

# **WZRDnet<sup>®</sup>**

## **Repeater WRN-320(V)2**

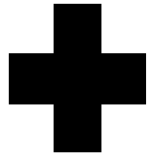
### **User Manual**

**Version 1.2.1**

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**5** SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

- 1** DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
- 2** IF POSSIBLE, TURN OFF THE ELECTRICAL POWER
- 3** IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL
- 4** SEND FOR HELP AS SOON AS POSSIBLE
- 5** AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION. REFER TO FM 21-11

## WARNING



## HIGH VOLTAGE

High Voltage is used in the operation of this equipment. Be careful when working near AC power distribution. Observe warning notes in this technical manual and warning decals on equipment. Death on contact may result if safety precautions are not observed.

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas. Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment.

Be careful not to come into contact with high-voltage connections or 115 volt AC input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

Do not be misled by the term “low voltage.” Voltages as low as 50 volts may cause death under adverse conditions.

For artificial respiration refer to FM 21-11.

## SHOCK WARNING

To avoid shock and damage to equipment, be certain the POWER switch is set to OFF position and the power cable is disconnected at the power source before disconnecting the signal cables.

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## SECTION 1: GENERAL INFORMATION

### 1. Introduction

This document forms the user manual for the WZRDnet Repeater Model WRN-320(V)2. As such it presents a detailed equipment description including the physical characteristics and operational instructions for the Repeater.

### 2. Features

WZRDnet is a low-power wireless ad-hoc mesh network that provides secure voice and data communications without the need for infrastructure (i.e., no cell towers or satellites required). In WZRDnet each device is a router, relaying calls from originator to destination. Unlike other mesh networks, this architecture does not employ central routing tables thus avoiding single points of failure. WZRDnet is a low-power network that allows its light-weight handsets to provide service for 38 hours between battery recharges. WZRDnet is a true end-to-end packet switched network which facilitates straight-forward interoperability with Wide Area Networks (WANs) supporting peer-to-peer communications and direct dialing. This is accomplished via the WZRDnet Gateway which provides connectivity with any available IP network (e.g., Wi-Fi, VOIP, etc.), or analog network (i.e., PSTN).

The WRN-320(V)2 Repeater design was focused on ease of use and minimal set-up requirements. This reduces training time and facilitates fast network configuration.

## SECTION 2: EQUIPMENT DESCRIPTION

### 1. Repeater Characteristics

#### Physical Characteristics

- Dimensions:
  - Repeater: 3.3W x 6.5L x 1.62H inches
  - Antenna length: 6 inches
- Weight: 0.8 lbs

#### Internal Components

- 2.4 GHz Radio Transceiver
- Real-Time Clock
- Rechargeable 3500mAh Lithium Ion Battery Pack

#### External Connectors

- Mini-USB Port
- Reverse SMA Antenna Connector
- 90 VAC - 264VAC Inlet.

#### Additional Software

- USB to Serial Driver
- WZRDnet Command Center



Figure 2.1.1 WRN-320(V)2 Repeater

## SECTION 3: REPEATER POWER

### 1. Repeater Power

Main power to the WRN-320(V)2 is provided by either an internal rechargeable 3500mAh Lithium Ion battery or by an external power source connected to the Relay's AC Inlet. The battery pack is constantly monitored and protected by an embedded battery gauge circuit. It is recharged whenever an external power source is connected to the AC inlet. **The mini-USB port is for troubleshooting and not for charging.** An internal charger circuit determines whether the power is being supplied by battery pack or through an external power source.

The Relay's on-board voltage regulator provides one output of 3.3VDC.

#### 1.1 Battery Charging

The battery pack is recharged via the AC inlet. This can be done by plugging in the AC cord.

#### 1.2 Battery LED

The current state of the Repeater's battery pack status is displayed with an LED on the side of the device. The user can use the LED to monitor the voltage and be alerted when the battery is low. When the battery voltage drops below a predetermined level, the Repeater will shut down automatically to save power.

LED Status	Minimum Voltage	Maximum Voltage
Not Illuminated	3.8v	
Solid	3.5v	3.8v
Flashing	3.3v	3.5v
Automatic shutdown	0	3.3v



## SECTION 4: MODES OF OPERATION

### 1. Start-up Mode

The Repeater enters Start-up Mode when the battery pack is charged and the power switch is flipped. In the absence of a charged battery pack, the Repeater enters Start-up Mode when an external power source, i.e., a wall charger is connected to the AC Inlet.

When Start-up Mode is entered, the microcontroller checks the condition of the battery supply to determine if it should proceed to Power-on Mode.

### 2. Power-on Mode

The Repeater is always operating in Power-on Mode when it is running at maximum clock frequency with all the peripherals fully functional.

### 3. Power-off Mode

The Repeater enters Power off Mode by a controlled power-off sequence or by an uncontrolled power off sequence. Both sequences will cause the main regulator to be disabled as the voltage supply disappears, thus the Repeater will remain off.

#### 3.1 Controlled Power off

The WRN-320(V)2 can be powered off by flipping the power switch on the device.

#### 3.2 Uncontrolled Power-off

The Repeater is powered off automatically if the battery voltage falls below a predetermined threshold or if the battery is removed from the Repeater. The Repeater is also powered off when the battery gauge disconnects the battery due to over temperature, over voltage, or under voltage.

Return to the Power-on Mode occurs when an external power source, i.e., a wall charger is connected.

### 4. No Supply Mode

The Repeater enters this mode if the battery pack is completely depleted and the voltage level falls below the undervoltage threshold.

Return to the Power-on Mode occurs when an external power source, i.e., a wall charger is connected.

## SECTION 5: NETWORK COMMUNICATIONS

### 1. Overview

The networking technology employed by WZRDnet is based on the IEEE 802.15.4 protocol. Each Wireless Mesh Network (WMN) is defined with a unique WMN Identifier (WMN ID).

### 2. Mesh Networking

WZRDnet supports mesh routing, allowing data packets to traverse multiple nodes in order to reach the destination node. This allows nodes to be spread out over a large region while still supporting communications among all nodes in the network.

### 3. Router

A Router must associate with a WMN before it can transmit, receive, or route data. In order to associate with a network the node must be provided the following network information:

- Operating channel
- WMN ID
- Network Key (for encryption only).

Handsets, Repeaters and Gateways are all considered Routers in the Mesh Network.

### 4. Ad-Hoc Network

WZRDnet is an ad-hoc network that is comprised of self-configuring handsets, Repeaters and gateways. These devices either form a new network or associate with the nearest available network. This encourages large-scale networks with minimal infrastructure support required.

#### 4.1 Network Formation

A network is formed by selecting an operating channel and WMN ID. Encrypted networks require assigning a network key for nodes to decipher data.

##### 4.1.1 Operating Channel

A WMN can operate on twelve channels from 1 to 12. The channel can be changed in cases of noise or excessive traffic through the WZRDnet Command Center software. For instructions on changing the Channel see the WZRDnet Command Center User Manual.

#### **4.1.2 WMN ID**

The WMN ID is used to uniquely identify a WMN on a specific channel. Multiple WMNs can operate independently on the same channel as long as each is assigned a unique WMN ID. For instructions on changing the WMN ID see the WZRDnet Command Center User Manual.

#### **4.1.3 Network Key**

The network key is used to encrypt and decrypt packets on a secure network. The Repeater must have the correct key in order to decipher packets.

### **4.2 Associating with a WMN**

WZRDnet Repeaters include a factory preset WMN ID and operating channel. The operating channel and the WMN ID can be changed with the WZRDnet Command Center software. For instructions on changing the Node WMN ID see the WZRDnet Command Center User Manual.

## **5. Network Addressing**

The 802.15.4 protocol specifies a 64-bit MAC address. A Node Identifier String can also be specified as a simple way to route packets to the underlying address.

### **5.1 64-bit MAC Address**

Each node contains a unique IEEE defined 64-bit MAC address. The 64-bit address uniquely identifies a node and is static.

### **5.2 Node Identifier String (NI)**

A node can be assigned a character based Node ID. The Node ID can be used to route messages to a specific node. The Node ID will then be linked to the underlying MAC address for packet transmission. For instructions on changing the NI String see the WZRDnet Command Center User Manual.

## **SECTION 6: SECURE COMMUNICATIONS**

### **1. Encryption**

The WZRDnet system can be set for secure or non-secure communication. If security is enabled, the network employs 128-bit AES encryption with a Network Key. Only devices that have the same security key can communicate on the WMN. Routers that associate with a secure WMN must obtain the correct security key.

## 1.1 Network Key

The Network Key is used to apply 128-bit AES encryption to all network level transmissions.

## 1.2 Key Update

The Network Key can be upgraded from WZRDnet Command Center software. For instructions on changing the Network Key see the WZRDnet Command Center User Manual.

# SECTION 7: OPERATING INSTRUCTIONS

## 1. Network Association

### 1.1 Change Channel

If a channel becomes crowded it is possible for a Repeater to switch to a new channel with the WZRDnet Command Center software. For instructions on changing the CH String see the WZRDnet Command Center User Manual.

### 1.2 Assigning Node Identifier Strings

Each WRN-320(V)2 Relay comes with a factory set Node Identifier String. The network administrator can change the Node Identifier String with the WZRDnet Command Center software. For instructions on changing the Node Identifier String see the WZRDnet Command Center User Manual.

## 2. Getting Started

### 2.1 Buttons and Connectors



Figure 7.2.1 External Power Connection

## 2.2 Battery Voltage Indicator

The battery voltage indicator LED is located at the bottom of the Repeater. Low voltage will result in a solid red LED. Extremely low voltage is indicated when the LED begins to flash. The Repeater will power off when the voltage drops below the minimum required threshold. When the light is not illuminated it is fully charged.

## 2.3 Charging the Battery

Charging the battery can be performed by AC wall adapter. Repeater operation is permitted while charging. Use only approved chargers with the WRN-320(V)2.

### 2.3.1 AC Wall Adapter Charging

1. Attach the AC wall adapter to the mini-USB port on the bottom of the Repeater.
2. Attach the AC wall adapter to a wall outlet.

## 2.4 Turning ON/OFF

To turn the Repeater on and off simply flip the power switch on or off.

## SECTION 8: TROUBLESHOOTING

### 1. Mini-USB Port

The WRN-320(V)2 includes a mini-USB port for troubleshooting. The Operating Channel, WMN ID, and Network Key can be changed wirelessly via the WZRDnet Command Center. If a system administrator cannot access the WRN-320(V)2 wirelessly it is also possible to connect to the Repeater via the mini-USB port.

In order to connect attach the Repeater to a PC via a mini-USB to USB cable. Open WZRDnet Command Center and click on Network in the menu bar. To change Repeater information follow the instructions in the WZRDnet Command Center User Manual



Figure 8.1.1 Mini- USB Port

## SECTION 9: INSTALLATION INSTRUCTIONS

The WRN-320(V)2 has mounting holes on both sides of the Repeater for installation along a wall. The WRN-320(V)2 must be installed horizontally along a wall with the antenna bent at a right angle as shown in Figure 9.1.

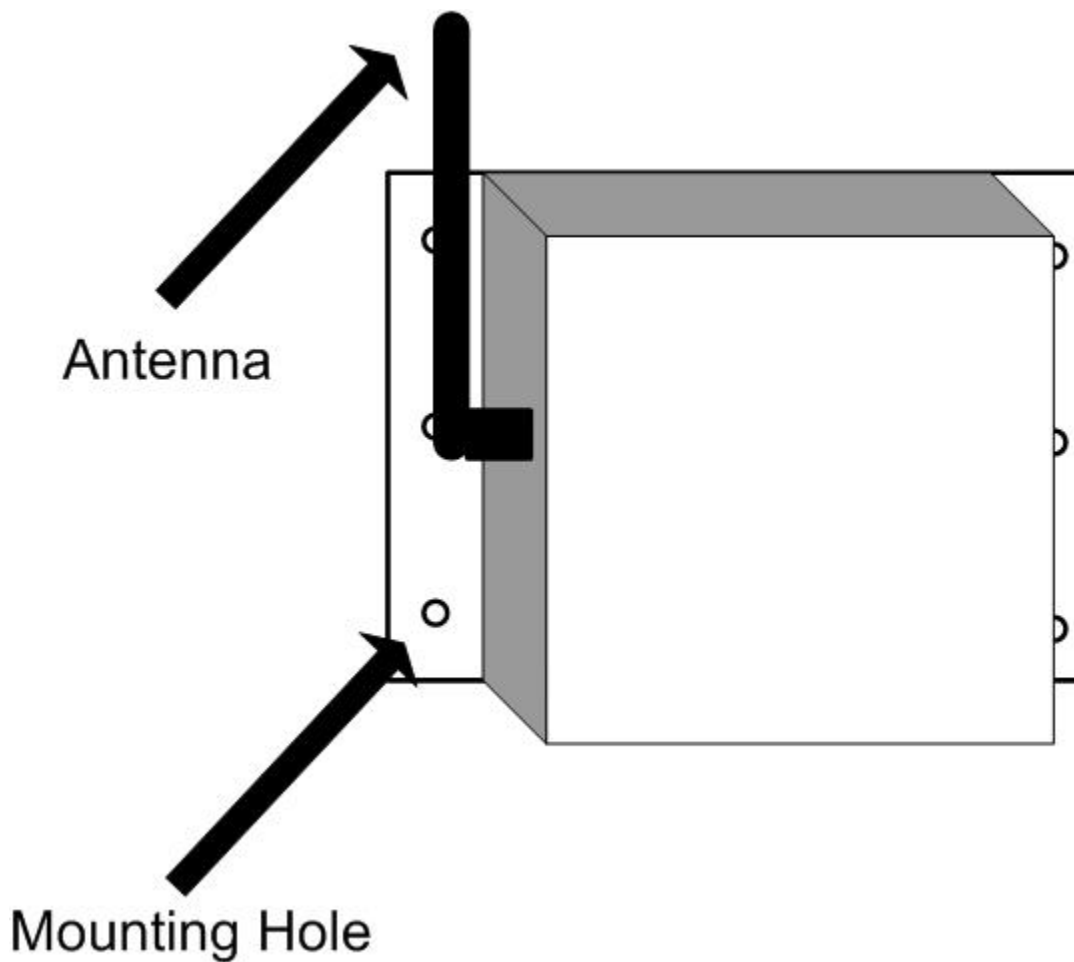


Figure 9.1 WRN-320(V)2 Installation

## SECTION 10: PRODUCT AND SAFETY INFORMATION

### 1. WRN-320(V)2 Safety Instructions



Do not disassemble, crush, open, bend, deform, microwave or puncture Handset.

Avoid dropping Repeater.

Avoid excessive pressure on Repeater.

Do not expose to extreme temperatures, liquid, moisture, or high humidity.

Repeater contains small parts which may present a choking hazard.

Keep metal objects away from connectors and battery terminals.

Do not expose to open flames.

Do not dispose of Repeater in fire or water.

Recycle or dispose of Repeater according to local regulations.

Do not use harsh chemicals, aerosol cleaners or solvents to clean the Repeater

Avoid dramatic shifts in temp as will cause moisture. Allow sufficient time for moisture to evaporate before using the Repeater.

Avoid pushing objects into the Repeater as this action might cause a short circuit, a fire, or electric shock. Never force a connector into a port.

Do not disassemble Repeater or accessories.

Do not repair or service the Repeater yourself.

Turn your Repeater OFF where posted notices so require.

Failure to observe all safety instructions will void Warranty.

#### 1.1 Battery Information

The WRN-320(V)2 contains rechargeable Lithium Ion batteries. Lithium Ion batteries pose a risk of fire, explosion, leakage, or other hazard. Replace only with approved batteries. Recycle or dispose of used batteries according to local regulations.

Use only approved batteries and chargers. Use of an unapproved battery or charger may present a risk of fire, explosion, leakage, or other hazard.

Do not disassemble, crush, open, bend, deform, microwave or puncture battery.

Avoid dropping battery.



Keep metal objects away from battery terminals.

Do not expose battery to extreme temperatures, fire, direct sunlight, liquid, moisture, or high humidity.

Do not use batteries that appear damaged, deformed, discolored, rust or emits foul odor.

In the event the battery leaks and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated, the battery fluid could cause damage to the eye.

Do not use charger if the power cord or plug has become frayed or damaged; The charger is exposed to rain, liquid, or excessive moisture; The charger has become damaged.

## **1.2 Antenna**

Use only approved replacement antennas. Unauthorized antennas or modifications could damage your Repeater or result in a violation of wireless regulations.

Do not use any Repeater that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.

## **1.3 Health and General Use**

Repeater is designed for mobile and fixed uses. Repeater is not designed for portable use and should be kept at least 20cm away from the body.

Avoid use on Aircraft. RF Interference might disrupt instrumentation, communication and performance; Might disrupt the network; Might be illegal. Turn your Repeater OFF before boarding an aircraft. Always request and obtain prior consent and approval of an authorized airline representative before using your Repeater aboard an aircraft. Always follow the instructions of the airline representative whenever using your Repeater aboard an aircraft, to prevent any possible interference with airborne electronic equipment

Do not place the Repeater in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a Repeater is placed in the air bag deployment area and the air bag inflates, the Repeater may be propelled with great force and cause serious injury to occupants of the vehicle.

Do not use in explosive atmosphere in presence of explosive fumes, explosive dust, or other explosive chemicals. Sparks could cause fire or explosion resulting in serious injury or death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fueling areas such as gasoline or petrol stations; below deck on boats; fuel or chemical transfer or storage facilities; vehicles using liquefied petroleum gas (such as propane or butane); areas where the air contains chemicals or particles, such as grain, dust, or metal powders; and any other area where you would normally be advised to turn off your vehicle engine.

**Blasting areas:** To avoid interfering with blasting operations, turn off all wireless connections on the Repeater when in a “blasting area” or in areas posted: “Turn off two-way radio”. Obey all signs and instructions.

Use of Repeater when driving, riding or walking is not recommended and is illegal in some areas. Comply with local laws and regulations regarding use of wireless Handsets when driving, riding or walking.

**Pacemakers:** The Advanced Medical Technology Association (AdvaMed) recommends that a minimum separation of 6 inches (15 centimeters) be maintained between a handheld wireless handset and a pacemaker.

These recommendations are consistent with those of the U.S. Food and Drug Administration.

Persons with pacemakers should:

- ALWAYS keep the handset more than 6 inches (15 centimeters) from their pacemaker when the handset is turned ON.
- Not carry the handset in the breast pocket.
- Use the ear opposite the pacemaker to minimize the potential for interference.
- Turn the handset OFF immediately if you have any reason to suspect that interference is taking place.

**Hearing Aids:** Some digital wireless radios may interfere with some hearing aids. In the event of such interference, you may want to consult your hearing aid manufacturer to discuss alternatives.

This Repeater may cause RF Interference with other personal medical equipment. Consult manufacturer of medical equipment to determine if it is adequately shielded

Do not rely on this Repeater during emergencies. All wireless devices operate using radio signals which cannot guarantee a connection at all times due to network availability or environmental interference.

## SECTION 11: CERTIFICATIONS

### 1. Certifications

FCC ID: XAYWRN310V2  
IC ID: 9251A-WRN310V2

#### 1.1 FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been 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 instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna
- Increase the separation between the equipment and 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: Changes or modifications not expressly approved by TELEGRID Technologies, Inc. could void the user's authority to operate the equipment.

#### 1.2 Industry Canada (IC)

This device complies with the Class B limits for radio noise emissions as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICE-003 of Industry Canada. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. This Category II radiocommunication device complies with Industry Canada Standard RSS-310. Ce dispositif de radiocommunication de catégorie II respecte la norme CNR-310 d'Industrie Canada. This device complies with RSS 210 of Industry Canada under certification number 9251A-WRN310V2.

## SECTION 12: LEGAL NOTICES

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

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The Agreement shall entitle Customer to use the Software with the hardware communication devices purchased from TELEGRID (“Hardware”) to facilitate communications between the Hardware. The Customer is also entitled to use the Software with other equipment to provide a communication interface between the Hardware and other equipment, provided however, that Customer may not modify the Software in any manner. Customer may not re-sell, lease, license or distribute the Software by themselves or as part of any collection, product or service. Customer may not copy, in whole or in part, Software or documentation; modify the Software; reverse compile, reverse engineer or reverse assemble all or any portion of the Software.

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diagnostics. This software maintenance is not included with the Software and is available for an extra fee.

Software integration includes the creation, design, implementation, etc. of the Software. This software integration is not included with the Software and is available for an extra fee.

This Agreement will continue in perpetuity until terminated by either Party upon 90 days prior written notice, unless otherwise stated. If the Customer does not meet its obligations as set forth in this Agreement then TELEGRID shall have the immediate right to terminate this Agreement. In addition, this Agreement may be terminated by TELEGRID without notice based on any breach of the provisions of the hardware agreements for the equipment supplied by TELEGRID. Customer's obligation to pay all charges that have accrued will survive any termination of this Agreement.

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If any provision of this Agreement or any construction or application of any provision of this Agreement is held to be unenforceable or invalid for any reason, then the validity of all the remaining provisions shall not be affected and the validity of any remaining construction or application of the provision shall not be affected, and the rights or obligations of each of the parties hereto shall be construed and enforced as if the Agreement did not contain such invalid provision or, as the case may be, invalid construction or application of such provision; provided, however, that such resulting construction and enforcement shall be generally consistent with the basic purpose of this Agreement. For this purpose, "provision" refers to any word, phrase, dollar amount, part, term or other portion of this Agreement.

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### **3. Limited Warranty**

TELEGRID TECHNOLOGIES, INC. ("TELEGRID") warrants to the Customer that the equipment to be delivered hereunder will be free from defects in material and in workmanship for a period of one year ("Warranty Period") from the date of delivery by TELEGRID unless extended at the time of purchase as evidenced by adequate documentation.

The Customer must notify TELEGRID within 30 days of any claimed defect. Any equipment which becomes defective due to material or workmanship during the Warranty Period will be promptly repaired or replaced by TELEGRID at its option using either new or like new equipment.

TELEGRID warrants the items repaired or replaced under this clause will be free from defects in material and workmanship for ninety (90) days from date of delivery by TELEGRID, or the balance of the Warranty Period for the equipment, whichever is longer. Equipment found not to be defective will be

returned to the Customer, freight charges collect, and charges will be forwarded to the Customer for inspection and test time. Transportation charges for equipment found to be defective within the Warranty Period will be paid by TELEGRID to and from the original point of acceptance. TELEGRID's liability to the Customer shall not in any case exceed the cost of correcting defects in the equipment as provided herein or the price paid to TELEGRID by the Customer, whichever is less.

TELEGRID will not warrant any equipment if, during the Warranty Period the Customer: (a) fails to follow applicable operation, maintenance, or environmental requirements described in any of the manuals and other materials provided to the Customer, including without limitation product bulletins; (b) makes additions to, alters, modifies, enhances, repairs or disassembles the equipment (itself or using a third party) without TELEGRID's written consent; (c) mishandles, abuses, misuses or damages the equipment (either itself or by others doing so).

TELEGRID will not warrant any equipment damaged due to fire, explosion, power irregularities, power surges, Acts of God (including, without limitation, earthquakes, rains, floods or lightning), or any other cause not attributable to TELEGRID.

Upon expiration of the Warranty Period, all warranty liability shall terminate. The foregoing shall constitute the sole remedy of the Customer and the sole liability of TELEGRID and shall be in lieu of any other Warranty, implied, statutory, or otherwise, including the Warranty of Merchantability. TELEGRID SHALL NOT BE LIABLE FOR INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES.

#### **4. Jurisdiction**

This Customer's rights and obligations shall be governed and construed pursuant to the laws of the State of New Jersey; (b) Any lawsuit concerning this product shall be brought in a court of competent jurisdiction in Essex County, New Jersey; (c) Customer consents to be subject to the jurisdiction of the state or federal courts located in Essex County, New Jersey; (d) Customer may not assign this Agreement except with TELEGRID's prior written approval; (e) No action may be brought by the Customer more than one year after the cause of action has occurred.