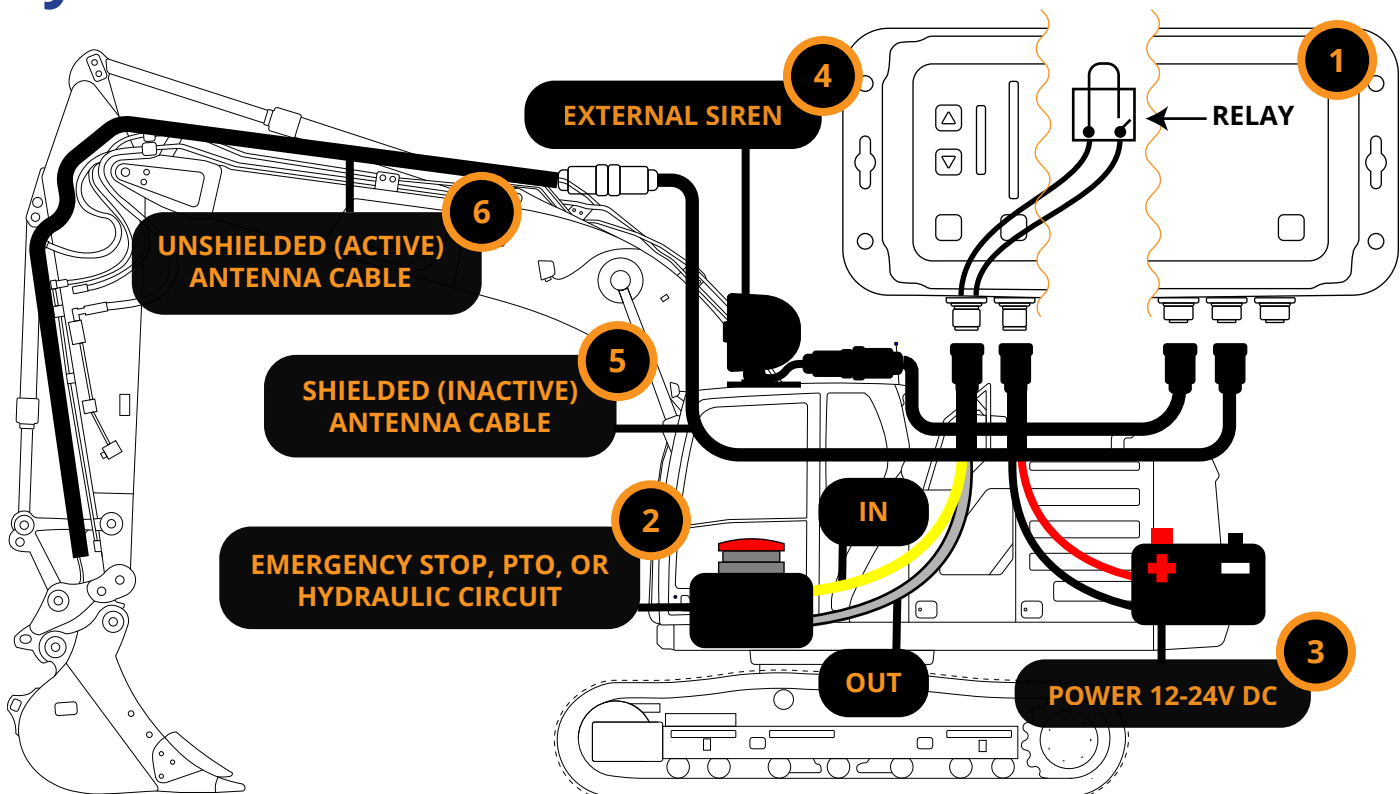
Included parts/assemblies



1. VOLTEK 2™
2. Estop/Shutdown cable (optional)
3. Power cable
4. External siren (optional)
5. Antenna cable - inactive (shielded)
6. Antenna cable - active (unshielded)
7. Mounting bracket - adapter plate (optional)
8. Mounting bracket - (optional) RAM® Round Plate with Ball (RAM® Part #: RAM-B-201U-A)
9. Mounting bracket - (optional) RAM® Double Socket Arm - B Size Short (RAM® Part #: RAM-B-201U-A)



System overview



Installation instructions

- 1 Voltek™**
 Plug power cable into connector on bottom of the main unit and route to a 12-24V power source on your equipment. A 5A fuse is required for connections directly from the battery.
- 2 E-Stop activation/Electric over hydraulic control shutdown cable (Optional)**
 Plug E-Stop/Shutdown cable into main unit. Thread the connector clockwise until tight. Route cable to system (Hydraulic controls or machine E-Stop) to be affected by this function. Splice into system. This creates a loop that is controlled with a relay in the main unit. When SHUTDOWN is indicated, the relay opens breaking the continuity of the integrated system causing the equipment to stop or shut down.
- 3 Power Cable**
 Plug power cable into connector on bottom of the main unit and route to a 12-24V power source on your equipment. A 5A fuse is required for connections direct to the battery.
- 4 External Siren (Optional)**
 Mount the external siren in desired location (multiple mounting options available). Plug cable into connector on bottom of the main unit and route the cable to external siren and plug in.
- 5 Shielded/Inactive Antenna Cable**
 Plug shielded antenna cable into connector on bottom of the main unit. This portion of the antenna connects to the active/unshielded antenna on the boom of your equipment. The shielded antenna cable does not detect E-field. Route cable from main unit outside of cab to the base or the boom or where you want the active antenna to begin.
- 6 Unshielded/Active Antenna Cable (Linear Wire Antenna)**
 Plug unshielded/active antenna cable into shielded antenna cable end. Install the antenna cable along the boom, on the topmost portion when possible. Run the antenna the entire length of boom and cut to appropriate length. The antenna should never be less than 10' in length. Strip back antenna cable jacket (approx 1") at the end of the antenna, exposing both internal wires. Strip internal wires (18 gauge) and terminate together.

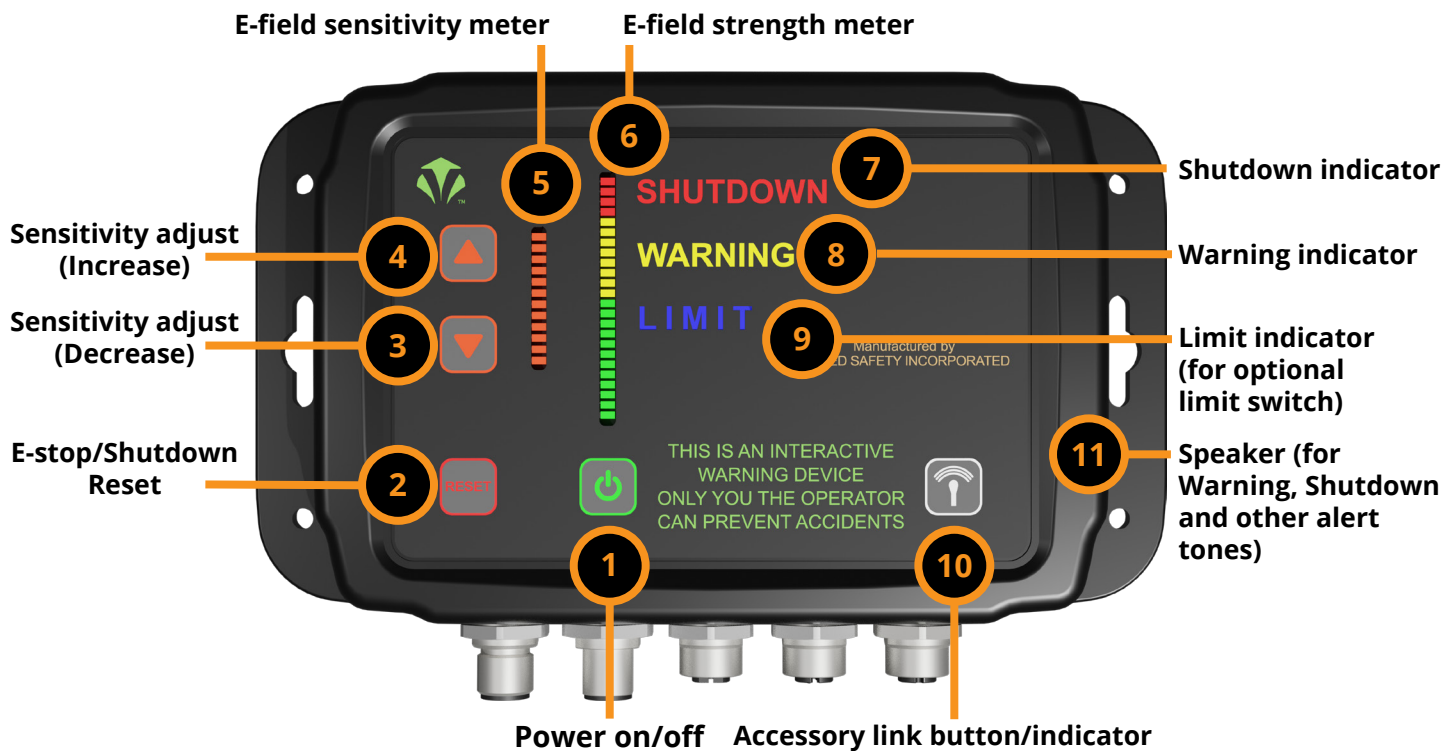
Important Note:

The two internal wires must be terminated together forming a loop. This is required in order to have correct functionality and to be able to alert the operator of an antenna fault if the cable is cut or damaged.



- 7**
- 8**
- 9 Mounting Bracket Components (optional)**
 Multiple mounting bracket options available. Contact for more details.

Controls and Operation



1. Power on/off

2. E-stop/Shutdown Reset Button: Press and hold to reactivate equipment if in SHUTDOWN (if installed)

3. & 4. Sensitivity adjust: Press and release for small adjustments - press and hold for faster/larger adjustments

5. Sensitivity meter: Indicates the set sensitivity level of the system

6. E-Field meter: Indicates the relative strength of the E--field based on the sensitivity level

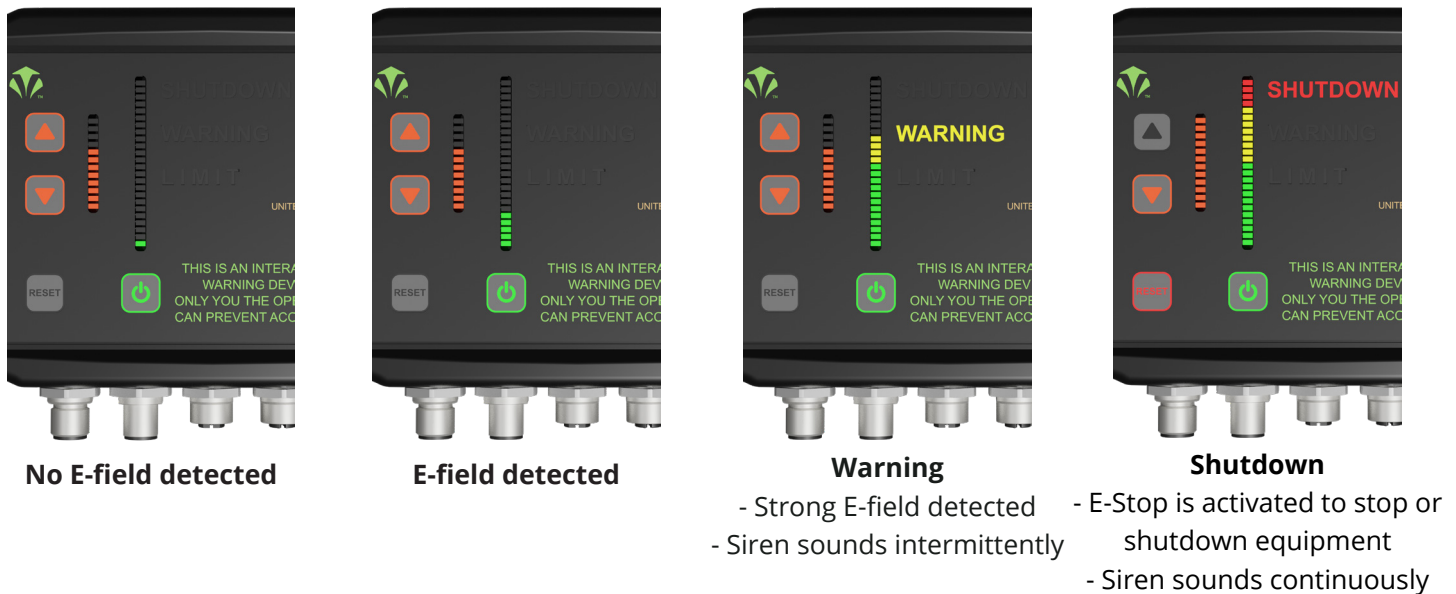
7. SHUTDOWN indicator

8. WARNING indicator

9. LIMIT (Optional): Indicates that external limit switch has been activated

10. Accessory link and status indicator: Links Voltek™ to optional accessories/displays link status of accessories

The diagrams below shows the display as it progresses from no E-field detected to SHUTDOWN. Notice in the last picture the RESET button is illuminated. If shutdown controls are installed on your equipment the reset button must be pressed and held to reactivate and move safely away from the power lines.



How to use your system

1. Power on

If powered by your equipment, the Voltek™ it will turn on as soon as it has power. If for some reason the system has been turned off, hold the power button **1** until it turns on (approx 3 seconds).

2. System self test

After power up, the Voltek™ conducts a system and antenna test. Three quick chirps **11** sound and the display will show any detected E-Field if no faults are detected.

3. Alert mode - Initial discovery and alert of nearby power lines

Next the system will default to maximum sensitivity in order to detect any nearby power lines. If the E-Field meter indicates green, it is assumed that you are a safe operating distance from power lines. If either WARNING or SHUTDOWN are displayed and the siren begins to sound, stop immediately to assess the situation. If it is safe to do so, slowly and carefully move equipment away from power lines-press and hold RESET button (2) if necessary.

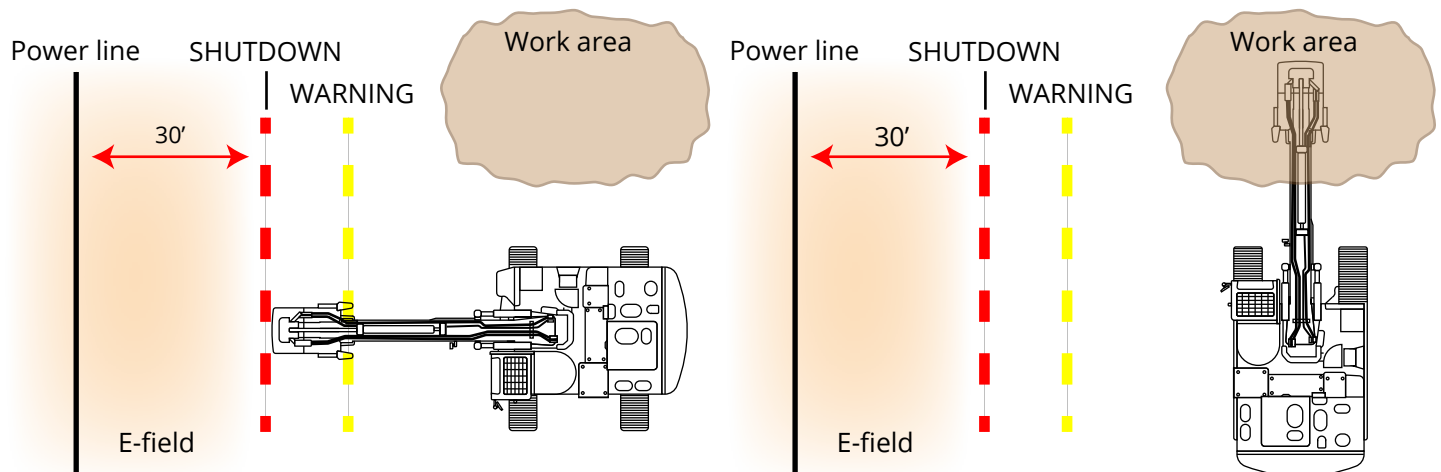
4. Adjusting the sensitivity - setting WARNING or SHUTDOWN

The Voltek™ can be used in conjunction with other safety measures to provide an indication that your equipment is encroaching upon a set warning zone.

1. Move equipment to the location that you wish to indicate either WARNING or SHUTDOWN (Never closer than 20' from power line).

2.) Adjust the sensitivity up or down **3** **4** until either WARNING or SHUTDOWN is indicated.

3.) The sensitivity of your system is now set. The E-Field intensity detected in that particular location/position is rerecorded. If you move or boom away and then return back to the original position, the system should indicate WARNING or SHUTDOWN according to the previous settings. If your equipment is moved or reconfigured significantly, you will have to reset your warning and shutdown zones.



In this scenario an excavator is working near power lines. The operator wants to set the SHUTDOWN threshold at a measured distance of 30'. The operator is aware of the power lines and they are properly marked with signage. First, he slews the boom to a measured distance of 30'. He then adjusts the sensitivity up or down until the display indicates "SHUTDOWN". The operator then rotates the boom away from the power line and notices the E-field meter drop from SHUTDOWN to WARNING and then into the green safe working area. If he rotates towards the power line, the meter will progress from the green "safe" zone into WARNING and then again into SHUTDOWN. If the excavator travels away from the location at which the sensitivity levels were set, he will have to reset the SHUTDOWN threshold again.

5. Moving out of SHUTDOWN if E-Stop/Shutdown function is integrated with machine

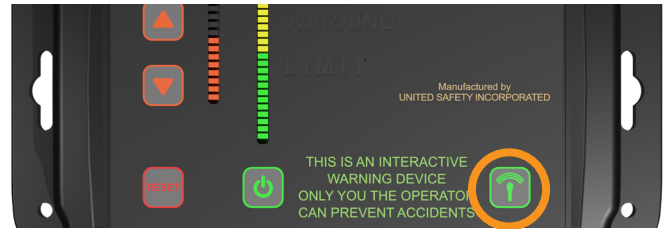
If your the system is integrated with your E-stop, PTO, hydraulic controls or any other system on your equipment, the Voltek™ will break continuity by opening the internal relay when SHUTDOWN is indicated on the display. This will stop movement, limit functionality or shut down your equipment - depending on how it is installed. To reactive your equipment to move away from the power line-the reset button **2** must be held down continuously until you are out of the SHUTDOWN zone on the meter.

6. Linking optional accessories

Press and hold the link button **10** until it flashes blue. Repeat steps with the corresponding accessory. Any products that are in link mode (flashing blue) will automatically link and the button will turn green when linking is complete.



System ready to link when button is blue



System is linked when button is green

7. Limit

If an external limit switch is being used the Limit indicator will light up. When switch is engaged the reset button must be pressed and held to reactivate equipment.

Troubleshooting/ Maintenance

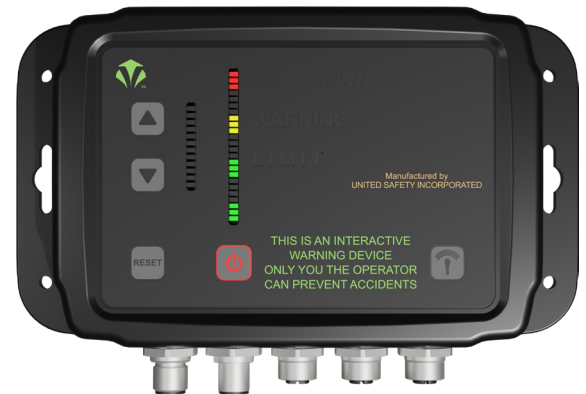
Problem:

Display is showing dashed lines

Check:

The system will indicate that there is a problem with the antenna with dashed lines and periodic siren tones (see diagram). When this occurs the antenna has either been unplugged or has been cut or severed. Carefully check all components and repair or replace immediately.

Note: The antenna must be terminated at the end (see installation instructions) forming a loop. The system constantly checks antenna continuity. If continuity is broken (damaged wire) the antenna fault will be shown.



Dashed lines and a periodic siren tone indicate an antenna fault

Problem:

System is going into WARNING or SHUTDOWN even though power lines are not close

Check:

Even if there are power lines nearby the system might still be detecting them. The System is designed to detect a wide range of voltages- max sensitivity is capable of picking up E-field from power lines several hundred feet away. Check to make sure that the sensitivity is not set to maximum. Turn down sensitivity as needed.

- Before each use check cable connections, cable condition, and batteries of any accessories. If anything is damaged-contact us for replacement parts.
- Keep main unit out of direct weather if possible. The enclosure is rated against dust and water ingress (IP65), however standing water on the unit an extreme conditions can eventually cause damage.
- Check for pinch points if using a linear wire antenna. Make sure the cable is not interfering with any pins, bushings, hydraulics or other moving parts.

15 | FREQUENTLY ASKED QUESTIONS

Does the system detect underground power lines?

No-underground power lines are heavily insulated by the earth and are not detectable by the Voltek Systems products.

Does it detect all overhead power lines and wires?

Although the system can detect voltages as low as 120V AC, the system is designed to work with power distribution and transmission lines rated at 7200V AC and above. Our system only detects live AC power lines and does not detect other wires such as cable or other telecommunications cables commonly found on power line poles.

Can I set a specific distance with this system?

The Voltek™ system measures E-field intensity - not distance. The system records the level of detected E-field that corresponds with that precise location. If a “shutdown” or “warning” zone is set by the user, it will reliably alarm at the same location-considering the equipment hasn't moved locations or the configuration has changed.

Can I trust a product like this to keep me safe?

Products such as ours have been used reliably for over 40 years to mitigate power line strikes. Yes-you can trust that this system will reliably detect power lines, however this system is not meant as a standalone preventative measure. Our power line warning systems should only be used as an additional tool to add to your safety program. It is not meant to replace training, safety procedures and situational awareness.

Is this system going to be something that I will have to mess with constantly while I am operating my equipment?

No. Our system was designed to be effective but not intrusive. As an equipment operator, you already have many things vying for your attention and our products are designed to not significantly add to your workload. Our system will require some interactions it will assist you with operating your equipment safely.

What kinds of equipment can this system be used on?

Our products have been used on excavators, dump trucks, telehandlers, cranes, side booms, vac trucks, mining haul trucks, concrete pump trucks, man lifts, and more. We can customize our products to reliably protect any kind of boomed or aerial equipment.

Does the system need to be periodically calibrated?

No. Our products work right out of the box. The only calibration required is adjusting the sensitivity levels according to the need of your specific job site or location.

5 YEAR LIMITED WARRANTY | 16



WARRANTY:

United Safety Incorporated ("USI") warrants your Voltek™ ("product") against defect in materials or workmanship under normal use, for five years from date of original retail purchase. USI will, at its option, repair or replace the product. This limited warranty is valid only to the original purchaser of the product, is not assignable or transferable to any subsequent purchaser or user, and applies only when the product is purchased through an USI or an authorized dealer or distributor and used within the United States ("U.S.") including U.S. Territories.

THIS LIMITED WARRANTY DOES NOT COVER:

1. Damage or normal wear and tear during the course of normal operation
2. Service trips to deliver, pick up, or install the product or for instruction on product use.
3. Correction of product installation.
4. Damage or failure caused by accidents, lightning, wind, fire, floods or other natural disasters
5. Damage or failure resulting from misuse, abuse, improper installation, repair or maintenance. Improper repair includes use of parts not approved or specified by USI.
6. Damage or failure caused by unauthorized modification or alteration to the product.
7. Damage or failure caused by incorrect electrical current and/or voltage
8. Cosmetic damage, including scratches, dents, chips or other damage to the product, unless such damage results from defects in materials or workmanship and is reported to USI within seven (7) calendar days from the date of delivery.
9. Damage or missing items to any, open box, discounted, or refurbished product.
10. Product where the original factory serial numbers have been removed, defaced or changed in any way.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING AND WITHOUT LIMITATION TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT ANY IMPLIED WARRANTY IS REQUIRED BY LAW, THIS WARRANTY IS LIMITED IN DURATION TO THE TERM PERIOD EXPRESSED ABOVE. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY FOR THE CUSTOMER. NEITHER THE MANUFACTURER NOR ITS U.S. DISTRIBUTOR SHALL BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, OR PUNITIVE DAMAGES OF ANY NATURE, INCLUDING AND WITHOUT LIMITATION TO, LOST REVENUES OR PROFITS, OR ANY OTHER DAMAGE, WHETHER BASED IN CONTRACT, TORT, OR OTHERWISE.

CONTACT USI TO OBTAIN WARRANTY SERVICE & ADDITIONAL INFORMATION:

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