Gantry RFID Equipment Installation Manual

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Revision History Table

Table 1. Revision History.

Revision	Changes Since Previous Revision
1	This is the original release of the document.
2	Added data cable shielding instructions
3	Added pictures and descriptions, modified Remote Hub
4	Added images of Remote Hub
5	Added description of installation with remote Gantry Server

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1 INTRODUCTION

This document describes the procedure to mount and test the Radio Frequency Identification (RFID) hardware equipment on an overhead roadway gantry with the purpose to read RFID windshield tags, personal badge tags and RFID enabled container seals.

Typical installation includes a Gantry Server that controls the Gantry Reader and hosts software for communicating to the backend and the Gantry Reader with antennas.

2 OVERVIEW OF THE HARDWARE AND INSTALLATION

2.1 Hardware Components

The main hardware units that need to be installed are as follows:

1. Gantry Server
2. Gantry Reader Kit
3. Gantry Connection Box
4. Cables

Additional hardware components that may be required:

1. External UPS
2. Remote Hub

Please refer to Appendix A for detailed component descriptions.

Gantry Server must be installed in a server room with a climate-controlled environment.

2.2 Gantry Location Types

There can be three possible installation case scenarios for the gantries in terms of their location and hookup:

1. Standard case where Gantry Reader location is close to the Gantry Server. The reader takes 24Vdc power and Ethernet connection directly from the Gantry Server and the required cable runs are no more than 100 meters.
2. Installations where Gantry Server is installed remotely, and Gantry Reader is connected to the local LAN switch and 24Vdc power – both provided by the customer. Again, power and Ethernet cables should not be longer than 100m.
3. Installations where Gantry Reader has to be installed far away from the Gantry Server or local LAN/Power requiring more than 100m cable run. A Remote Hub must be installed that will provide power and network connections to the remote gantry or gantries.

A standard configuration Gantry Server and Remote Hub can support up to 3 Gantry Readers. If the installation requires more than three read points – the equipment can be customized for additional capacity. This will be identified in the site survey.

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2.2.1 Standard Gantry Location Setup

This is a preferred setup. The Gantry Server provides a protected 24Vdc power supply and an industrial grade Ethernet switch to have a good EMI and power surge protection. All equipment operates on a separate LAN for extra security and the Gantry Readers have a UPS support to keep working when there are power outages. The data is preserved if local LAN or Internet are down.

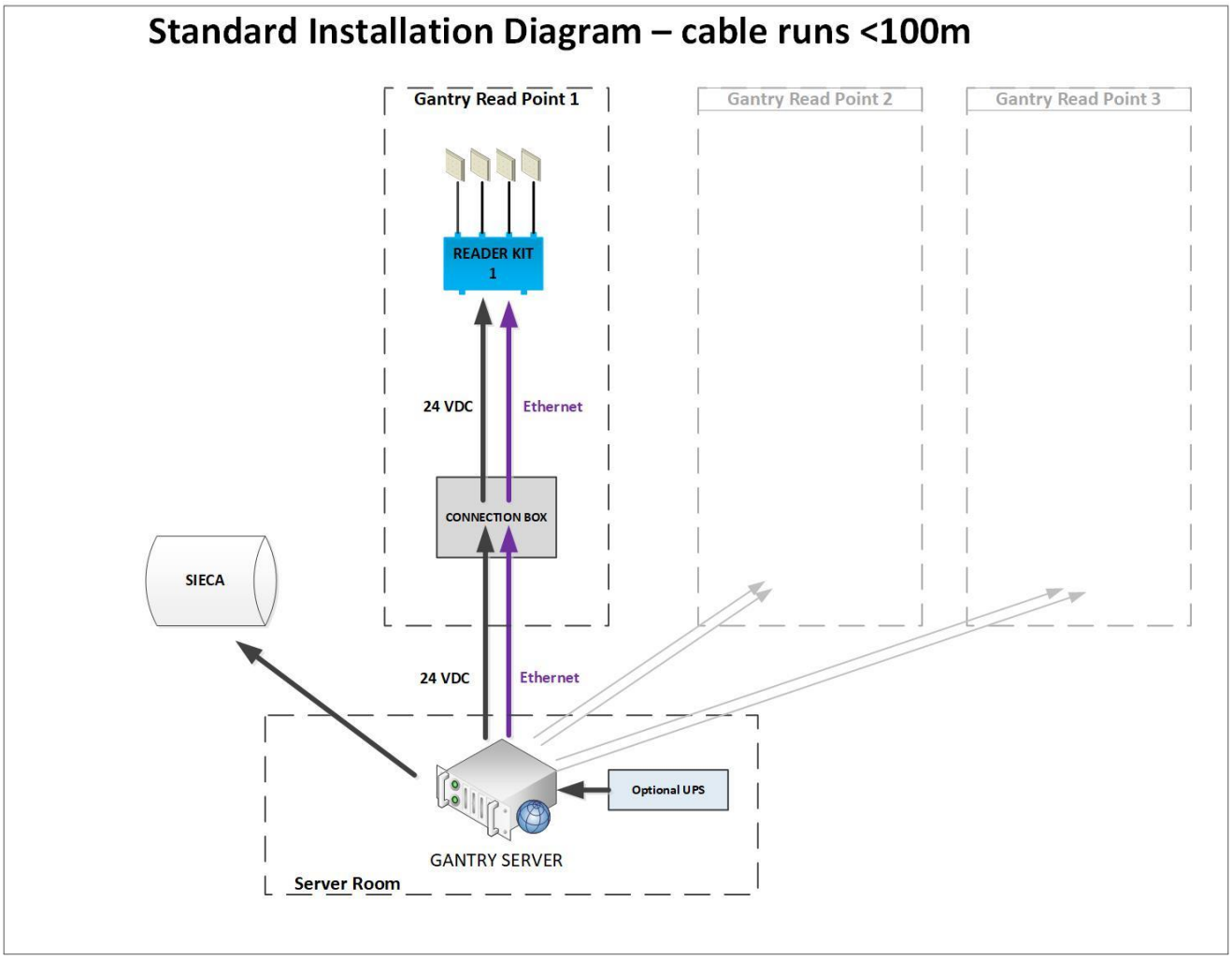

Figure 1. Standard installation diagram.

2.2.2 Remote Server Location Setup

When it is not practical to install a Gantry Server locally a customer may choose to put readers on local LAN and power them from a local 24Vdc source sacrificing protection, and UPS supported uptime of Gantry Readers. This setup will not provide data collection and retention during power outages. Also, the data will be lost if local LAN is down or there is no internet connection.

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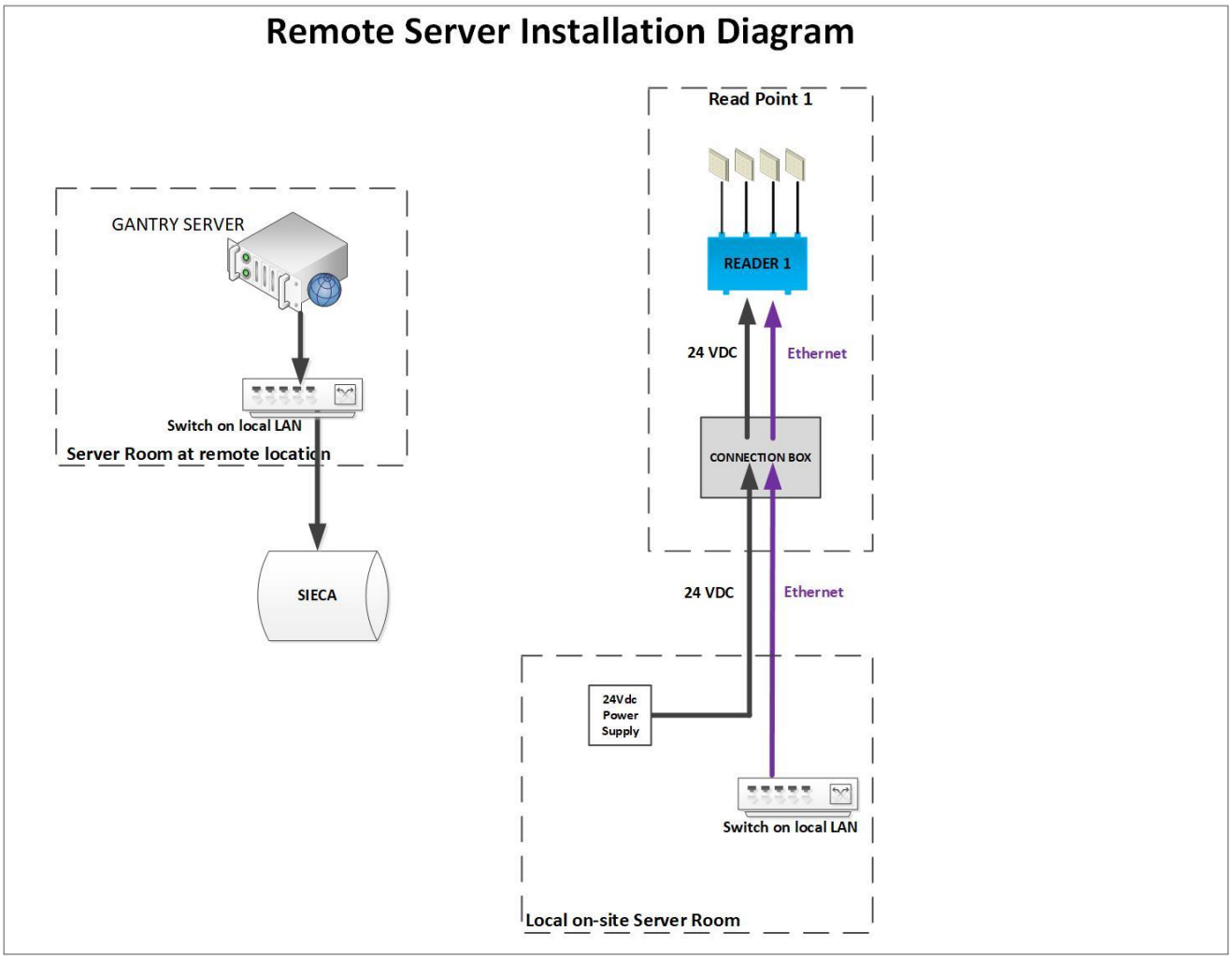

Figure 2. Remote Server installation diagram.

NOTE:
24Vdc power source must be able to provide 2A of current per one connected reader. For example, if 3 readers are connected – the power supply must be rated for 6A or more.
24Vdc wire is subject to resistive losses. Longer runs will require a thicker wire. Please refer to Chapter 4.5 Connection Box Installation for reference on the required wire gauge.
The 24Vdc power supply must conform to local electrical code and have a proper fuse.

2.2.3 Remote Gantry Location Setup

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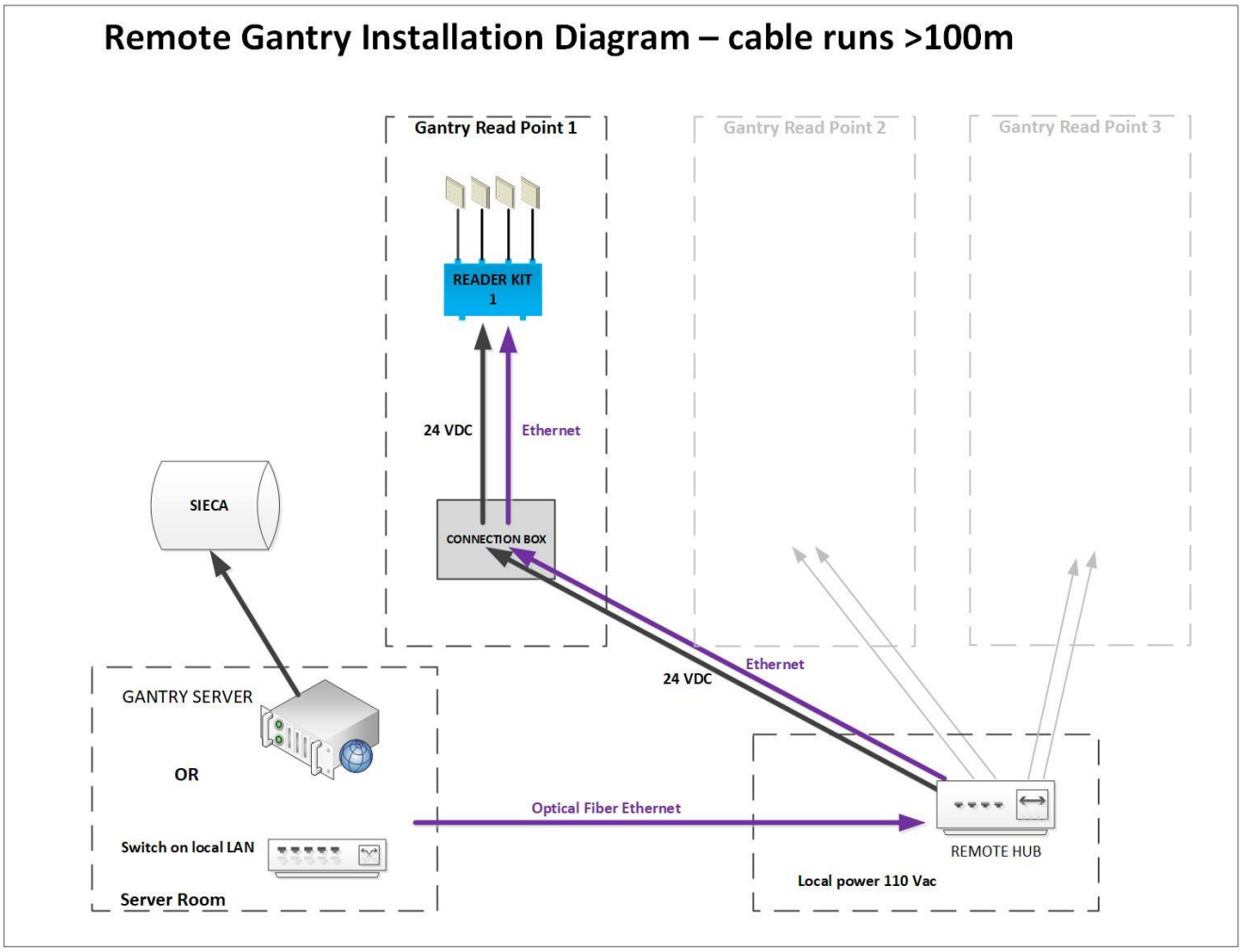

Figure 3. Remote Gantry installation diagram.

2.3 Gantry Read Point Variations

A read point can have two or four RFID antennas to cover one or two road lanes. More than one read point can be mounted on a single gantry.

For reliable reading of container seals, the RFID antennas height and spread must not exceed 4m and 5m respectively. Road lanes MUST be established with permanent late separators on both lane sides to guide traffic in between the RFID antennas.

Site survey will determine the required gantry dimensions and antenna locations. If the lane separation cannot be enforced and / or the recommended antennas height and spread cannot be provided the read rates for container seals may be negatively affected. A customer may choose to accept the read rate degradation due to physical constraints of a specific road construction.

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2.3.1 Read Point with 2 RFID Antennas

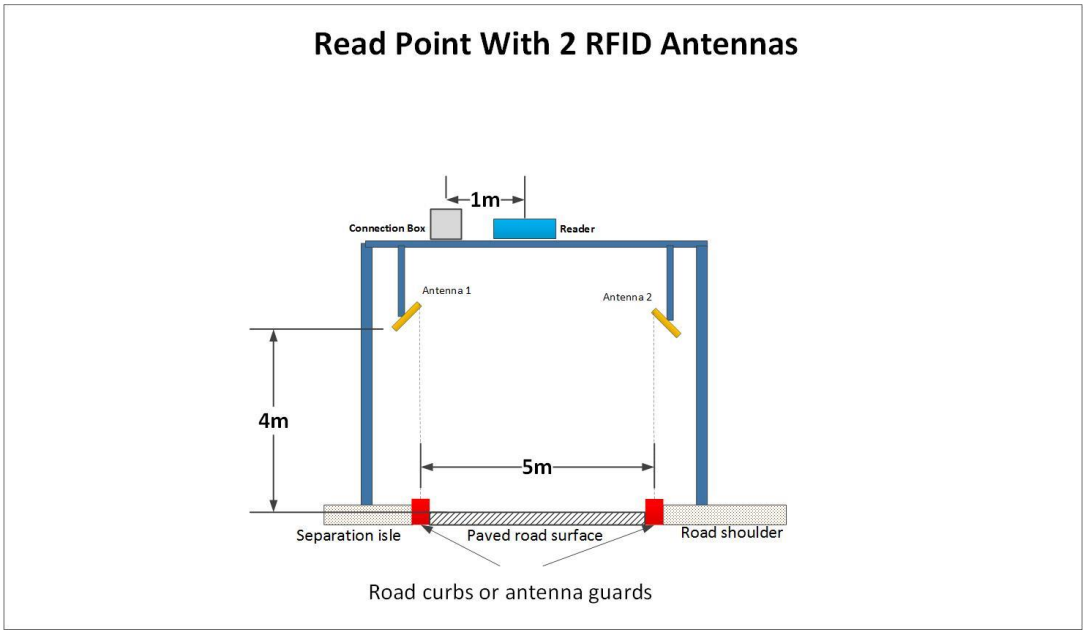

Figure 4. Read Point with 2 RFID antennas.

2.3.2 Read Point with 4 RFID Antennas

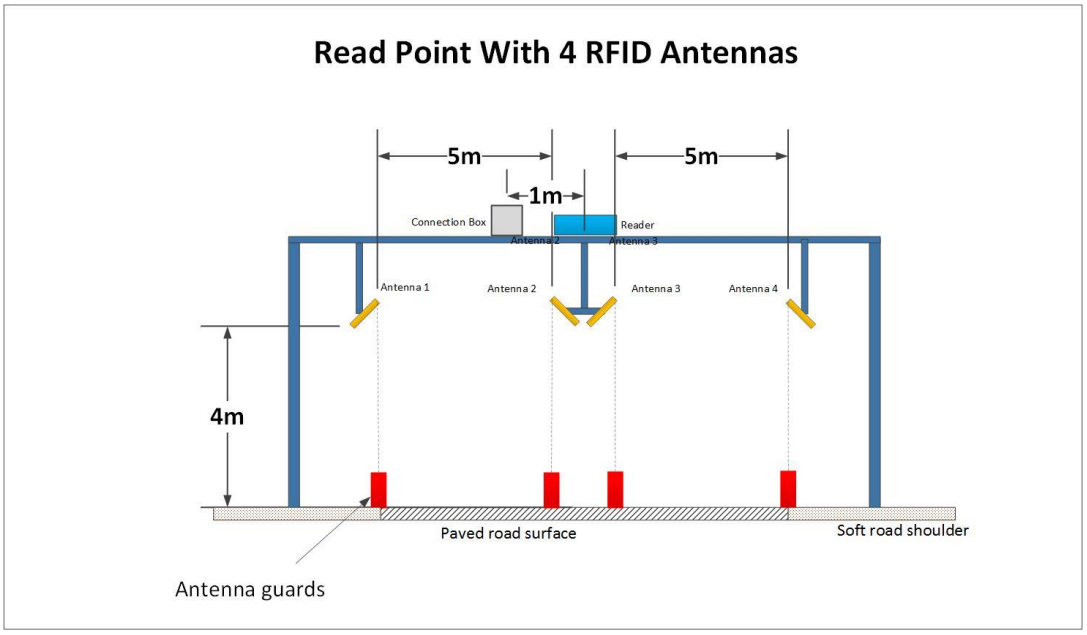

Figure 5. Read Point with 4 RFID antennas.

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3 OVERVIEW OF THE HARDWARE OPERATION

3.1 Read Point Operation

A reader will read and buffer all RFID tags (seal, windshield and badge). The reader power of 24Vdc will be provided from a UPS built in the Gantry Server in the case of a standard gantry installation. For a remote gantry installation – the reader power and communication will come from a Remote Hub. The Remote Hub will have its own UPS and a network switch.

The reader – server communication will be over a standard Ethernet connection.

3.2 Gantry Server Operation

The Gantry Server will host middleware for reader management and back end support.

The reader – server communication will be over a standard Ethernet connection.

The Gantry Server will have a built in UPS unit that will power its own computer as well as connected readers. If longer backup operating times are required or if more than one reader is powered from the server box – an external 110Vac UPS will be required with appropriate battery size. This will be specified at Site Survey.

Power on reader reset can be performed from the Gantry Server.

3.3 Connection Box Operation

A local contractor will have to run data and 24V power cables from a Gantry Server to a Connection Box installed on a gantry close to the reader. The Connection Box will provide environmental sealing to the cable connections.

For the 24V power connection there will be a set of screw in terminals.

For the Ethernet connection there will be an RJ45 jack.

3.4 Remote Hub Operation

A Remote Hub will host a UPS unit to power up to 3 readers. Can be custom configured for more if needed. Will be specified at Site Survey.

The Hub will also have a network switch for 3 readers in the standard configuration. Can be custom configured for more if needed. Will be specified at Site Survey.

Data connection to the hub will be done over a fiber optical connection. Power of 110Vac must be provided locally.

The Remote Hub enclosure will accommodate two 110Vac outlets and optical fiber receiver with a power adapter.

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4 GANTRY EQUIPMENT INSTALLATION

4.1 Required Hardware

1. READER HW:

Gantry Reader Kit: **600249PKG**

Gantry Reader	Gantry Antenna – 4pcs (*)	Antenna Bracket – 4pcs (*)
		
600249	351435	351436

Antenna Cable, 8m – 2pcs (**)	Antenna Cable, 3m – 2pcs (**)	Gantry Mounting Kit
		
500772	XXXXXX	XXXXXX

Test Tag

XXXXXX

(*) Order quantities as per Site Survey
(**) Order cable lengths and quantities as per Site Survey

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2. CONNECTION BOX:

Must be provided by a local contractor.

Connection Box: **XXXXXX**

Connection Box	Connection Box Mounting Kit
	
XXXXXX	XXXXXX

3. REMOTE HUB:

Remote Hub: **XXXXXX**

Remote Hub NEMA Box	Remote Hub Kit	Remote Hub Installation HW
XXXXXX	XXXXXX	XXXXXX

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4.2 Gantry Preparation.

The Gantry must be built with features that will allow easy mounting of the Gantry Reader and Antennas as well as a Connection Box and a Remote Hub where required according to the Site Survey.

The Gantry must be reliably grounded for lightning protection with the ground resistance of 5 Ohms or less.

The following must be pre-installed on the gantry:

1. **Drop down bars** for antenna mounting:
   - Length and location according to the Site Survey.
   - The bars must have high wind resistance so that they do not swing in strong winds when large antennas are attached to them.
   - It is imperative that the attachment of bars to gantry is not permanent and they can be moved left or right for final adjustment of the antenna alignment with the road rails or curbs serving as antenna guards.
   - Refer to the Antenna Mounting instructions below for the bar-antenna attachment requirements.
2. **Reader mounting plate**:
   - Centrally located (see Site Survey) the plate must have matching holes for attachment of the reader bracket – see Reader Mounting below.
3. **Connection Box mounting plate:**
4. **Remote Hub mounting plate:**
   - Where required by Site Survey.

4.3 Reader Mounting

- Before mounting the reader make sure that it is configured with correct networking parameters according to Site Survey.
- Gantry Reader must be mounted in the middle of the gantry to minimize the length of antenna cables. Refer to the Site Survey for the exact location.
- Gantry Reader must be mounted vertically with the heat sink fins aligned vertically to allow proper convection cooling.
- Antenna ports on the reader must be facing down to allow gravity to drain water away from the enclosure.
- Gantry must provide a vertically oriented mating mounting plate to match the reader mounting bracket. Drill four holes in the gantry plate to match the slot holes of the reader mounting bracket. Refer to the drawings below.

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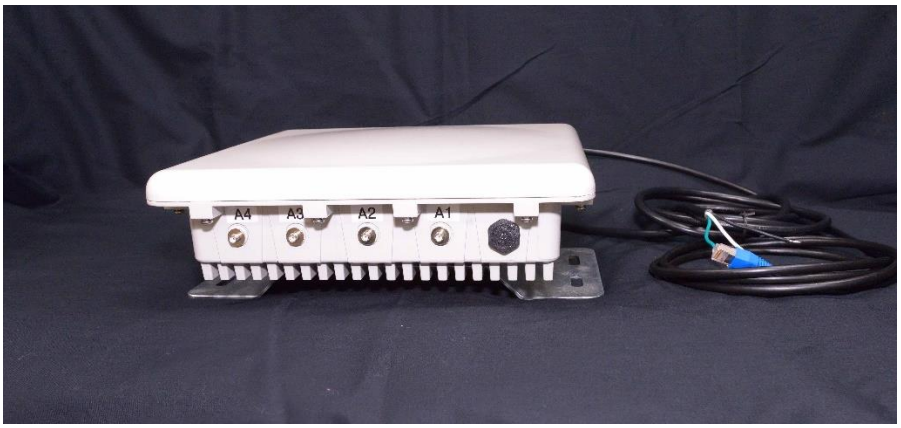

Figure 6. Reader Box image.

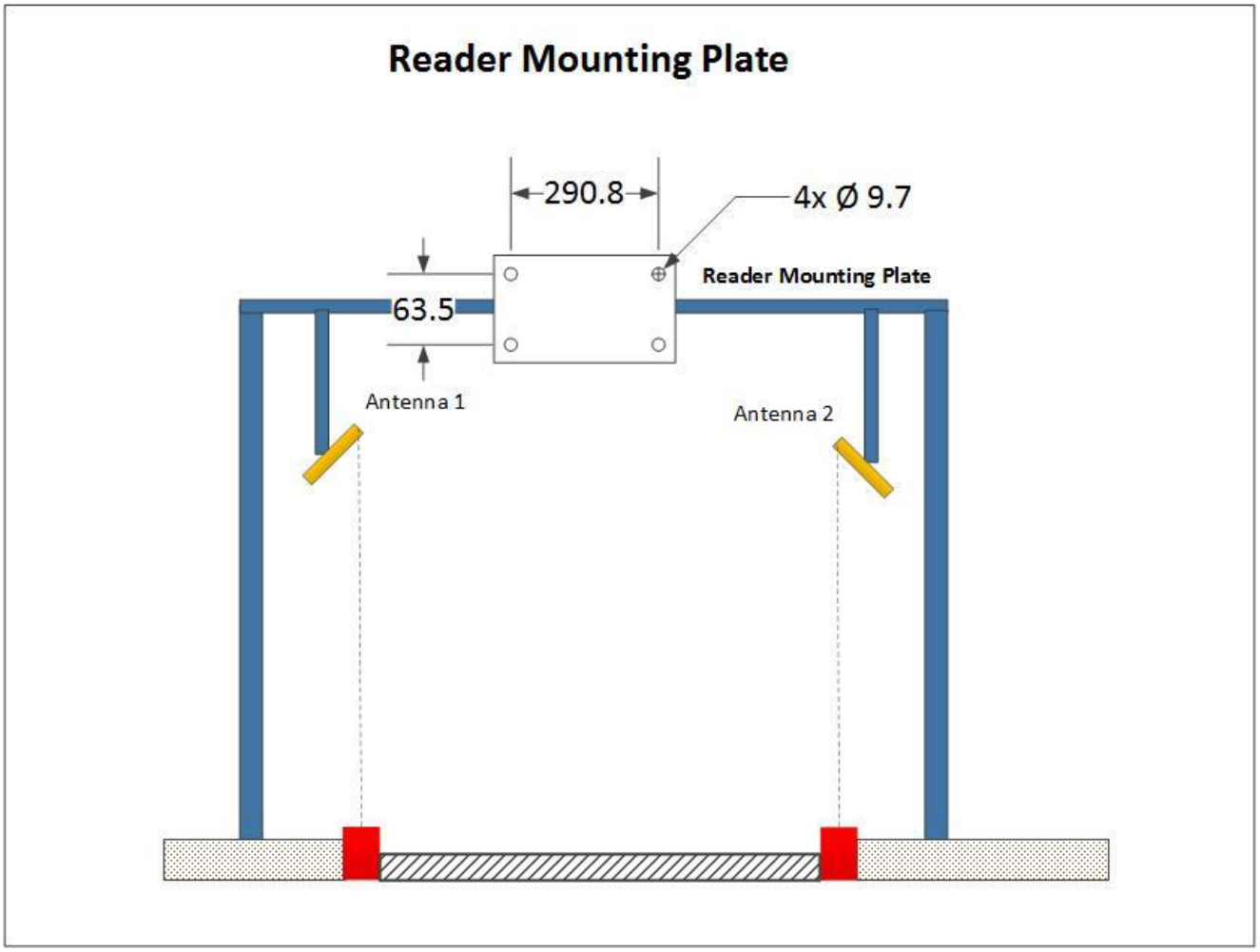

Figure 7. Reader mounting plate location and dimensions.

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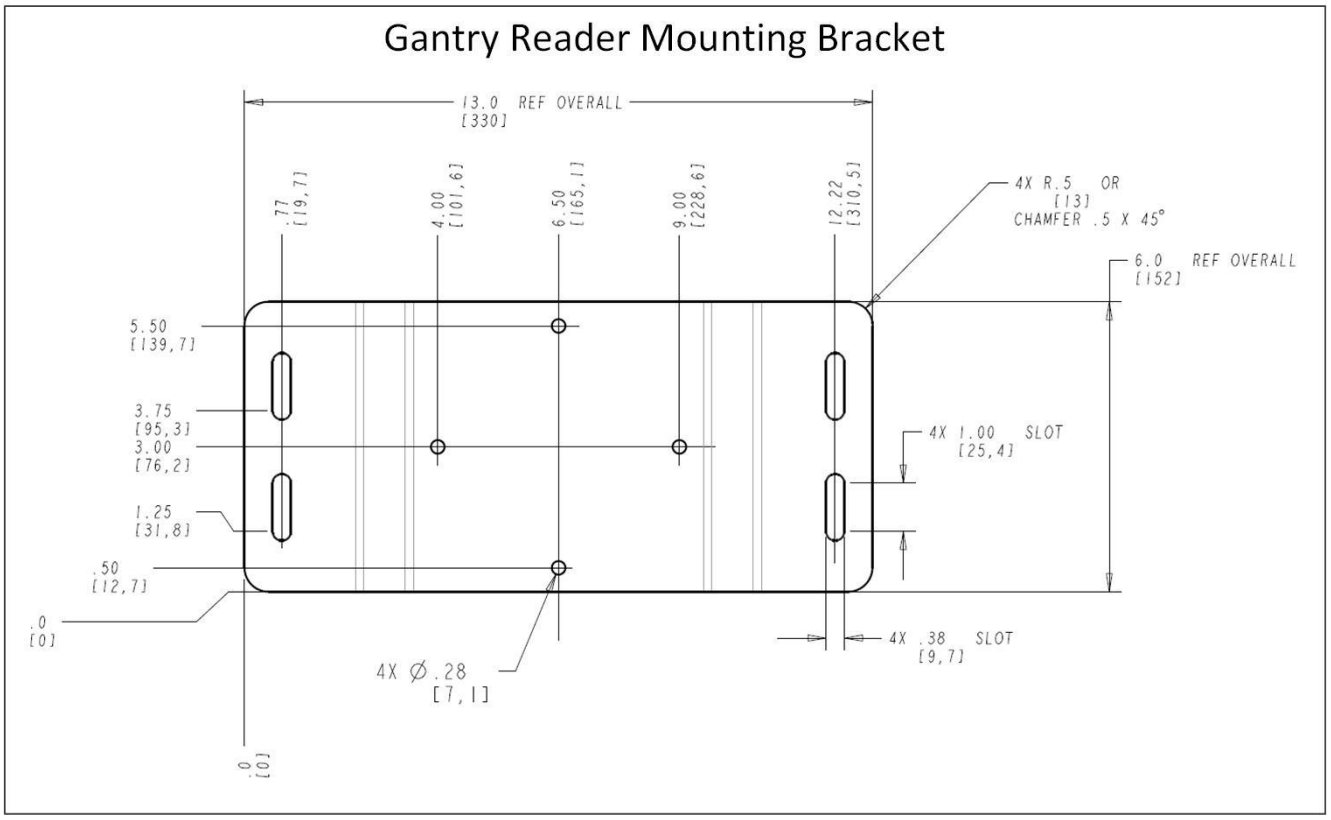

Figure 8. Reader mounting bracket dimensions.

4.4 Antenna Mounting

- Antennas must be mounted on drop down bars in the locations specified in the Site Survey.
- IMPORTANT! Antennas can be mounted to provide vertical or horizontal polarization. Antennas covering the same lane MUST have vertical polarization for one and horizontal polarization for the other – please orient them in accordance with the relevant Site Survey. Antennas have marking on the back to indicate the direction of polarization.

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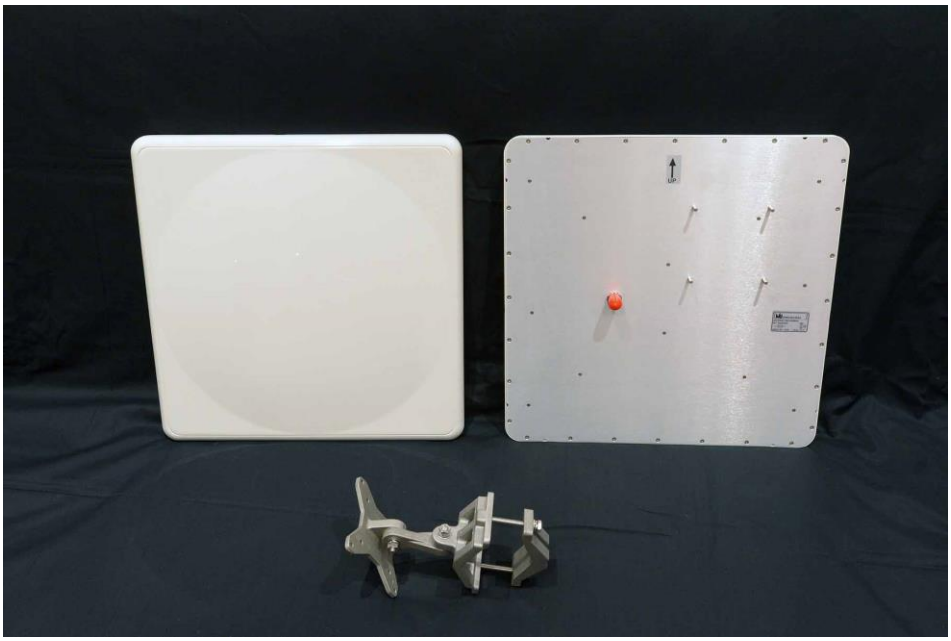

Figure 9. Antenna and mount.

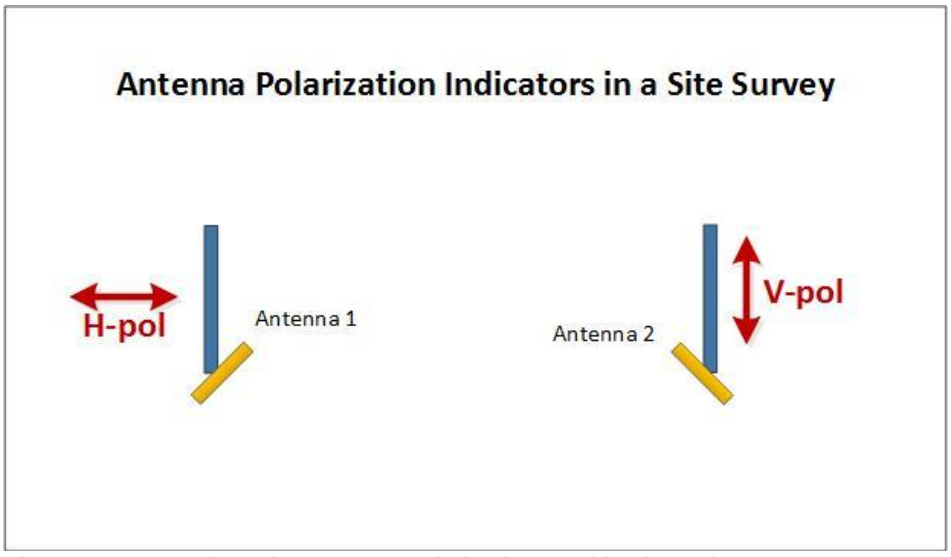

Figure 10. Example of the antenna polarization marking in a Site Survey.

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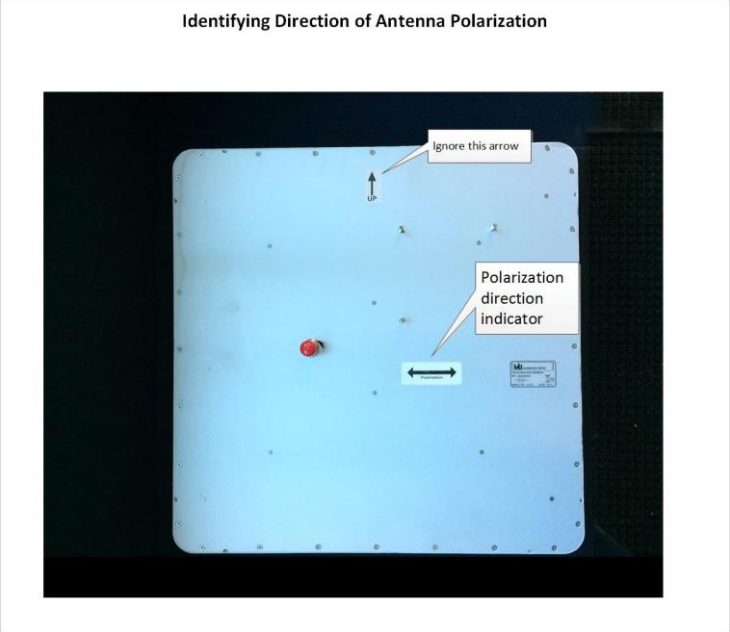

Figure 11. How to identify the direction of antenna polarization.

- The antenna mounting bracket can accept the bar diameter or diagonal in the range of 1”-3” or 25.4mm-76.2mm.
- Antennas can be mounted either on vertical or horizontal bars. Refer to the illustrations below.
- After mounting of the antennas the bar locations will have to be adjusted left or right so that the antennas are in proper vertical alignment with the guard structures on the ground. Refer to the illustration below.

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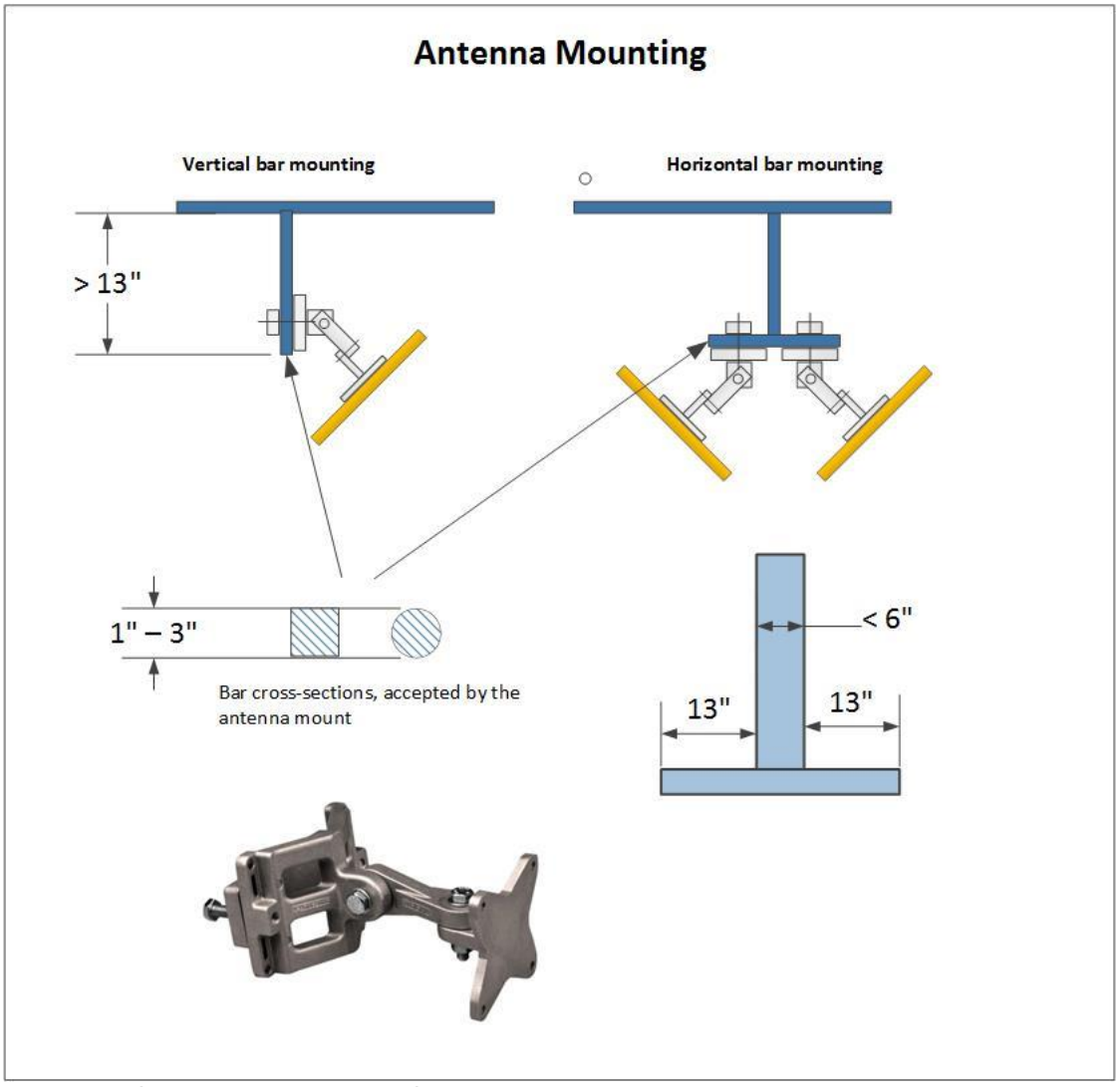

Figure 12.Antenna mounting.

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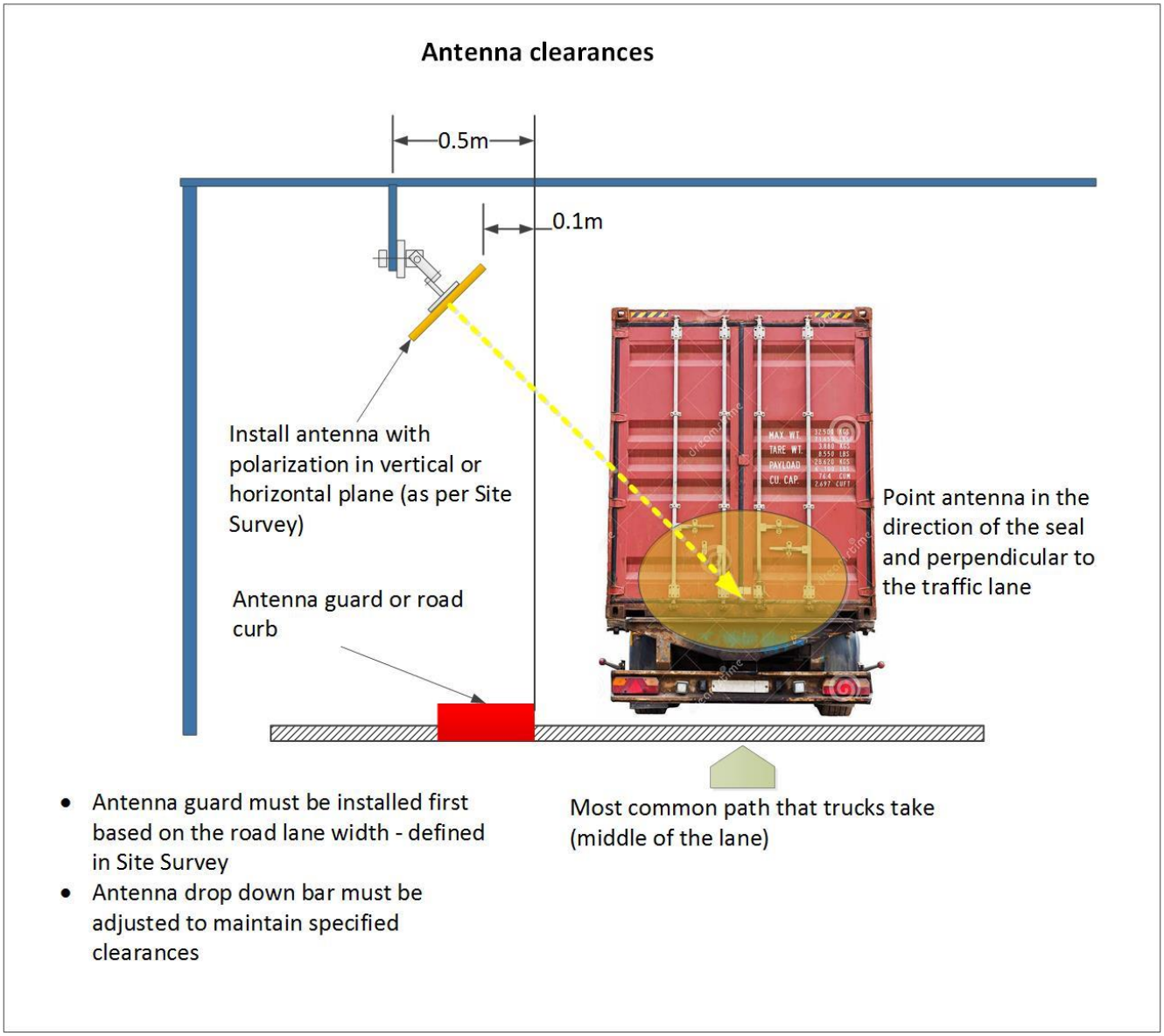

Figure 13. Antenna clearances.

4.5 Connection Box mounting.

- Local contractor must install a UV and weather protected Connection Box to connect the Gantry Reader with the Gantry Server or the Remote Hub – refer to Site Survey.
- Connection Box must be mounted within 1m distance from the reader.
- Connection Box must provide a terminal block with screw-in connections for the 24Vdc power.

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- Connection Box must provide an RJ45 jack for the data connection.
- Local contractor must run 24Vdc and Ethernet UV protected cables to the Gantry Server or the Remote Hub.
- For the 24Vdc cable the wire gauges must be selected according to the table below depending on the length of the run:

Wire Length, m	25	40	70	100
Wire gauge, AWG	16	14	12	10

- Wiring of the Connection Box is described in the diagram below.

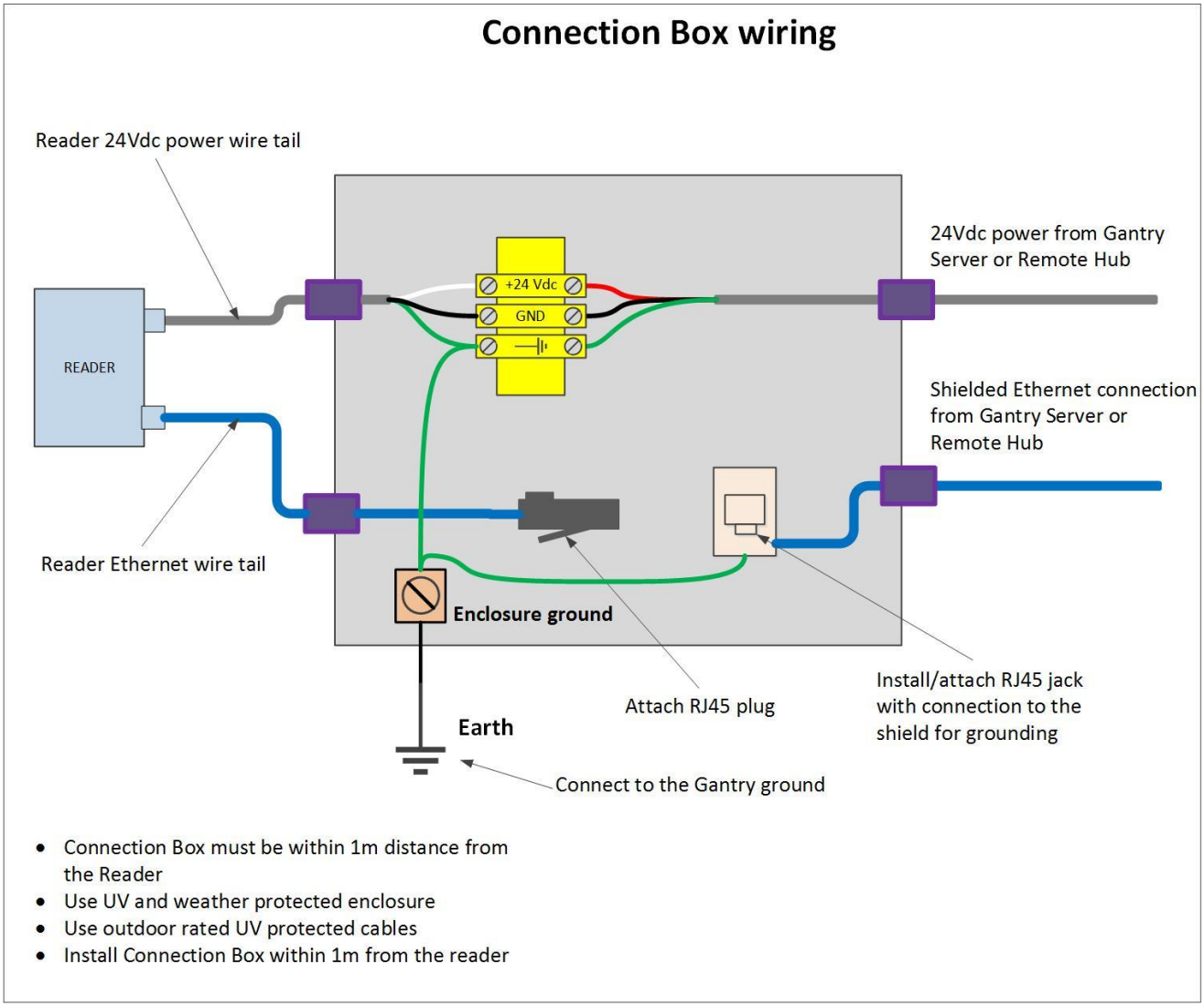

Figure 14. Connection Box wiring.

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5 GANTRY SERVER INSTALLATION.

The Gantry Server must be installed in an environmentally controlled room, existing server room being an ideal choice.

Figure 15. Gantry Server box.

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Figure 16. Gantry Server Box with the door open.

The server box can be mounted on the wall or in a standard 19” equipment rack.

There could be two situations with regards to the Server to Read Point connections:

1. Standard Gantry location, where the read point(s) require cable runs of less than 100m;
2. Remote Gantry location, where cable runs have to be more than 100m.

In case of a standard installation – the power to the read points will be delivered directly from the Gantry Server using low voltage cables and the data communication will also be direct via a standard Ethernet cable.

In case of a remote installation – the Gantry Server will connect to an optical fiber converter that will deliver the data connection to a Remote Hub. The 24Vdc power to the read points will be taken from the Remote Hub.

Same Gantry Server can be wired for the combination of both standard and remote read points if required – see Site Survey.

Refer to illustrations below.

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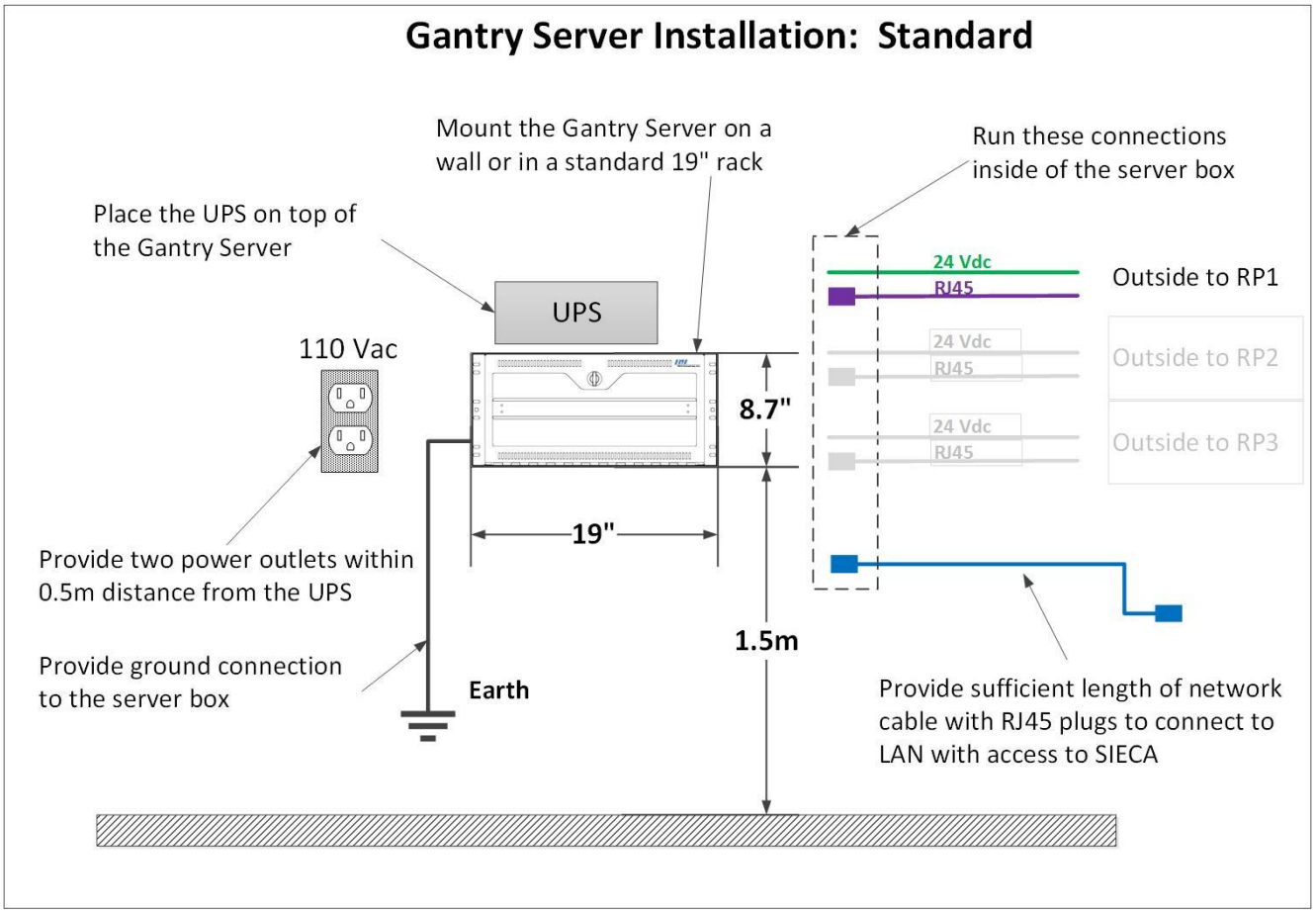

Figure 17. Gantry Server Standard installation diagram.

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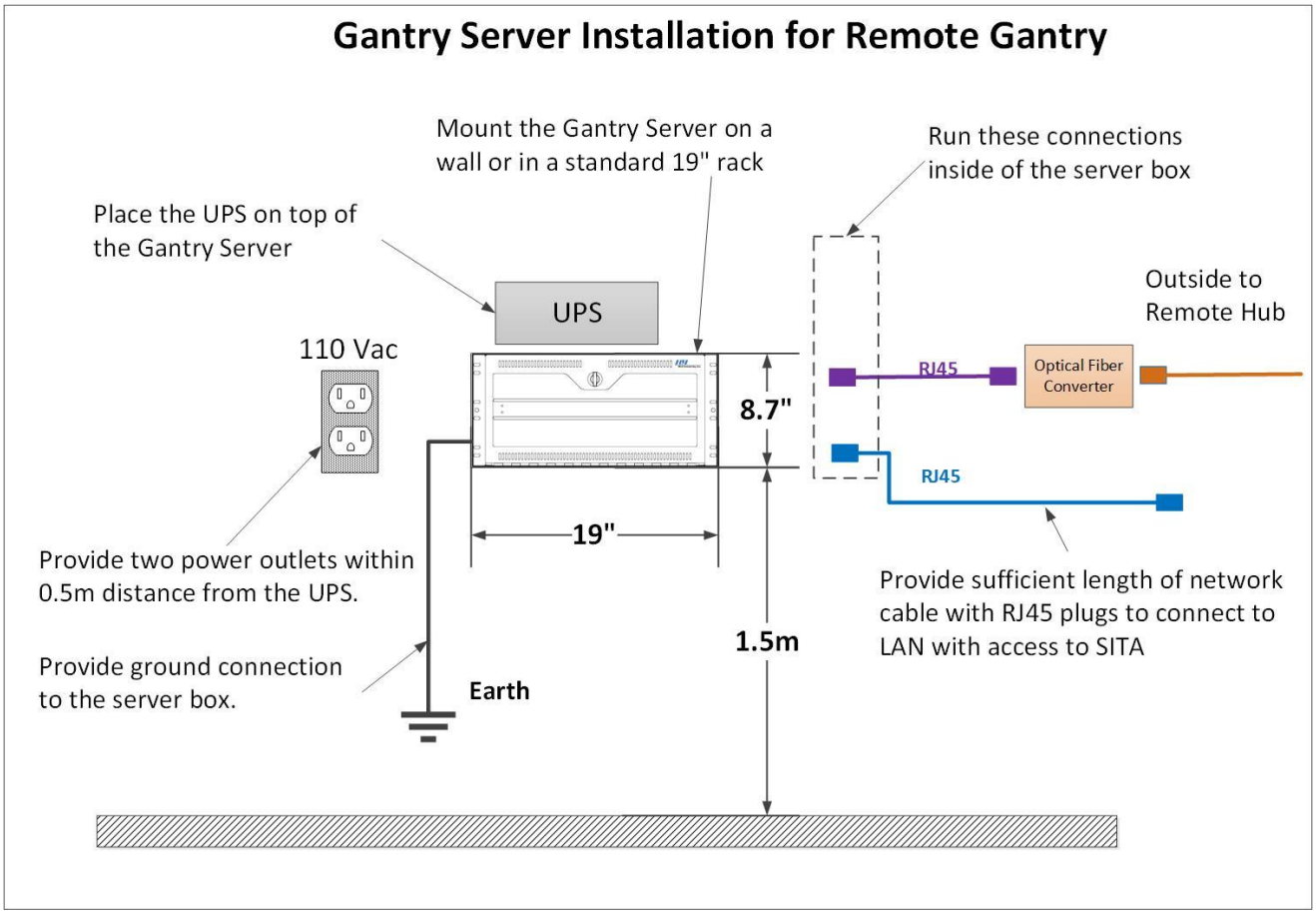

Figure 18. Gantry Server Installation for Remote Gantry diagram.

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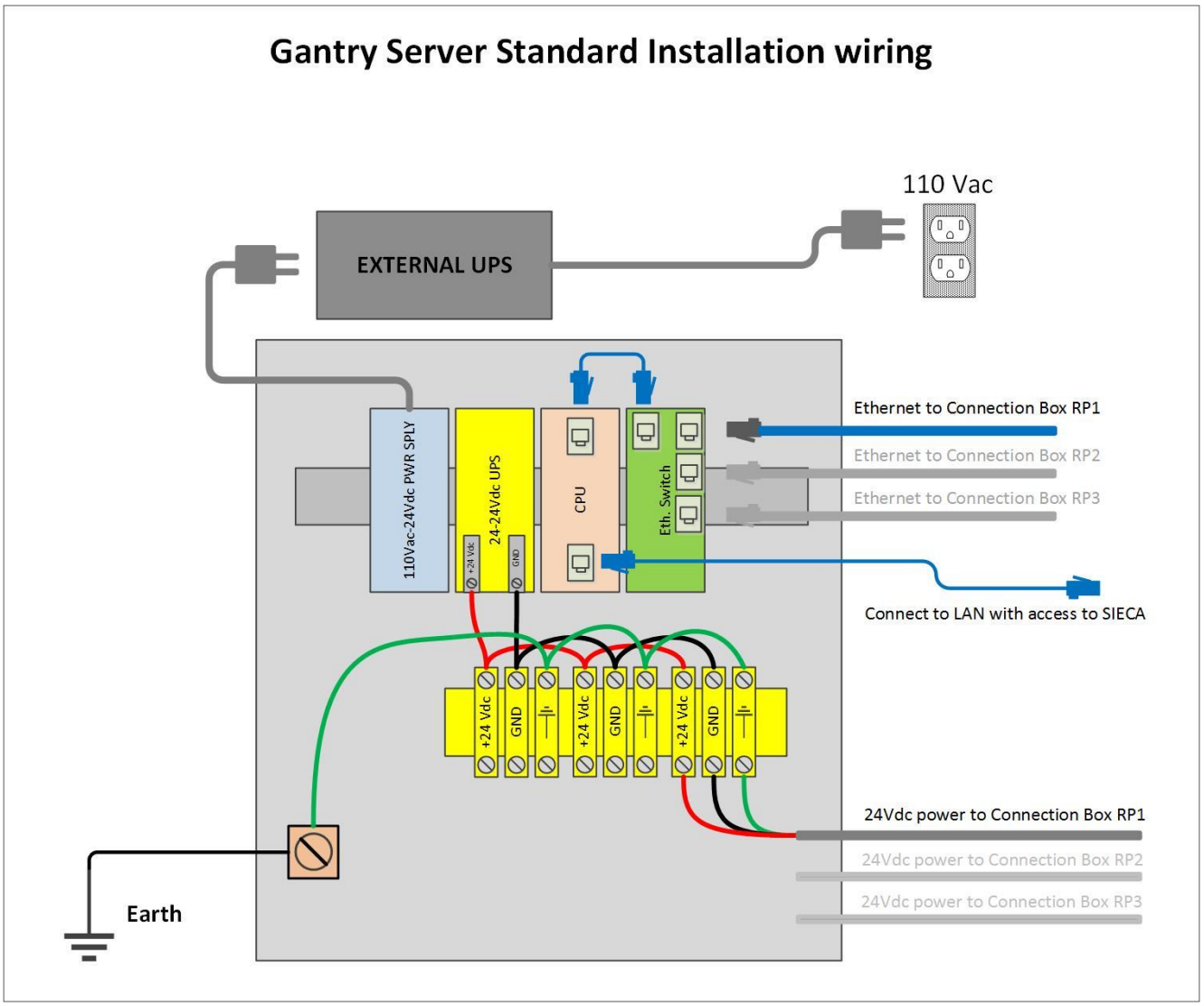

Figure 19. Gantry Server Standard installation wiring diagram.

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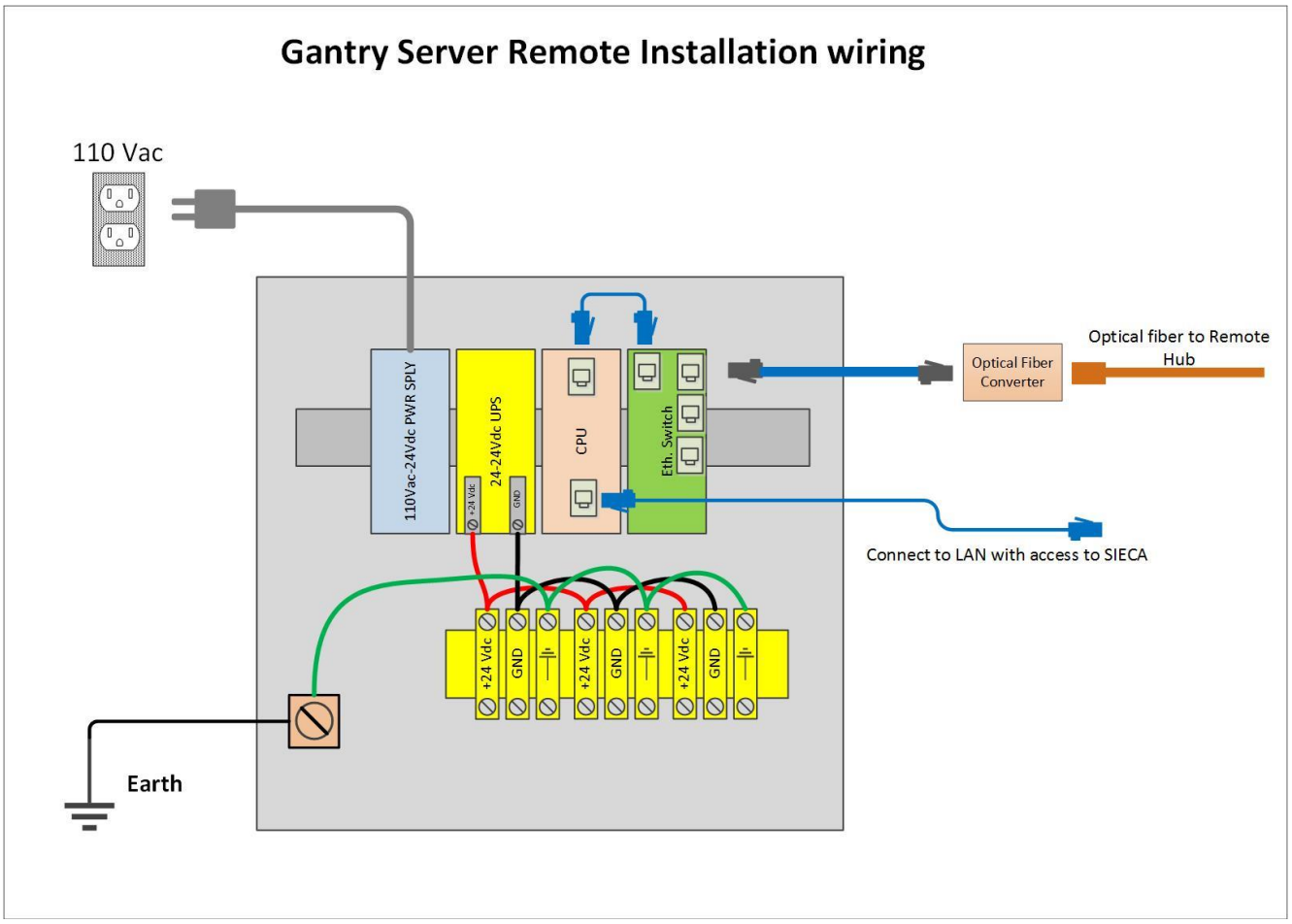

Figure 20. Gantry Server Remote installation wiring diagram.

6 REMOTE HUB INSTALLATION

- Remote Hub must be installed high up on a gantry to prevent theft.
- Remote Hub enclosure must be oriented vertically for the best convection cooling.
- Local contractor must provide and install a weather protected NEMA Hub enclosure in accordance with the specifications below.
- Local contractor must provide, install and connect a 110Vac power outlet inside of the Remote Hub enclosure at the location indicated in the drawing below.
- Local contractor must provide, install and connect an optical fiber connection media converter inside of the Remote Hub enclosure at the location indicated in the drawing below.
- For wire gauges and cable lengths follow the same specifications as defined in the Connection Box Mounting.

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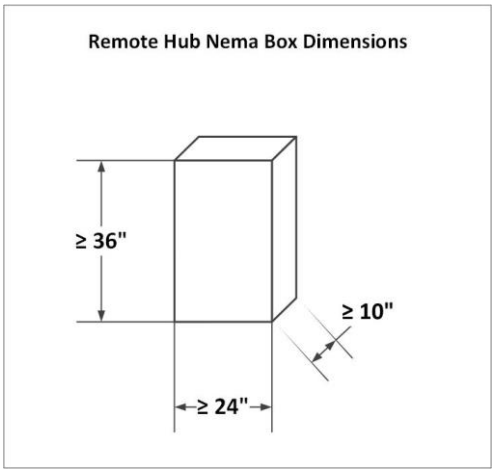
6.1 Remote Hub NEMA Box Specification

- NEMA Box Enclosure must provide reliable weather protection through the use of UV resistant materials, rubber seals and cable glands.
- Do not use a forced air vented enclosure. The enclosure has to be fully sealed to prevent the sea salt micro particles from entering inside.
- NEMA Box Enclosure must be of light color, preferably white, to reduce heating caused by the sun exposure.
- NEMA Box Enclosure must be made of metal to facilitate convection heat exchange.
- Please size the enclosure according to the minimum dimensions requirements below.



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6.2 Remote Hub Component Placement.

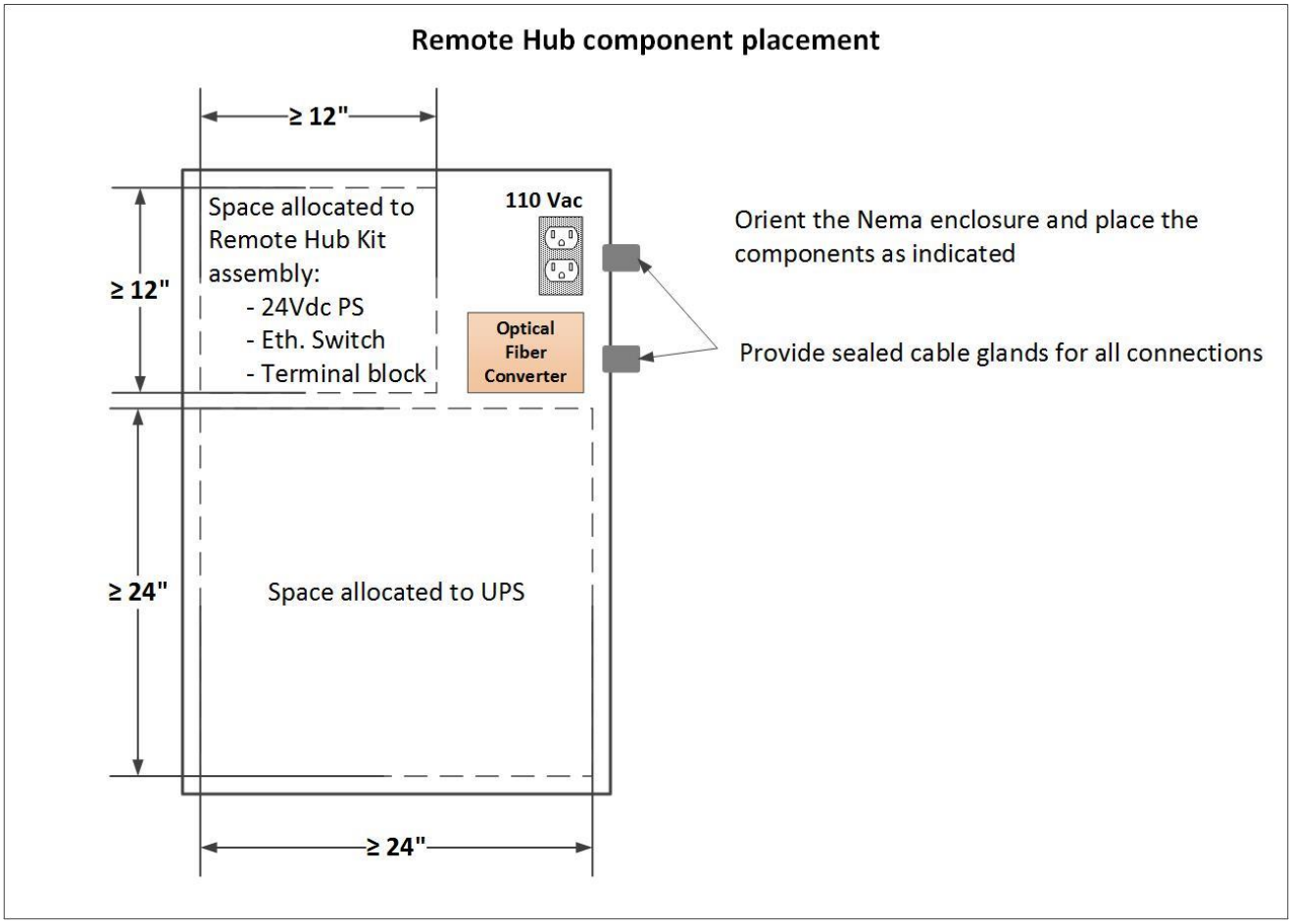

Figure 21. Placement of components inside of the Remote Hub enclosure.

6.3 Remote Hub Kit Assembly

The Remote Hub Kit comes pre-assembled on an aluminum mounting plate sized 12” x 12”. See the picture below.

The Ethernet cables may be removed for transportation – please re-install them as per the picture below.

The kit comes with a set of sealed cable glands to be installed on the NEMA box as well as Velcro tape to attach the aluminum plate to the NEMA box if necessary.

For wiring refer to the Remote Hub Wiring diagram in the chapter that follows.

WARNING:

Make sure to make the Earth connection to the screw that is located in the middle of the Ethernet Lightning Arrestor.

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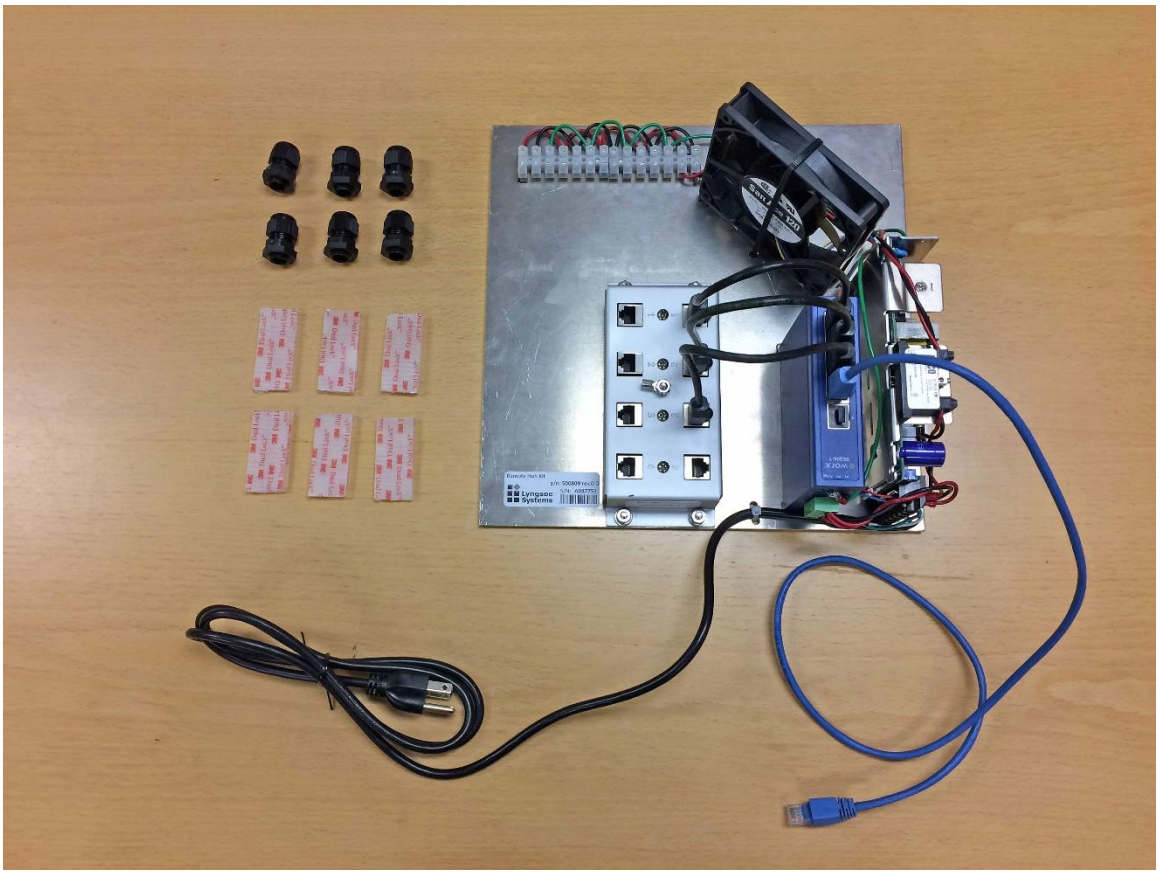

Figure 22. Remote Hub Kit components.

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6.4 Remote Hub Wiring.

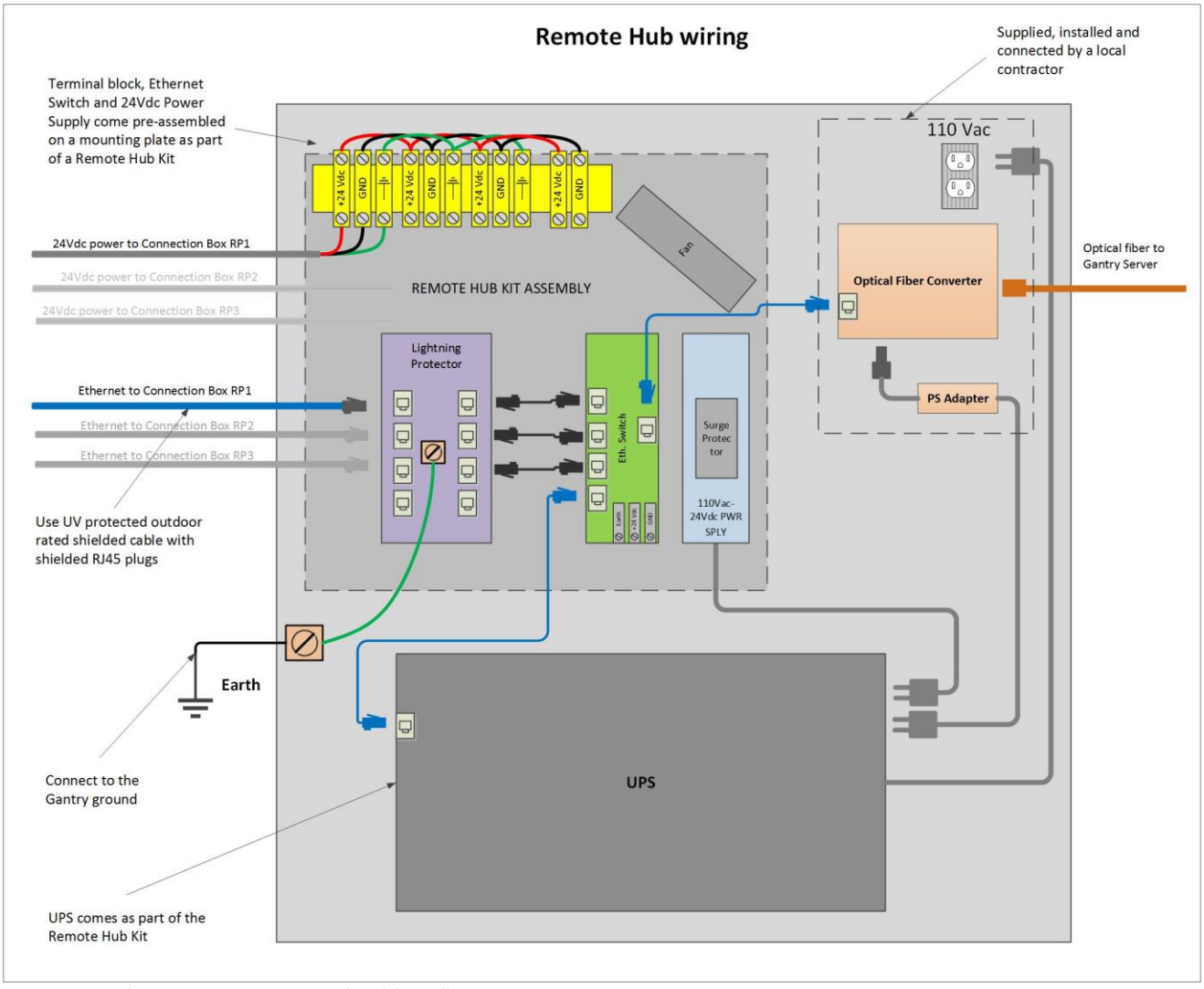

Figure 23. Remote Hub wiring diagram.

7 TEST TAG INSTALLATION

The Gantry Kit includes a Test Tag that is used to verify that the system is operational.

The Test Tag must be placed on one of the gantry posts in the line of sight and within the reading range of one of the antennas.

The Test Tag should be located high to avoid vandalism.

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Figure 24. Test Tag.

8 EQUIPMENT TEST

1. Apply power to the Gantry Server.
2. Unplug the Gantry Server computer from the local LAN and connect it to a test laptop.
3. Log in to the Gantry Server from the test laptop.
4. Verify communication to all installed readers.
5. Verify that all antennas on all read points can read test tags. For that configure readers to work with one antenna at a time, check the reception of a test tag and move on to the next antenna. Repeat for all read points.
6. Unplug the power from Gantry Server and confirm that all of the equipment continues to work for more than 30 minutes.
7. If applicable - do the same for the Remote Hub.
8. Start and configure EDECS.
9. Reconnect the Gantry Server back to the local LAN.
10. Using VPN – connect to the Gantry Server from outside of the LAN using Internet.
11. Verify that SIECA receives data from the Gantry Server.

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9 APPENDIX A. DESCRIPTION OF COMPONENTS.

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