

Wireless RS-485

Models:
890-00606

Installation manual

895-00694

Version 00

Date: 02-01-16

AgriAlert



895-00694

Use of this Equipment Information page will help you identify your equipment in the case that you need to notify the company. For this reason, this information should be filled out and kept on record.

Equipment Information

Model Number: _____

Serial Number: _____

GSI Electronics

Canada

Phone:

Fax:

Date Purchased: _____

Dealer Name
and Phone Number: _____

All information, illustrations, photos, and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

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NOTES

1 Introduction

Topics Covered in this Chapter

- Contact information
- General safety precautions and usage
- Telecommunication advice
- Terms of use
- What to look for when you receive your system
- System overview
- Guidelines on the ideal location for installation
- Clearance around the Wireless RS-485
- Correctly supporting and routing cables
- Grounding recommendations for the system

Contact information

Manufacturer

GSI Electronics

5200 Armand Frappier

Saint-Hubert, Qc

Canada

J3Z 1G5








Warranty is void if this product is used in a manner not specified by the manufacturer. Every effort has been made to ensure that this manual is complete, accurate and up to date. The information contained in this manual is subject to change without notice.


General safety precautions and usage

Safety symbols

	Warning. Read the following text carefully; it contains important information which, if ignored, may cause the controller to operate improperly
	High Voltage. Hazard of electrical shock. Read the message and follow the instructions carefully
	Direct current (DC)
	Alternating current (AC)

	<p>Protective Earth Ground Terminal, Primarily used for protective earth terminals.</p> <p>Terminal connected to conductive parts of a device for the purpose of safety and is intended to be connected to an external system for protective grounding</p>
	<p>Functional Ground Terminal Primarily used for functional earth terminals which are generally associated with test and measurement circuits. These terminals are not for safety earthing purposes but provide an earth reference point.</p>
<p>NOTE:</p>	<p>To emphasize points or remind readers of something, or to indicate minor problems in the outcome of what they are doing</p>
	<p>Failure to follow the instructions can result in damaged equipment or loss of data or potential problems</p>
	<p>Failure to follow the instructions carefully can result in serious or fatal injury</p>
<p>IMPORTANT:</p>	<p>The following information is of great significance and must be read carefully</p>
	<p>Read the following text carefully; it contains important information which, if ignored, may cause the controller to operate improperly</p>
<p>Tip</p>	<p>Shortcut or a faster way of getting to an end result</p>

Safety messages



Turn off the main electrical disconnect switch prior to servicing any of the system's Boxes. Failure to do so might lead to serious injury or death.

Always use extreme caution when measuring voltage or performing procedures that require a module to be powered on.

IMPORTANT: *Ensure all your settings are properly configured. Improper configuration of your settings may generate false alerts or fail to generate an alert.*

Electrostatic discharge prevention when manipulating a printed circuit board (PCB)

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. ESD damage occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Always follow ESD on a PCB-prevention procedures when you remove and replace components. Ensure that the chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the grounding clip to an unpainted surface of the chassis frame to safely ground unwanted ESD voltages. To guard against ESD damage and shocks, the wrist strap and

cord must operate properly. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

For safety, periodically check the resistance value of the antistatic strap, which should be between 1 and 10 megohm (Mohm).



The radio (DNT2400P) circuit boards are electrostatic discharge (ESD) sensitive. ESD precautions must be observed when handling and installing these components. Installations must be protected from electrical transients on the power supply and I/O lines. This is especially important in outdoor installations, and/or where connections are made to sensors with long leads. Inadequate transient protection can result in damage and/or create a fire and safety hazard.

Telecommunication advice

FCC Caution and Safety Notices

Any changes or modifications (including the antennas) made to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Antenna Gain Restriction

The radio DNT2400 (from RFM) has been designed to operate with any dipole antenna of up to 9 dBi of gain, or any patch of up to 6 dBi gain.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

IC RSS-210 Detachable Antenna Gain Restriction

This device has been designed to operate with the antennas having a maximum gain of 9 dB. The required antenna impedance is 50 ohms.

FCC ID and IC ID

The RFM Wireless radio, the FCC ID is HSW-DNT2400 and HSW-DNT2400P. The IC ID is IC: 4492A-DNT2400 and 4492A-DNT2400P.

Health and radiation

This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Terms of use

Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications. If the product is used in a manner not specified, the protection provided by the product warranty will be void.

Using the product according to your function

A responsible body is an individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function.

Chapter 1: Introduction

Maintenance personnel perform routine procedures on the product to keep it operating properly

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

General safety usage

Follow the guidelines given below for safe usage of the product:

- Installation must only be performed by qualified service personnel
- Carefully read all instructions
- Comply with local and national safety codes
- Repairs must only be performed by qualified service personnel
- When replacing the fuses, use only the same type and same rating as specified
- Make sure the unit is disconnected from AC Power when servicing
- Do not try to operate the system if it is damaged. Disconnect the Power from the units and call your local service representative
- Do not operate while condensation is present
- Use of the system in a manner not specified by these instructions may impair the safety protection provided by the system. Do not operate the system outside its rated supply voltages or environmental range
- Omission to read the installation and user manuals or to comply with the warnings and references contained herein can result in serious bodily injury or damages to the controllers
- Do not insert metal objects into the connectors
- Use the system only as specified, or the protection supplied by the product can be compromised
- Follow all installation and maintenance recommendations and consider all provided information regarding product specifications and limitations
- Do not use the system if it does not operate correctly
- The enclosures must be closed and locked at all times, particularly when operating the system
- Use only specified replacement parts

What to look for when you receive your system

Table 1-1 *Shipment contents*

Wireless RS-485	1x Wireless RS-485, 1x Quick guide, 1x U-Bolt
-----------------	---

Damage inspection

Your system and its components were carefully inspected both electrically and mechanically before shipment. After unpacking all items, check for any obvious signs of physical damage that may have occurred during transit. Report any damage to the shipping agent immediately. Save the original box for possible future shipment.

Returning the unit for repair

If you must return the system for repair, carefully package the system in its original box or an equivalent, and follow these instructions:

1. Call the customer service department to get a Return Material Authorization (RMA) number. Have on hand the system's serial number and date code found on the system's main board.
2. Indicate clearly that the box is to be given to the repair department and attach a copy of the RMA number on the shipping label.

Contact information

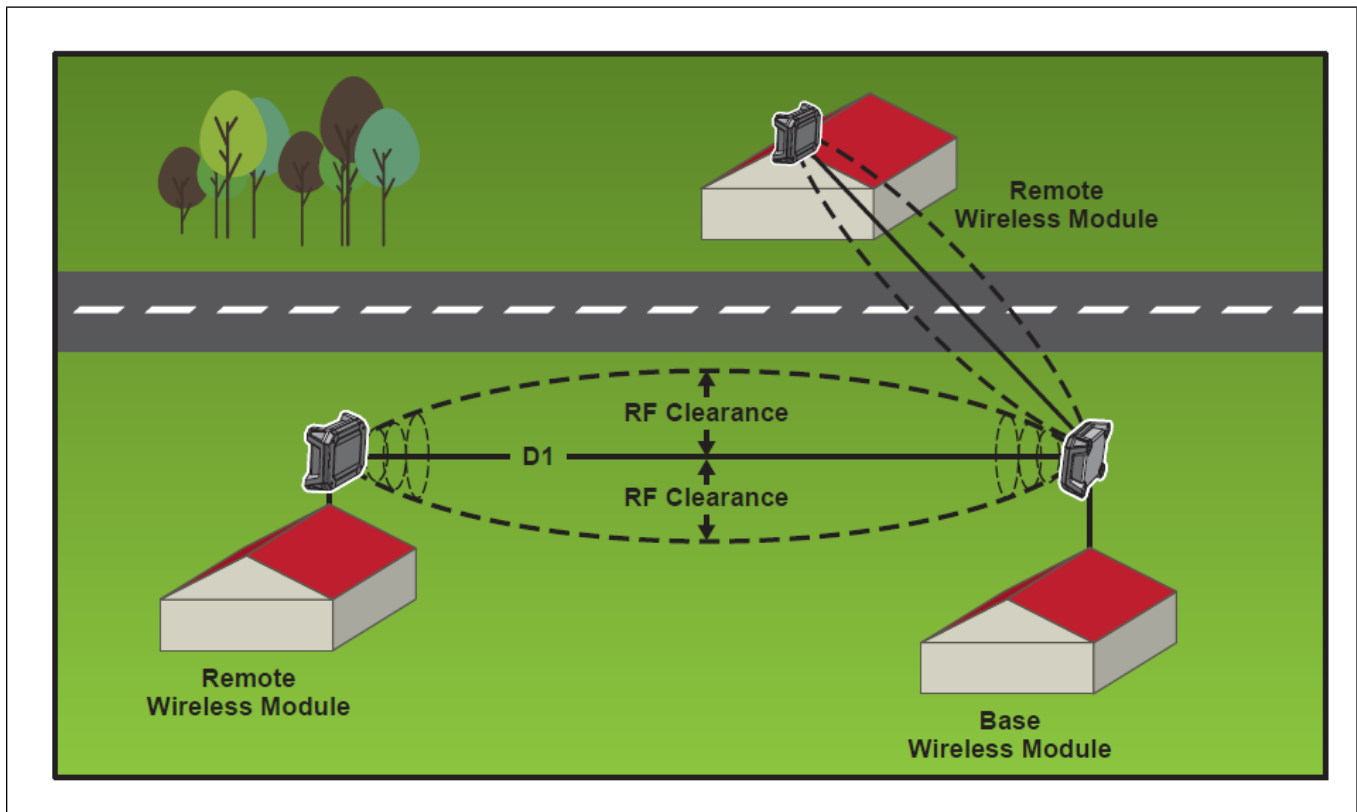
If you experience trouble with your system, or to get repair or warranty information, please contact

GSI Electronics Inc.

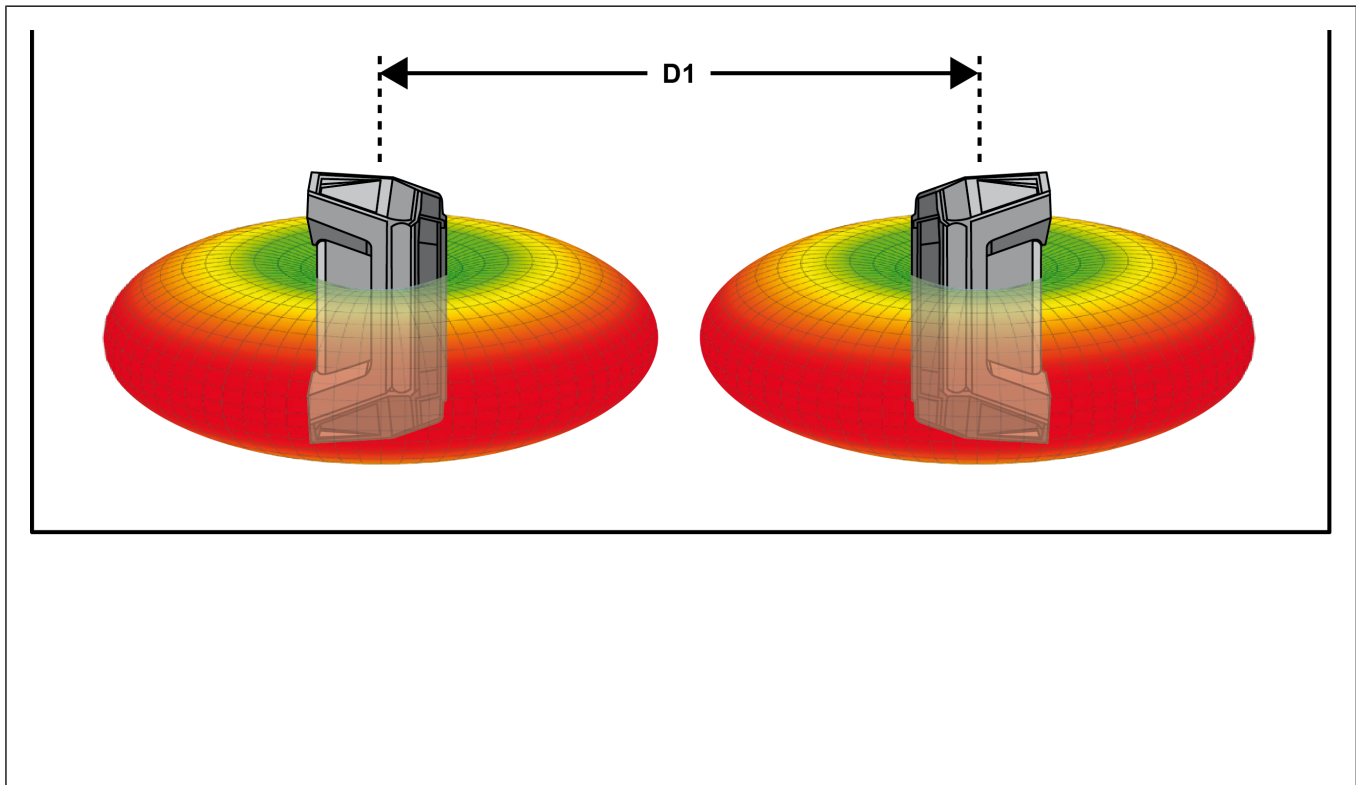
Phone: 1-877-926-2777

E-mail: mtl_techsupport@gsiag.com.

System overview



Wireless RS-485 (Base)	Wireless RS-485 allows transparent wireless communication of the main system and its sub-modules between livestock buildings. The Wireless RS-485 (Base) acts as the master in a wireless network.
Wireless RS-485 (Remote)	Wireless RS-485 allows transparent wireless communication of the main system and its sub-modules between livestock buildings. The Wireless RS-485 (Remote) acts as the auxiliary in a wireless network.



Typical Site

The typical site is composed of a main building and secondary buildings. All buildings (or hardwired sub-networks) have a Wireless RS-485 to communicate with each other using radio frequency (RF) signals. A distance of D1 (6,500 feet or 1.20 miles or 2 kilometers.) can be reached by the Wireless RS-485 system.

Typical Site for an AA128 system

In all, the Wireless system allows establishing communication between up to 16 links per Wireless RS-485 (Base): 1 Wireless RS-485 (Base) and 16 Wireless RS-485 (Remote).

Typical Site for legacy products

In all, the Wireless system allows establishing communication between up to 7 links per Wireless RS-485 (Base): 1 Wireless RS-485 (Base) and 7 Wireless RS-485 (Remote).

Typical Installation, main building and Wireless RS-485 (Base):

A site must have one main building that gathers information from other buildings. The main building is the place where the Wireless RS-485 (Base) can be found; this type of module has a radio transmitter that is specially configured to achieve this function. The Wireless RS-485 (Base) is normally used in combination with a main controller (AA128 Touch, AA9600) . Hooking up these two devices allows optimizing the overall wireless communication between buildings.

Secondary Buildings and Wireless RS-485 (Remote):

A secondary building is a place where a Wireless RS-485 (Remote) can be found; this type of module has a radio transmitter configured to transmit information to the Wireless RS-485 (Base).

Guidelines on the ideal location for installation

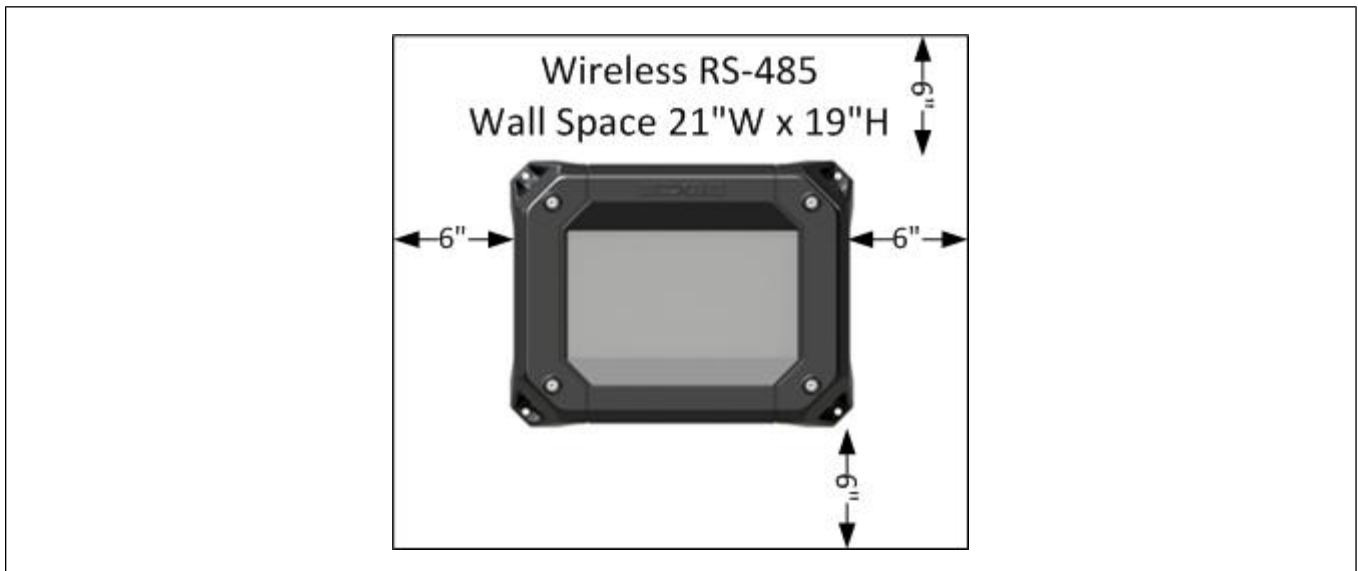
Operating environment

- The ideal ambient temperature is between -40 to 40°C (-40 to 104°F)
- Install the Wireless RS-485 far from sources of vibration and where it is not likely to get bumped
- Install the Wireless RS-485 to be accessible for the user for maintenance

IMPORTANT: *If you are not planning on installing the system immediately, store the units in a cool dry place.*

Clearance around the Wireless RS-485

The following minimum clearances must be respected around the wireless RS-485 enclosure:



Correctly supporting and routing cables

Properly supporting and routing the cables helps avoid electromagnetic interference and wire damage.

Cable connectors

NOTE: *Nylon cable glands are permitted for cable or wire fastening. The nylon cable glands come installed.*



As a replacement to the nylon cable glands, use watertight compression cable glands rated IP66 for each cable used



Use silicone to seal the cable gland rated IP66 if more than one cable is use in the same cable gland.



The warranty is void if the product enclosures are not sealed correctly and the installation does not respect the manufacturer recommendations.

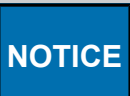


Ensure all cables enter through the bottom of the plastic enclosure. Do not make holes on the top or on the sides of the enclosures. Be careful not to damage the electronic cards located inside the enclosure when drilling at the bottom of the enclosure.



The use of flexible tube with water and dust tight connectors at both ends is acceptable.

Cable support



Never run low voltage (24V and less) communication wires in the same conduit as a High Voltage (Power) wire.

When low voltage cables run parallel to high voltage cables (120/230/380 VAC or 24 VDC), place them at a distance of at least 300 mm (12 inches) from each other to avoid electromagnetic interference.

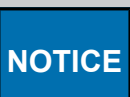
If low voltage cables cross high voltage cables, ensure they cross at an angle of 90° to minimize electromagnetic interference.

Grounding recommendations for the system

A correctly grounded system protects your equipment from electrical surges and spikes.



Each module must have its own ground connection from a common junction box. Do not run the earth ground cable between the modules.



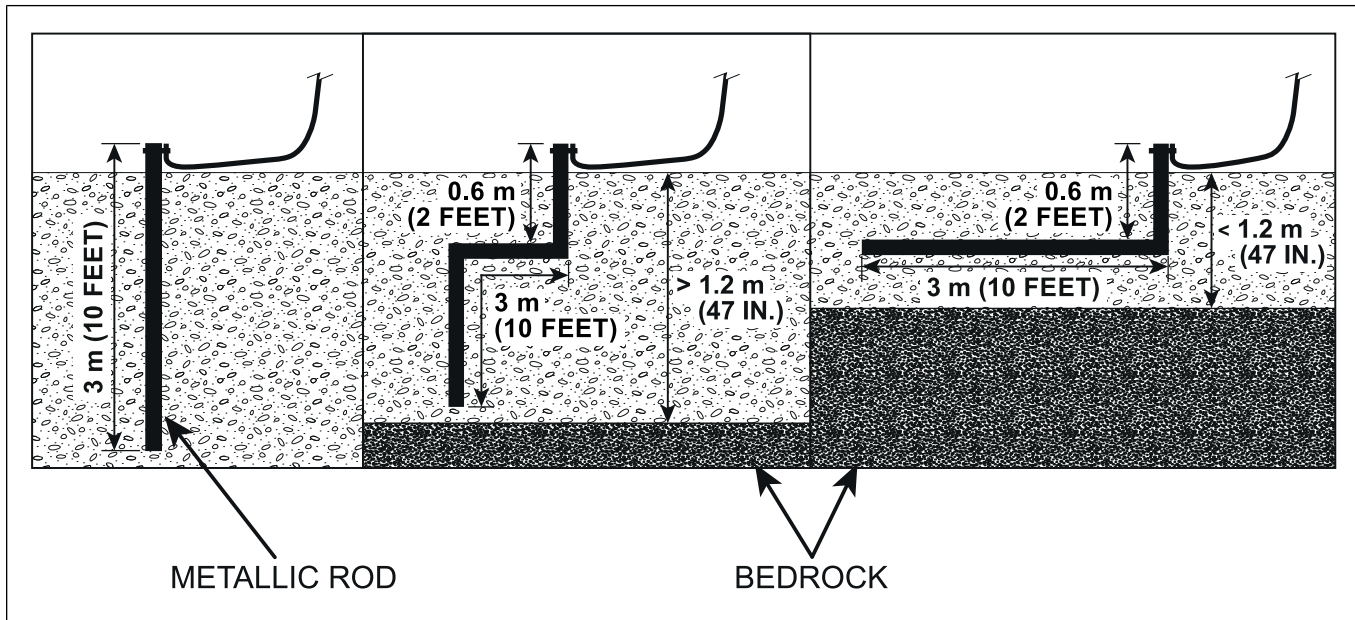
The ground resistance levels must comply with local and national electrical codes.

IMPORTANT: *If outdoor connections are used, mount the enclosure as close as possible to the entry point of the outdoor wiring.*

IMPORTANT: *An improper ground connection voids the system's warranty.*

Insert the rod into the ground until a few inches of the tip is left above ground level. Attach the cable to the rod tip with an appropriate connector. Attach the other end of the cable to a breaker box or a junction box near the main enclosure.

Figure 1-1 Grounding installation depending on bedrock depth



- If the bedrock is more than 3 meters (10 feet) below ground level, drive the grounding rod vertically 3 meters (10 feet) into the ground.
- If the bedrock is more than 1.2 meters (47 inches) below ground level, drive the rod into the ground to bedrock level and bury the remainder horizontally at least 0.6 meters (2 feet) below ground level.
- If the bedrock is less than 1.2 meters (47 inches) deep, bury the rod horizontally at least 0.6 meters (2 feet) below ground level.

NOTE: Refer to your local regulations and practices if an adequate grounding installation isn't possible.

Rod specifications for grounding

The rod specifications are guidelines only. Refer to your national and local regulations for compliance criteria.

Table 1-2 Grounding rod specifications

Item	Description
Material	Metallic, normally steel core.
Rod surface	The surface must be clean. It cannot be coated with paint, varnish or any non-conducting substance.
Minimum diameter	16 mm (5/8 inches)
Minimum length	2440 mm (8 feet)

Cable specifications for grounding

The cable specifications are guidelines only. Refer to your national and local regulations for compliance criteria.

Table 1-3 Grounding cable specifications

Item	Description
Certification and type	CSA, TEW type.

Chapter 1: Introduction

Table 1-3 *Grounding cable specifications (cont'd.)*

Item	Description
	UL, 1015 type, 12 AWG, 600 V, 105 °C (221 °F), green/yellow insulated wire.
Maximum length	15 meters (50 feet)
Suggested cable	Beldon # 9912, color code 189, or equivalent

2 Basic connections

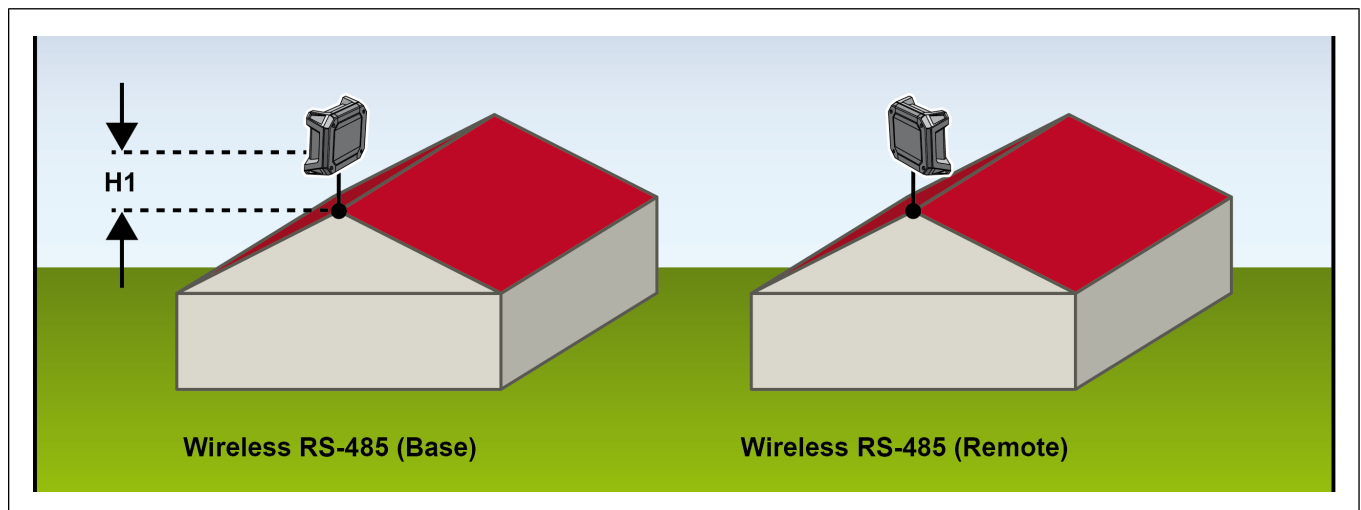
Topics Covered in this Chapter

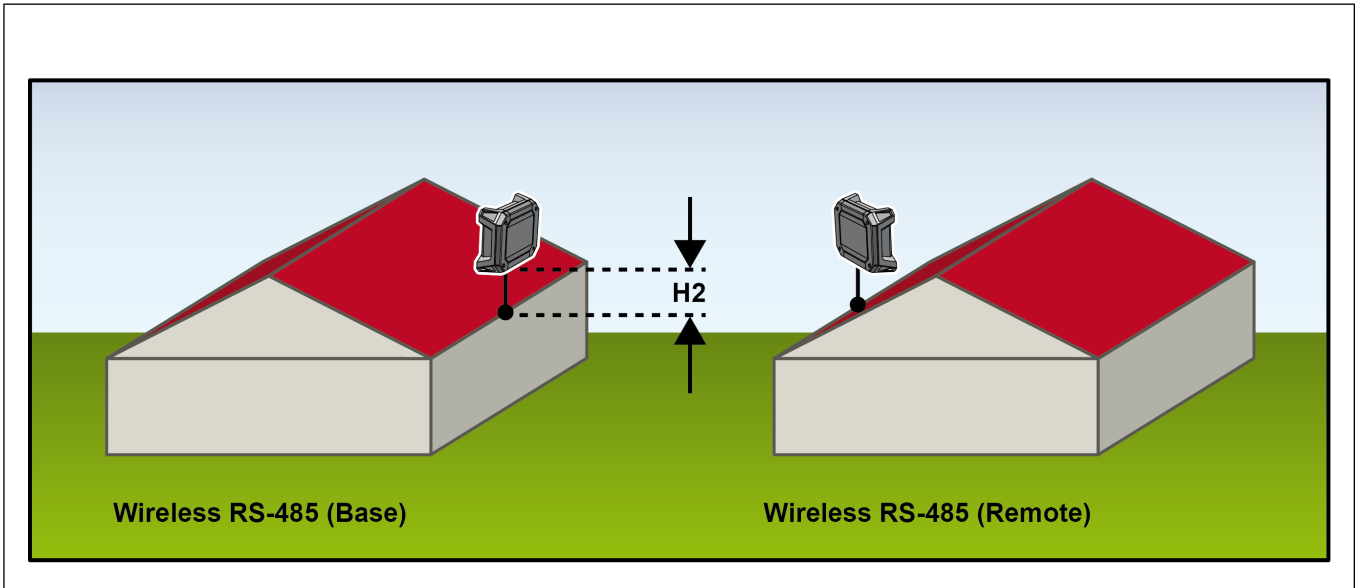
- Mounting the Wireless RS-485 enclosure
- Verifying the Received Signal Strength Indicator (RSSI)
- Connecting a Wireless RS-485 on a DC network (Agri Alert 128 touch and Agri Alert 9600)
- Connecting a Wireless RS-485 on the independent power supply (PSU 24V 20W)
- Connecting the Wireless RS-485 to the communication network
- Grounding

Mounting the Wireless RS-485 enclosure

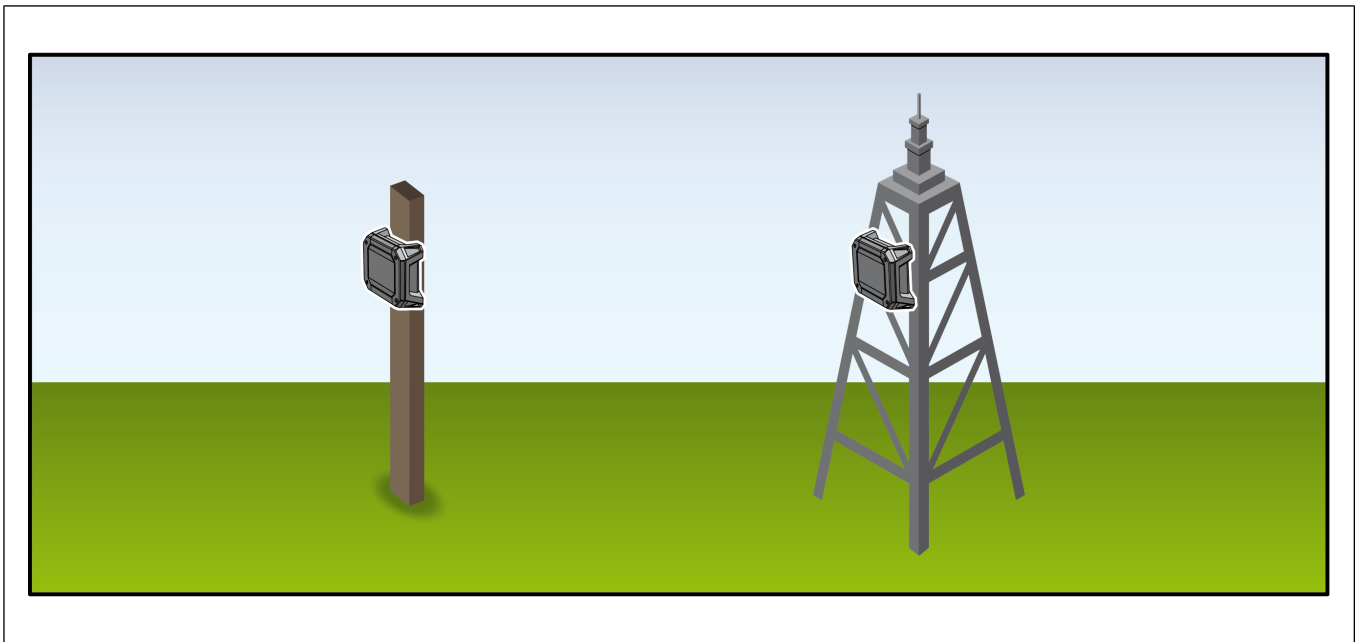
Recommended positions

The best Wireless RS-485 location is on the edge of the top of the roof as illustrated below. In this situation, the Wireless RS-485 must be at least 2 feet (see H1) higher than the roof peak. Another possibility is to install the Wireless RS-485 on the roof cornice. However, in this case, the Wireless RS-485 must be at least 4 to 6 feet (see H2) higher than the cornice. Make sure the roof does not impede the RF signal transmission.

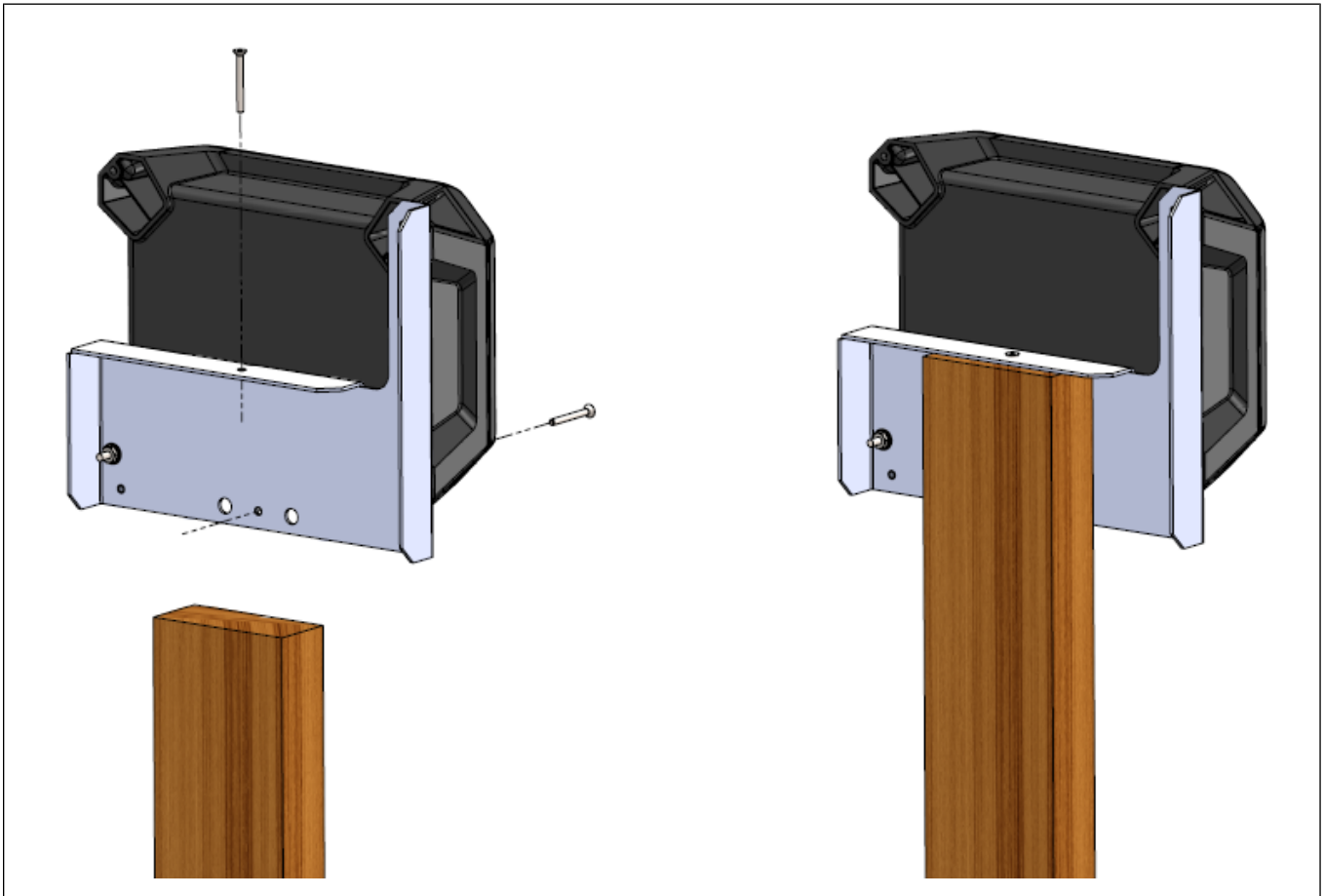




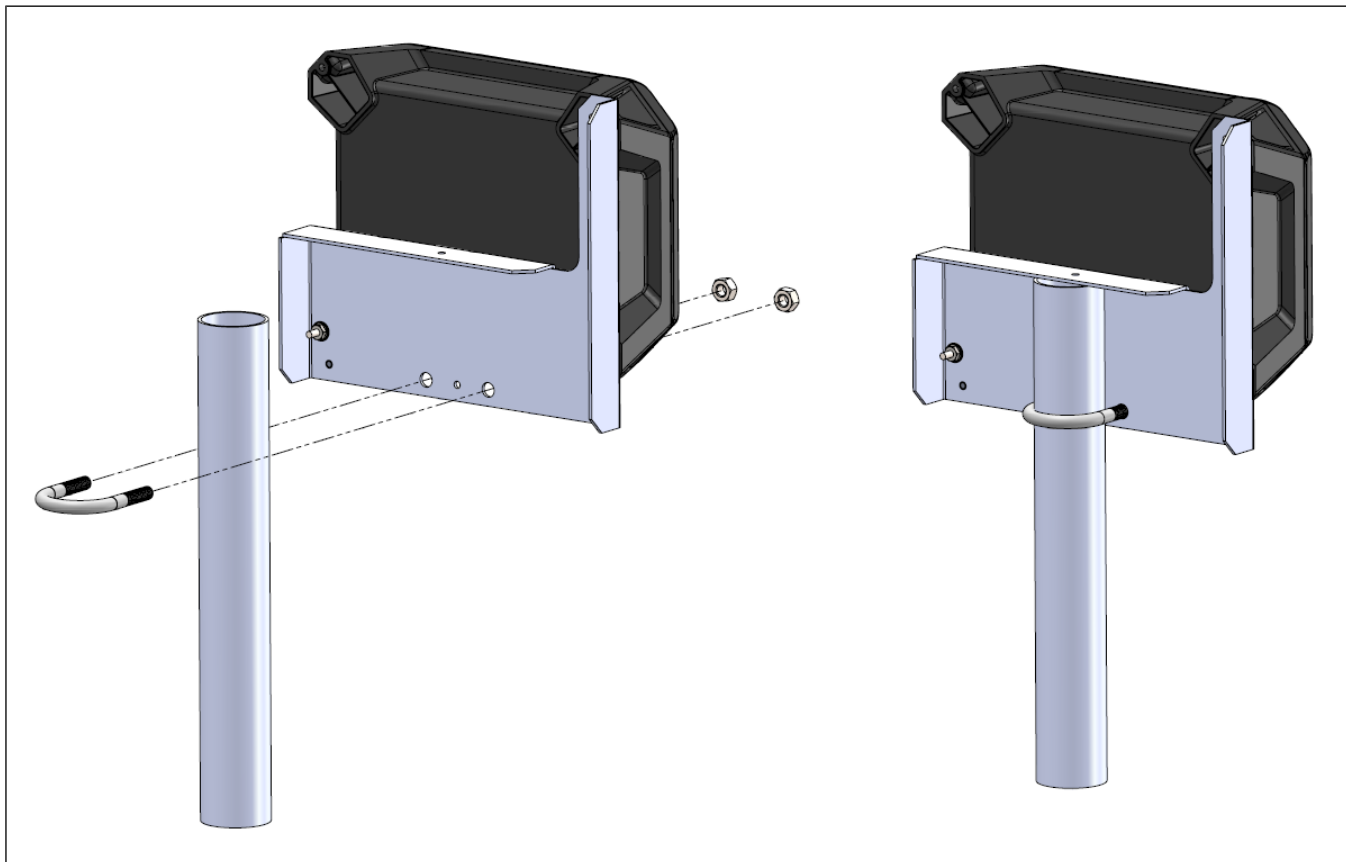
Other possibilities are: using a pole (wood or metal) or using an existing telecommunication tower.



A metal support is installed by the factory. A u-bolt is also provided by the factory. The metal support allows a using of pole with right angles. The metal support allows a pole width up to 7 inches (177.8mm). GSI Electronics recommends the following screw for the assembly : Deck Screw for Wood.



The u-bolt allows the use of a pole with a round shape ranging from 1 inch (25.4mm) to 1.5 inches (38.1mm).



If a telecommunication tower or a metal pole is used, ensure that the tower or the pole is correctly grounded.

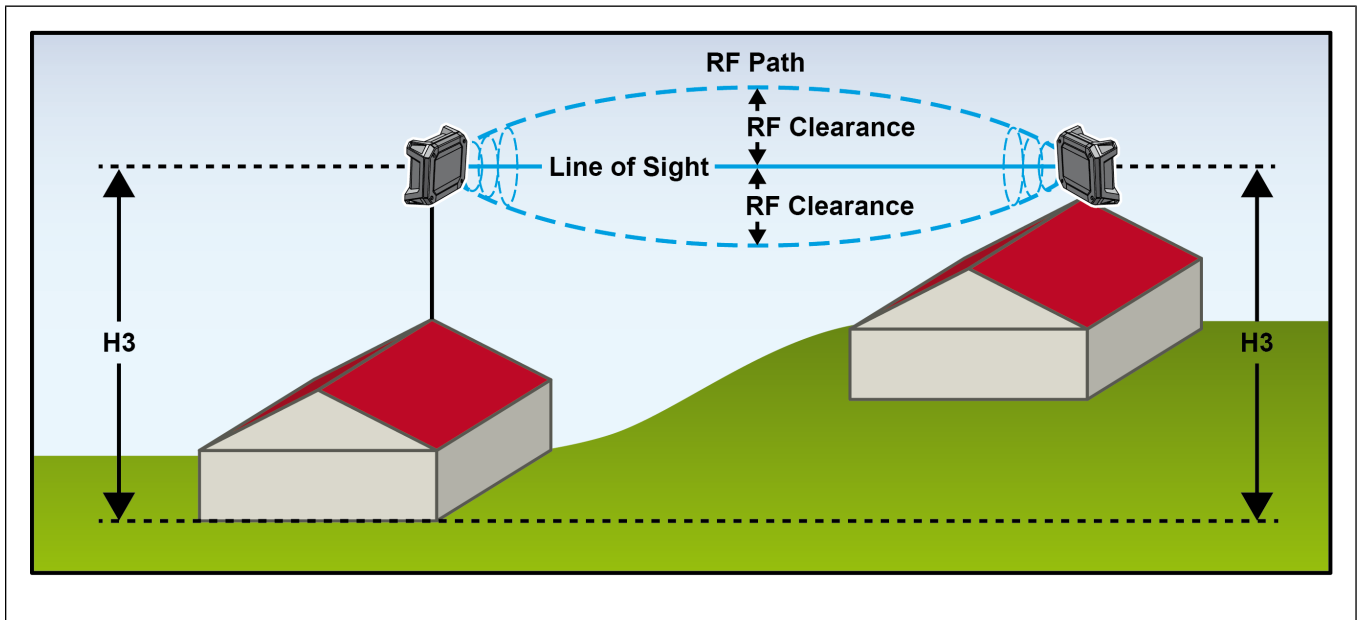


Please get professional help, to ensure that the pole or the tower is correctly installed.

Height of the Wireless RS-485

The following must be considered when deciding on the height of installation of the Wireless RS-485:

- **Distance between the buildings** – The longer the link, the higher the Wireless RS-485 needs to be.
- **Line of Sight (LOS) & RF Path** – All Wireless RS-485 (Remote) must be mounted in order to have a direct line of sight with the Wireless RS-485 (Base). This direct line of sight is only possible when all Wireless RS-485 have about the same height above mean-sea-level (look at H3). In addition, the area around the visual line of sight – the RF path – must be clear from obstacle or else signal strength will be reduced.



Wireless RS-485 height and RF path clearance

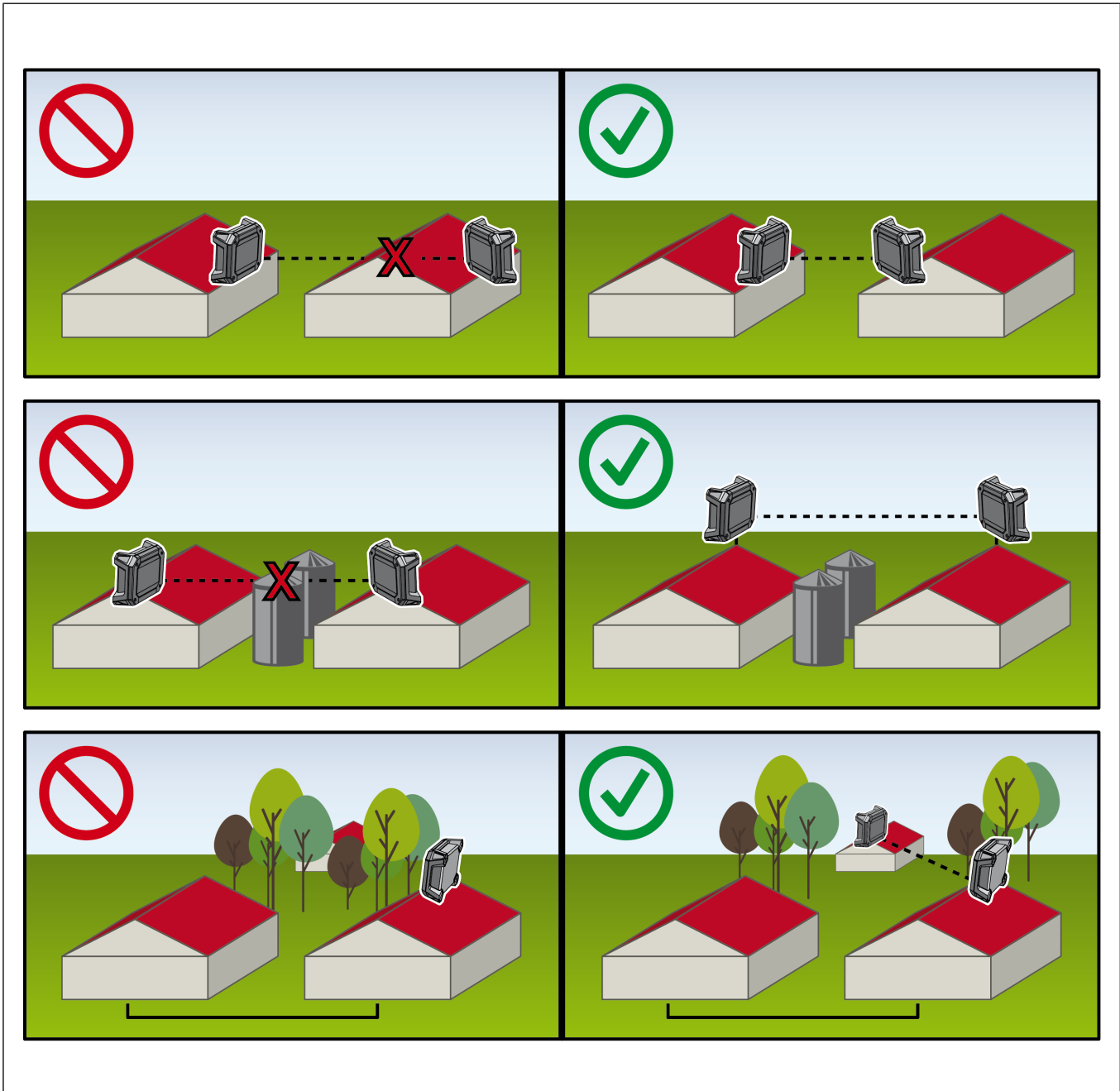
The height of the Wireless RS-485 must ensure a complete clearance of the RF Path. This path has an elliptical shape and is defined based on the greater distance that separates any two buildings on site. Take the greater distance between two buildings and then refer to the table in Appendix – RF Path Clearance to see what RF clearance must be respected. This clearance must be present at the midway point between the buildings, above and below the line of sight (see picture above). Determine the Wireless RS-485's height accordingly.



Do not install the Wireless RS-485 higher than recommended unless immovable objects are in the RF path. The Wireless RS-485 height must not exceed 4 feet above the roof peak; otherwise, it may become a target for lightning. If you are unable to meet the recommended Wireless RS-485 height requirements, ask for assistance from a professional installer.

Choosing the ideal location

Before attempting to install your Wireless RS-485, determine where you can best place it to obtain optimum results. Best performance is achieved when all Wireless RS-485 are close to each other, mounted at the same height, and in a direct line of sight with no obstruction in the RF Path as shown:



1. Make an overview diagram of your site including the following elements:

- Location and orientation of the buildings;
- Distance between buildings;
- Obstacles (trees, bins, roads, fields, etc.)

2. Determine the Wireless RS-485 location of each building based on the following requirements:

IMPORTANT: Make sure the RF signal is properly received by all Wireless RS-485 before fixing any equipment permanently. Refer to the section **Verifying the received signal strength Indicator**.

- Identify the main building. This building is ideally located in the site's median zone, at equal distance from other buildings
- Identify the location of the main system (it can either be located in the main building or in the building's hardwired subnetwork)
- Write down the required Wireless RS-485 height (as defined in Appendix – RF Path Clearance)
- Make sure the distance between any Wireless buildings never exceeds 6,500 ft (2 km)
- Determine the Wireless RS-485 position for each building. Make sure no obstacle blocks the RF signal transmission (roof, trees, bins, etc.). It may be required to cut down trees or to relocate any element that impedes the direct line of sight between Wireless RS-485.



If you are unable to meet these requirements, ask for assistance from a professional installer.

Verifying the Received Signal Strength Indicator (RSSI)

Before permanently installing your equipment, make sure the radio frequency (RF) signal is properly received in each secondary building. Status LEDs indicating the received signal strength (RSSI) are located on the circuit board of each Wireless RS-485. These pilot lights indicate how well the Wireless RS-485 (Remote) communicates with the Wireless RS-485 (Base) module. It is also possible to check the communication statistics directly on the main system (Agri Alert 128 Touch, Agri Alert 9600)

Verifying the Signal on the Wireless RS-485 (Remote)

NOTE: *Check the RSSI on the Wireless RS-485 (Remote) only (the signal strength on the Wireless RS-485 (Base) is not suitable). The signal strength LED must be close to the **Good** position in the good atmospheric conditions for the system to have acceptable performances (Fair signal reception).*

IMPORTANT: *Ensure the LED « LINK » is activated*

1. Choose a fix location for the Wireless RS-485 (Base). Wireless RS-485 on secondary buildings will be based on the main building.
2. Power the Wireless RS-485 (Base) and the main system (Agri Alert 128 Touch, Agri Alert 9600)
3. Mount a second Wireless RS-485 (Remote) on a rigid PVC pipe.
4. Power the Wireless RS-485 (Remote) by using a a PSU 24V 20W and an extension cord
5. Position the Wireless RS-485 (Remote) next to the secondary building and verify the received signal strength. Permanent Wireless RS-485 (Remote) installation can be performed if the signal strength LED is close to the **Good** signal strength position in the good atmospheric conditions.

IMPORTANT: *Consult the main system manual to ensure setting correctly the wireless network before testing the wireless network performance.*

Verifying the Signal on the Main System (Agri Alert 128 Touch, Agri Alert 9600)

1. Read the manual of the main system (Agri Alert 128 Touch, Agri Alert 9600) to know how to consult the communication statistics.
2. Wait 5 minutes and check the number of packet loss at that moment. In an excellent installation, the amount of packet loss would be less than 3% loss in the correct atmospheric conditions. This loss rate is only reached in perfect conditions; an application can be functional with a higher packet loss rate.

NOTE: *If you want to improve your communication statistics, try relocating the Wireless RS-485.*

IMPORTANT: *Consult the main system manual to ensure setting correctly the wireless network before testing the wireless network performance.*

Connecting a Wireless RS-485 on a DC network (Agri Alert 128 touch and Agri Alert 9600)

The DC bus from the AA128 system or from the AA9600 supplies the Wireless RS-485 (terminal V+ and terminal -). The recommended installation is 18 AWG for the power supply wires at a length of 900 meters (3000 feet).

1. Locate the terminals V+ and - on the Wireless RS-485 you want to connect.
2. Connect the wires from the Wireless RS-485 to the network (V+ to SBI-1 and – to SBI-4 on AA128 Touch and AA9600).

Consult the wiring diagrams to see the maximum cable distance according to the wire gauge.

IMPORTANT: *Make sure to connect same identifications together and use the same network from one side to the other.*

Connecting a Wireless RS-485 on the independent power supply (PSU 24V 20W)

Before You Begin

IMPORTANT: *Install a disconnect switch to interrupt Power to L1 and N/L2 electric Power lines before connecting the system's main input on the power supply. It must be in close proximity to the equipment and within easy reach of the operator. It must be marked as the disconnecting device for the equipment.*



If the disconnect switch or the circuit breaker is used as a sectioning device, the device must be correctly identified with which function of the controller opens the circuit. The Off or Stop and On position must be clearly identified on the sectioning device. GSI Electronics recommends using a DPST disconnecting switch in series with a breaker. In the case of the use of a SPST disconnecting switch, connect the SPST disconnecting switch to cut the hot line with a neutral circuit case.



Disconnect supply before servicing

1. From the Power source, follow the wiring diagram to connect the main voltage supply to the system's main inputs on the PSU 24V 20W.
2. Open the disconnecting switch or breaker before wiring.
3. Plug the wires (L1 to L1, L2/N to L2/N, Earth to Earth) from the PSU 24V 20W Into a Power source (main voltage supply).
4. Correctly ground the system by using a Functional Earth configuration.
5. If you are using either a KP-8IN-1REL, TP-8IN-1REL, or TR-2IN-1REL, connect **V+** to **24V**, and **-** to **GND**. If you are using either a TP-800, KP-400, or KPB-400, connect **V+** to **SBI 1** and **-** to **SBI 4**.
6. Power on the system and make sure it is receiving Power from the Power source.

NOTE: *The working voltage range is between 90 Vac and 264 Vac. The system consumes a Power of 2.8W and the wires in accordance with local and national safety codes. A minimum voltage rating of 300V and a minimum temperature rating of 90°C is used for the wires.*

IMPORTANT: *In the Agri Alert 128 Touch network or Agri Alert 128 Touch, use the Automation network on KP-8IN-1REL or TP-8IN-1REL or TR-2IN-1REL.*

Connecting the Wireless RS-485 to the communication network

The communication bus enables communication between the main controller (AA128 Touch, AA9600) and the Wireless RS-485 (terminal A and terminal B).

1. Locate the terminals A and B on the Wireless RS-485 you want to connect.
2. When connecting an Agri Alert 128 Touch directly to a Wireless RS-485, connect the **PVX A** terminal to the Wireless RS-485 **A** terminal. Connect the **PVX B** terminal to the Wireless RS-485 **B** terminal. When using either a KP-8IN-1REL, TP-8IN-1REL, or TR-2IN-1REL, connect terminal **A** to terminal **A** and terminal **B** to terminal **B**. When you are connecting either to a TP-800, KP-400, KPB-400, or to an AA9600, connect the terminal **A** to **SBI 2** and terminal **B** to **SBI 3**.

IMPORTANT: *Make sure to connect same identifications together and use the same network from one side to the other.*

IMPORTANT: *The communication network must be installed in a daisy chain topology. Consult the wiring diagrams to see the maximum cable distance according to the wire gauge.*

IMPORTANT: *In the AA9600 network, use the SBI bus if you have old generation controllers as TP800, KP400, KPB400.*

IMPORTANT: *In the AA128 Touch network, use the PVX bus if you have controllers as KP-8IN-1REL, TP-8IN-1REL, TR-2IN-1REL*

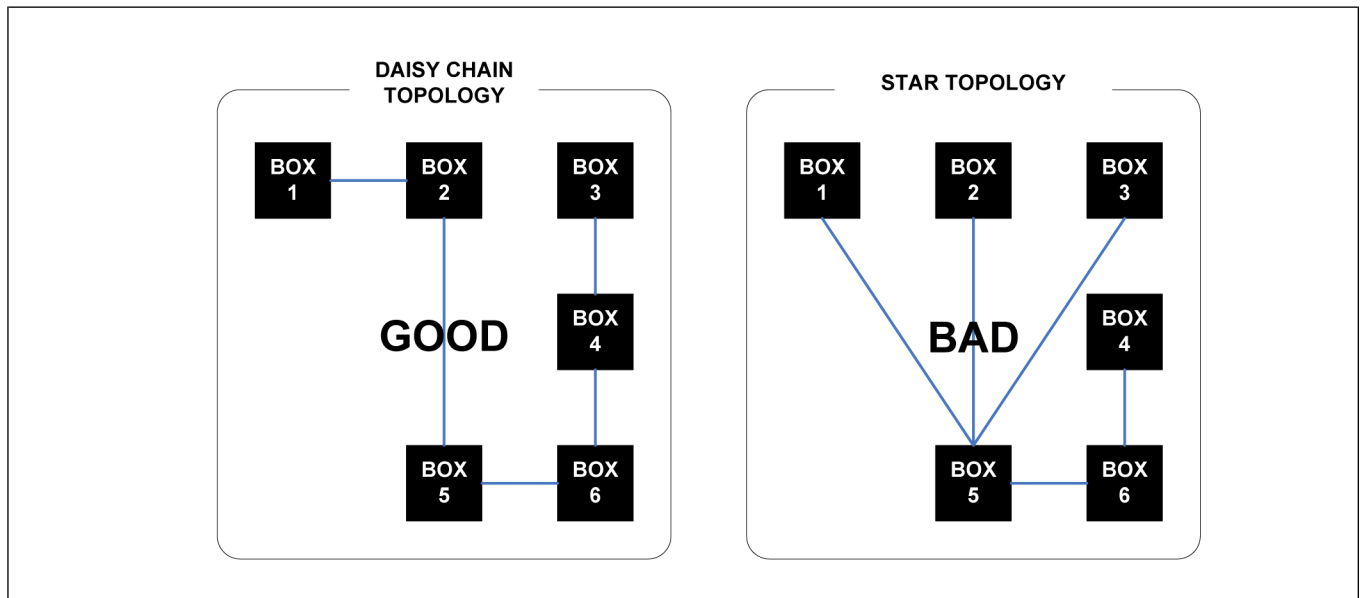
NOTICE

The recommended installation is 18 AWG for the power supply wires at a length of 900 meters (3000 feet). The recommended installation is 18 AWG for the communication wires at a length of 1200 meters (4000 feet). The cable must be twisted pair and shielded.

NOTICE

When tightening small terminal blocks, use a torque between $0.5N*m$ ($4.43lb*in$) and $0.6 N*m$ ($5.2lb*in$) to fasten a wire gauge from 16AWG to 18AWG.

The communication network must be installed in a daisy chain topology. The order of the wires is very important. At both ends of network, the End-of-Line must be activated. If the wiring can't be done in a single chain, you might need to deactivate the end-of-line (EOL) resistor to improve communication. GSI Electronics does not warranty the proper operation if the topology network is not daisy chain.



Grounding

The Wireless RS-485 only needs a functional Earth. The functional Earth connector is located at J5. Connect a green and yellow wire from the Wireless RS-485 metal frame to the Earth if you are using a wood pole. Otherwise, connect the Wireless RS-485 metal frame to the grounded tower or to the grounded metal pole.

NOTICE

When tightening small terminal blocks, use a torque between $0.5N*m$ ($4.43lb*in$) and $0.6 N*m$ ($5.2lb*in$) to fasten a wire gauge from 16AWG to 18AWG.

3 Maintenance

Topics Covered in this Chapter

- Inspecting and cleaning the enclosure
- Inspecting and tightening connections

Inspecting and cleaning the enclosure

Inspecting the enclosure and keeping it clean can help prolong the proper functioning of the Wireless RS-485.

Before You Begin



Disconnect the voltage supply before servicing or performing any maintenance operations.



Secure the screws on the enclosure once the wiring is complete or when servicing.

- Every year, open and inspect the enclosure for moisture or dust build-up.
- Every year, inspect the enclosure components to make sure they do not deteriorate in order to keep a good enclosure seal.

Inspecting and tightening connections

At some point, the connections must be verified to ensure they are not loose and that the installation is always safe. The inspection ensures that no overheating occurs on the tightening connections. GSI Electronics recommends verifying the connections on power and control terminals every 3-12 Months. The torques are stated in the manual where tightening torque is required according to the specific terminal.

NOTES

4 Troubleshooting

Problem	Solution
Trouble between a master and a sub-module of a Wireless RS-485	Verify if the Wireless RS-485 are powered up
	Verify if there are activities on the communication bus by looking at the activities of the LEDs: RX, TX
	Verify if the network link is installed correctly: Terminal "A" from Wireless RS-485 to the controller terminal "A", Terminal "B" from Wireless RS-485 to the controller terminal "B"
	Verify if the network communication is installed in daisy chain.
	Verify if your end of lines (EOL) are set correctly on your network
	Verify if the network link is cut. Either the wire is cut or the protections are activated
	Verify if there is a short-circuit on the network link between terminal "A" and "B"
	Verify if the network link length is below 4000 feet (1200m) with the recommended gage.
	Measure the voltage between the terminal "V+" and "-". The voltage must be at least 16V
	If the problem persists, contact your dealer or GSI Electronics
The Wireless RS-485 does not power up	Verify if the LED "3.3V" or "5V" or "VCC RADIO" are activated on the PCB-437
	Measure the voltage between the terminal "V+" and "-". The voltage must be at least 16V
	Verify if the power link is installed correctly: Terminal "V+" from Wireless RS-485 to the power source terminal "V+", Terminal "-" from Wireless RS-485 to the power source terminal "GND" or "-"
	Verify if the power link is cut: wire is cut
	Verify if the power link length is below 300 feet (1000m) with the recommended gage.
	If the problem persists, contact your dealer or GSI Electronics
Weak received signal (RSSI)	Make sure no objects are present in the RF path
	Make sure all Wireless RS-485 have a direct line of sight with each other
	Try increasing the height of the Wireless RS-485
	Reduce the distance between the Wireless RS-485 (Base) and the Wireless RS-485 (Remote)
	If the problem persists, contact your dealer or GSI Electronics
No signal is received (RSSI) on a Wireless RS-485 (Remote)	Verify if the LED "3.3V" or "5V" or "VCC RADIO" are activated on the PCB-437
	Verify if the LED "LINK" is ON. If the LED "LINK" is OFF, the Wireless RS-485 was not accepted in the network by the user or the Wireless RS-485 have not a direct line of sight with each other
	Make sure all Wireless RS-485 have a direct line of sight with each other
	Make sure no objects are present in the RF path
	Try increasing the height of the Wireless RS-485
	Reduce the distance between the Wireless RS-485 (Base) and the Wireless RS-485 (Remote)

Chapter 4: Troubleshooting

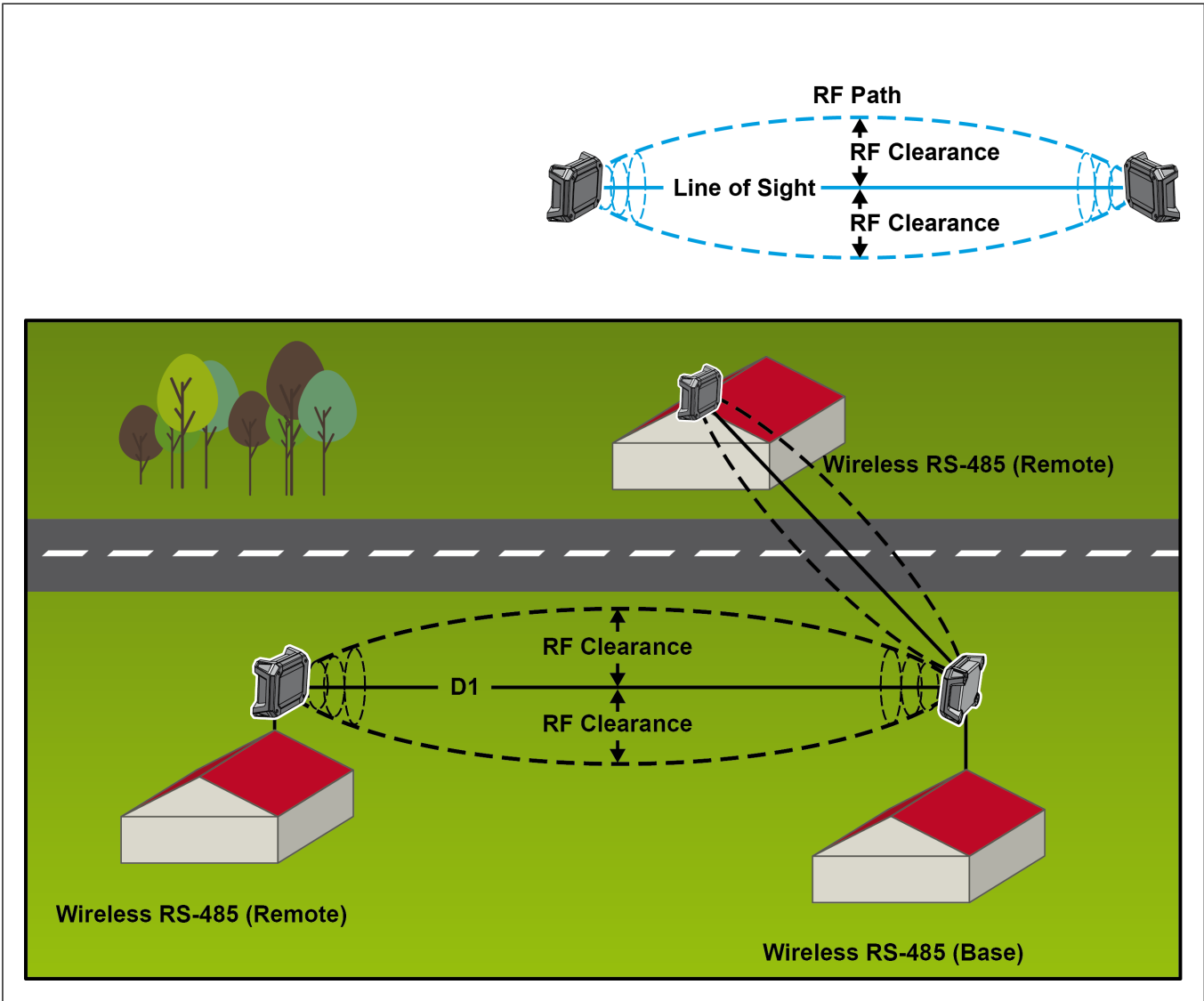
	If the problem persists, contact your dealer or GSI Electronics
The LED "ACTIVITY" is lit on a Wireless RS-485 (Remote) while the Wireless RS-485 (Base) is turned off.	Other RF signals are emitted in the surrounding area. (wireless phones, routers, or any devices using the ISM 2.4GHz band)

A RF clearance

The RF path is an area around the visual line of sight that must be clear from obstacles that can reduce the signal strength. This path has an elliptical shape and is defined based on the greater distance that separates any two buildings on site. It is important to know what the RF Path is in order to determine the height at which the Wireless RS-485 must be mounted.

To define the path, take the greater distance that separates 2 buildings and then refer to the table below to know what the RF clearance must be midpoint between the buildings. The RF clearance must be present above and below the line of sight

Maximum distance between buildings	Suggested RF clearance
1.25 miles (2.0km)	23ft (7m)
0.93 miles (1.5km)	20ft (6.1m)
3200 ft (1.0km)	16.5 ft (5m)
1600 ft (500m)	13 ft (4m)
985 ft (300m)	10 ft (3m)
165 ft (50m) and lower	7 ft (2m)



B LED meanings

Led identification	Description
5V	Led active when the 5Vdc is present
3.3V	Led active when the 3.3Vdc is present
VCC RADIO	Led active when the voltage for radio is present
DBG1	DEBUG LED
DBG2	
RX	Led blinks during communication activity
TX	Led blinks during communication activity
ACTIVITY	Led active when there is a telecommunication activity
LINK	Led active when there is a telecommunication link
SIGNAL STRENGTH – GOOD	Led active when the wireless signal is very good
SIGNAL STRENGTH – LED 8	Led active when the wireless signal is good
SIGNAL STRENGTH –LED 11	Led active when the wireless signal is medium
SIGNAL STRENGTH – WEAK	Led active when the wireless signal is low

NOTES

C Terminal identification

Table C-1 *Wireless RS-485*

Terminal name	Description or function
FUNCTIONAL EARTH	Functional Ground Terminal Primarily used for functional earth terminals which are generally associated with test and measurement circuits. These terminals are not for safety earthing purposes but provide an earth reference point.
V+	Communication bus - Power supply positive
A	Communication bus - Signal A of RS485 communication
B	Communication bus - Signal B of RS485 communication
-	Communication bus - Power supply return

NOTES

D Technical Specifications

Wireless RS-485 safety ratings

INPUTS : Supply Input : 24/28VDC, 2.8W

Operating Temperature: -40 to 40°C (-40 to 104°F)

Storage Temperature: -20 to 50°C (-4 to 122°F)

Environment type: Outdoor use

Pollution Degree: 2

Installation Category: 2

Altitude: 2000 Meters Max. (6561 Ft. Max)

Humidity (maximum relative) operating:

- -40 to 0°C (-40 to 32°F) Non condensing
- 0 to 10 °C (32 to 50 °F) Non condensing
- 10 to 30 °C (50 to 86 °F) 95 % (± 3 %) Non condensing
- 30 to 40 °C (86 to 104 °F) 95 % (± 3 %) Non condensing

IP rating (IEC 60529): 66

Nema Rating (Nema 250): 4X

Flame rating (UL94): 5VA V-0

Flame rating (IEC 60695 or IEC 60707): FV-0

IK rating (degree of mechanical protection - impact, IEC 62262): 08

Main supply voltage fluctuations shall not exceed +/- 10% of the nominal supply voltage.

Table D-1 *Wireless RS-485 functional ratings*

Enclosure Dimensions	Height	178 mm (7 inches)
	Width	229 mm (9 inches)
	Depth	76.2 mm (3 inches)
Weight	1 769.01 grams (3.90lbs)	
Radio ratings		
Frequency Band	US/Canada: 2409.33MHz – 2467.11MHz Europe: 2409.33MHz – 2467.89MHz	
Modulation	FSK/MSK	
Radio Output Power	63mW max.	
Receiver Sensitivity	-96 dBm typical at 200kb/s	
Optimum Antenna Impedance	50Ω	

Appendix D: Technical Specifications

Table D-1 *Wireless RS-485 functional ratings (cont'd.)*

RF Data Transmission Rates	200kb/s
RF Connection	DNT2400P - U.FL Connector
Network Topologies	Point-to-Multipoint
Access Schemes	CSMA
Number of Network Nodes on EDGE system	16 Wireless Remotes per Wireless Base
Number of Network Nodes on Legacy systems	7 Wireless Remotes per Base Wireless
Maximum distance between the receiver and the transmitter outside	2km (6562 ft or 1.24 mile)
Equipment classification (ETSI EN 301 489-1)	Equipment for fixed use

E Safety Characteristics and Certification

Safety characteristics

The controller is Safety Class I according to IEC classification and has been designed to meet the requirements of UL 61010-1 third edition, CAN/CSA-C22.2 n° 61010-1 third edition, EN 61010-1: 2010 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use). It is an Installation Category II intended for operation from a normal single phase supply.

The controller has been tested in accordance with IEC61010-1 and have been supplied in a safe condition. This instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

NOTE: PSU 24V 20W plastic enclosure is certified to use rigid tubing up to 1 inch.

EMC characteristics — emission standards

The controller has been designed to meet the requirements of the EMC Directive 2014/30/EU, the FCC directives, the Industry Canada directives. The compliance was demonstrated by meeting the test limits of the following standards:

EN 61000-6-4 (2007/ A1:2011)	Emission tests levels for industrial environment
EN61326-1 (2013)	EMC product standard for Electrical Equipment for Measurement, Control and Laboratory Use
IEC EN 60730-1 (2010):	Automatic electrical controls for household and similar use - Part 1: General requirements - EMC requirements
FCC part 15 Subpart B	Class A
EMC certification: ICES-001	Industrial, Scientific and Medical (ISM) Radio Frequency Generators – class A

Test number	Test name	Standard	Standard level
1	Conducted emissions	CISPR 11 : 2009 A1 (2010) FCC part 15, subpart B : 2012	Group 1, class A Class A
2	Radiated emissions	CISPR 11 : 2009 A1 (2010) FCC part 15, subpart B : 2012	Group 1, class A Class A

EMC characteristics — immunity standards

The controller has been designed to meet the requirements of the EMC Directive 2014/30/EU, the FCC directives, the Industry Canada directives. The compliance was demonstrated by meeting the test limits of the following standards:

Appendix E: Safety Characteristics and Certification

EN61326-1 (2013)	EMC product standard for Electrical Equipment for Measurement, Control and Laboratory Use
EN 61000-6-2 (2006):	Immunity tests levels for industrial environment
IEC EN 60730-1 (2010):	Automatic electrical controls for household and similar use - Part 1: General requirements - EMC requirements
FCC part 15 Sub-part B	Class A

Test number	Test name	Standard	Standard level
5	Radiated, radio-frequency, electromagnetic field immunity test	EN61000-4-3 : 2006 A1 : 2007 A2 : 2010	Modulation: 80% AM at 1kHz, 80MHz - 1GHz: 10V/m 1.4GHz-2 GHz: 3 V/m 2GHz-2.7GHz: 3 V/m Performance: A (A)
6	Immunity to conducted disturbances, induced by radio-frequency fields	EN61000-4-6 : 2008	Frequency test range : 150KHz and 80Mhz at 10Vrms Pause time: 0,5s (AC line, Earth, I/O connections >3m) Performance A (A)
7	Electrostatic discharge immunity test	EN61000-4-2 : 2008	± 8 kV air ± 6kV contact Performance A (B)
8	Electrical fast transient/burst immunity test	EN 61000-4-4 : 2012	±1kV/5kHz on the I/O >3m Performance A (B)
9	Surge immunity test	EN61000-4-5 : 2005	I/O : L-PE : ±1kV L-L : ±1kV
10	Power frequency magnetic field immunity test	EN 61000-4-8 : 2009	30 A/m, Performance A (B)

The definitions of performance criteria are as follows:

- Performance criterion A — During test normal performance within the specification limits
- Performance criterion B — During test, temporary degradation, or loss of function or performance which is self-recovering
- Performance criterion C — During test, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.

The performance level A may be replaced by a permissible loss of performance. Following parameters define the permissible loss of performance during immunity test. These parameters will not affect or degrade the functional performance of the product.

Wireless RS-485 element	Normal operation	Allowable loss of performance
RS485 link	1 communication frame loss	3 consecutive communication frames losses
Wireless link	1 communication frame loss	3 consecutive communication frames losses

Wireless RS-485 functional characteristics

The Wireless RS-485 was designed and tested to meet the following requirements:

Appendix E: Safety Characteristics and Certification

- FCC 47 CFR Part 15 Subpart E, §15.247 (Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz)
- RSS-210, Issue 8, December 2010, Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz Bands)
- RSS-210 Annex 2.9 (Spectrum Management and Telecommunications Radio Standards Specification; Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment)

The RFM Wireless radio, the FCC ID is HSW-DNT2400 and HSW-DNT2400P. The IC number is IC: 4492A-DNT2400 and 4492A-DNT2400P

Environment characteristics

Parameter	Condition	Value
Environment Location	Outside	
Temperature	Operating	-40 to 40°C (-40 to 104°F)
	Storage	-20 to +50 °C (-4 to +122 °F)
Humidity (Maximum Relative) Operating	-40 to 0°C (-40 to 32°F)	Non condensing
	0 to 10°C (32 to 50°F)	95 % (± 3%) Non condensing
	10 to 30 °C (50 to 86 °F)	95 % (± 3%) Non condensing
	Storage	Non condensing
Altitude		2000 Meters Max. (6561 Ft. Max)
Electromagnetic Environment		EN/IEC61326-1, IEC EN 60730-1, EN 61000-6-4, EN 61000-6-2, ETSI EN 301 489-1, ETSI EN 301 489-17
Enclosure Protection		Nema 250 : type 4x IP : 66, ref : IEC60529
Impact rating (IK)		08

The controller was tested under IEC60068-1 (Environmental testing - Part 1: General and guidance)

Environmental characteristics

The following environmental EU directives were followed:

2011/65/EU	The RoHS 2 Directive
2012/19/EU	The WEEE 2 Directive
1907/2006/EU	The REACH regulation
2006/66/EC	The Battery Directive
94/62/EC	Packaging and packaging waste Directive
97/129/EC	Packaging material identification Directive

NOTES

F FCC part 15 statement

Statement regarding the importation of radio frequency devices capable of causing harmful interference

GSI Electronics Inc. develops, manufactures and distributes innovative technological products for the agricultural industry. Our unique expertise allows us to offer accurate, simple and diverse electronic, data processing and mechanical solutions for improving agricultural production.

The Wireless RS-485 uses radiation-emitting technology: a Wireless Radio at 2.4 GHz from RFM. This wireless technology is used by GSI Electronics to replace a solid link between two controllers. The Wireless RS-485 is classed as intentional radiators (FCC 47-part 15-Subpart C). The Wireless radio respects the emission limitations and the performances required by the standards FCC 15.247, RSS-210 Annex 2.9, ETSI EN 300 328. The Wireless RS-485 is used in a production context and in an industrial context (FCC 47-part 15-Subpart B - Class A).

The RFM Wireless radio, the FCC ID is HSW-DNT2400 and HSW-DNT2400P.

GSI Electronics Inc. hereby declares that the 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 when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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 and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna (Wireless RS-485)
- 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 GSI Electronics

NOTES

G FCC RF exposure statement

Statement regarding the importation of radio frequency devices capable of causing radiation exposure

GSI Electronics Inc. develops, manufactures and distributes innovative technological products for the agricultural industry. Our unique expertise allows us to offer accurate, simple and diverse electronic, data processing and mechanical solutions for improving agricultural production.

The Wireless RS-485 uses radiation-emitting technology: a Wireless Radio at 2.4 GHz from RFM. This wireless technology is used by GSI Electronics to replace a solid link between two controllers. The Wireless RS-485 is classed as intentional radiators (FCC 47-part 15-Subpart C). This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The RFM Wireless radio, the FCC ID is HSW-DNT2400 and HSW-DNT2400P.

NOTES

H Industry Canada Statement

This device complies with RSS-210 and ICES-003 of the Industry Canada Rules. Operation of this device is subject to the following two (2) conditions:

- This device may not cause harmful interference;
- This device must accept any interference received, including interference that may cause undesired operation.

The RFM Wireless radio, the IC ID is IC: 4492A-DNT2400 and 4492A-DNT2400P.

Ce dispositif est conforme à la norme CNR-210 et ICES-003 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes:

- le dispositif ne doit pas produire de brouillage préjudiciable;
- ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable

The RFM Wireless radio, the IC ID est IC: 4492A-DNT2400 et 4492A-DNT2400P.

IMPORTANT: *Radiation Exposure Statement: This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.*

IMPORTANT: *Déclaration d'exposition aux radiations: Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.*

NOTES

FDA declaration

Statement regarding the importation of devices and public health hazard directives from FDA (U.S. Food and Drug Administration)

GSI Electronics Inc. develops, manufactures and distributes innovative technological products for the agricultural industry. Our unique expertise allows us to offer accurate, simple and diverse electronic, data processing and mechanical solutions for improving agricultural production.

GSI Electronics' controllers are shipping under 9032.89.60.30 Canada (Automatic Regulating or Controlling Instruments & Apparatus). Electronic controllers are used to monitor and to control animal environment in a barn: ventilation function; heating function; lightning function; alert system function. Electronic controllers can be used to control the food distribution and to scale animals.

Electronic controllers do not use laser technologies. Electronic controllers use liquid crystal display (LCD) or Light-emitting diodes (LED). It is important to note also that electronic controller incorporating Liquid Crystal Displays (LCD) or Light-emitting diodes (LED) are not capable of emitting x-radiation.

The Wireless RS-485 uses radiation-emitting technology: a Wireless Radio at 2.4 GHz from RFM. This wireless technology is used by GSI Electronics to replace a solid link between two controllers. The Wireless RS-485 is classed as intentional radiators (FCC 47-part 15-Subpart C). The Wireless radio respects the emission limitations and the performances required by the standards FCC 15.247, RSS-210 Annex 2.9, ETSI EN 300 328. The Wireless RS-485 is used in a production context and in an industrial context (FCC 47-part 15-Subpart B- Class A). The Wireless RS-485 complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The RFM Wireless radio, the FCC ID is HSW-DNT2400 and HSW-DNT2400P. The IC ID is IC: 4492A-DNT2400 and 4492A-DNT2400P.

GSI Electronics devices are not used in contact with animal food. Electronic controllers do not manipulate vaccines or drugs.

As such these products and are not subject to the FDA standards and do not pose a public health hazard.

NOTES

J Disposal and Recycling Information

North America : Canada

As the concern for the volume of electronic waste grows, a number of Provinces in Canada have passed regulations since 2006 to divert electronics waste from the landfills and to protect the environment. These waste diversion regulations require manufacturers of covered electronic devices to participate in approved electronic product stewardship programs. The programs allow consumers and businesses to drop off eligible electronic devices for recycling, free of charge at numerous depots throughout the Province.

For more detailed information about the recycling of the device or batteries, contact your local city office, the household waste disposal service, or the retail store where you purchased this device. These collection points are accessible free of charge.

North America : United States

For more detailed information about the recycling of the device or batteries, contact your local city office, the household waste disposal service, or the retail store where you purchased this device. These collection points are accessible free of charge.

Instructions for disposal of waste equipment by users

The "crossed out wheelie bin" symbol on the device (and any included batteries) indicates that they should not be disposed of as normal household garbage. Do not dispose of your device or batteries as unsorted municipal waste. The device (and any batteries) should be handed over to a certified collection point for recycling or proper disposal at the end of their life.



For more detailed information about the recycling of the device or batteries, contact your local city office, the household waste disposal service, or the retail store where you purchased this device. These collection points are accessible free of charge. All products with this sign must be brought to these collection points.

The disposal of this device is subject to the Waste from Electrical and Electronic Equipment (WEEE) directive of the European Union. The reason for separating WEEE and batteries from other waste is to minimize the potential environmental impacts on human health of any hazardous substances that may be present.

There are two ways available to dispose of waste:

Appendix J: Disposal and Recycling Information

- Public system— contact your municipality or the nearest collection site to dispose of Electrical and electronic Equipment waste
- Private system— For a Return Material Authorization for Disposal of Waste Equipment, contact customer support at 1-877-926-2777 or by e-mail at mtl_techsupport@gsiag.com.

K Low voltage cable specifications

Communication bus

The suggested cable is AlphaWire 45374 or with very similar specifications.

Table K-1 *communication bus*

Item	Description
Cable type	Twisted and shielded
Temperature range	-50 to 125°C
Minimum gauge	1 mm ² (18 AWG)
Certification and type	CSA, CMG FT4 type, 18 AWG, 600 V, 75 °C (167 °F)
	UL, AWM or CM ttype, 18 AWG, 600 V, 75 °C (167 °F)
Characteristic Impedance	81 Ω +/- 12
Inductance	0.18 μH/ft, Nominal
Mutual Capacitance	19.7 pf/ft @1 kHz, Nominal
Conductor DCR	7.3 Ω/1000ft @20°C, Nominal
OA Shield DCR	5.7 Ω/1000ft @20°C, Nominal
Number of Twists	5.3 Twists/foot (min)

NOTES

GSI Group, LLC Limited Warranty

The GSI Group, LLC (“GSI”) warrants products which it manufactures to be free of defects in materials and workmanship under normal usage and conditions for a period of 12 months after sale to the original end-user or if a foreign sale, 14 months from arrival at port of discharge, whichever is earlier. The end-user’s sole remedy (and GSI’s only obligation) is to repair or replace, at GSI’s option and expense, products that in GSI’s judgment, contain a material defect in materials or workmanship. Expenses incurred by or on behalf of the end-user without prior written authorization from the GSI Warranty Group shall be the sole responsibility of the end-user.

Warranty Extensions: The Limited Warranty period is extended for the following products:

	Product	Warranty Period
AP Fans and Flooring	Performer Series Direct Drive Fan Motor	3 Years
	All Fiberglass Housings	Lifetime
	All Fiberglass Propellers	Lifetime
AP/Cumberland	Flex-Flo/Pan Feeding System Motors	2 Years
Cumberland Feeding/Watering Systems	Feeder System Pan Assemblies	5 Years **
	Feed Tubes (1-3/4" and 2.00")	10 Years *
	Centerless Augers	10 Years *
	Watering Nipples	10 Years *
Grain Systems	Grain Bin Structural Design	5 Years
Grain Systems Farm Fans Zimmerman	Portable and Tower Dryers	2 Years
	Portable and Tower Dryer Frames and Internal Infrastructure †	5 Years

* Warranty prorated from list price:
 0 to 3 years - no cost to end-user
 3 to 5 years - end-user pays 25%
 5 to 7 years - end-user pays 50%
 7 to 10 years - end-user pays 75%

** Warranty prorated from list price:
 0 to 3 years - no cost to end-user
 3 to 5 years - end-user pays 50%

† Motors, burner components and moving parts not included.
 Portable dryer screens included.
 Tower dryer screens not included.

GSI further warrants that the portable and tower dryer frame and basket, excluding all auger and auger drive components, shall be free from defects in materials for a period of time beginning on the twelfth (12th) month from the date of purchase and continuing until the sixtieth (60th) month from the date of purchase (extended warranty period). During the extended warranty period, GSI will replace the frame or basket components that prove to be defective under normal conditions of use without charge, excluding the labor, transportation, and/or shipping costs incurred in the performance of this extended warranty.

Conditions and Limitations:

THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE LIMITED WARRANTY DESCRIPTION SET FORTH ABOVE. SPECIFICALLY, GSI MAKES NO FURTHER WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE IN CONNECTION WITH: (I) PRODUCT MANUFACTURED OR SOLD BY GSI OR (II) ANY ADVICE, INSTRUCTION, RECOMMENDATION OR SUGGESTION PROVIDED BY AN AGENT, REPRESENTATIVE OR EMPLOYEE OF GSI REGARDING OR RELATED TO THE CONFIGURATION, INSTALLATION, LAYOUT, SUITABILITY FOR A PARTICULAR PURPOSE, OR DESIGN OF SUCH PRODUCTS.

GSI shall not be liable for any direct, indirect, incidental or consequential damages, including, without limitation, loss of anticipated profits or benefits. The sole and exclusive remedy is set forth in the Limited Warranty, which shall not exceed the amount paid for the product purchased. This warranty is not transferable and applies only to the original end-user. GSI shall have no obligation or responsibility for any representations or warranties made by or on behalf of any dealer, agent or distributor.

GSI assumes no responsibility for claims resulting from construction defects or unauthorized modifications to products which it manufactured. Modifications to products not specifically delineated in the manual accompanying the equipment at initial sale will void the Limited Warranty.

This Limited Warranty shall not extend to products or parts which have been damaged by negligent use, misuse, alteration, accident or which have been improperly/inadequately maintained. This Limited Warranty extends solely to products manufactured by GSI.

Prior to installation, the end-user has the responsibility to comply with federal, state and local codes which apply to the location and installation of products manufactured or sold by GSI.

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This equipment shall be installed in accordance with the current installation codes and applicable regulations which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

AgriAlert

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Agri-Alert is a part of GSI, a worldwide Brand of AGCO.