StreetWAVE™ SW-1000 Roadside Unit Installation Guide

2005 De La Cruz Boulevard #111,
Santa Clara, CA 95050

Release: RSU
Document Version: 1.2

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1 Introduction

This installation guide describes the procedure to install the StreetWAVE™ SW-1000 Roadside Unit (RSU).

The SW-1000 RSU is an advanced DSRC Unit created to enable communication for Vehicle to Infrastructure (V2I) applications. It has been designed and tested to be compliant to the US-DOT v4.1 RSU Specification. It has been designed to be installed at any of the following locations:

- A mast arm

- A utility pole at the roadside

- An overhead sign bridge

Note: This document describes the installation procedure of the StreetWAVE™ device on a pole at the roadside.

1.1 Overview

This guide explains how to install, maintain, uninstall, and troubleshoot your StreetWAVE™ Roadside Unit.

For detailed instructions on using all the StreetWAVE™ features, refer to the ***Savari StreetWAVE™ Roadside Unit User Guide***.

1.2 Audience

This installation guide is created for the individuals installing Savari StreetWAVE™ Roadside Unit.

1.3 Safety Instructions

You need to follow the following basic safety guidelines when installing the Savari StreetWAVE™ device:

- Read the installation instructions before you connect the system to its power source.

1.4   Prerequisites

1.4.1 Before you Begin

Before installing the Savari StreetWAVE™ Roadside Unit, please ensure that the shipped kit[1] contains the contents as described in the section "**Various Parts and Functions"** in this guide.

Then, ensure the following:

- The components provided with the RSU are not damaged. The components supplied are based on the contents of the order but will at a minimum include the mounting hardware.

- Pull the Ethernet cable up from the cabinet through the conduit to the mounting location.

- All antennas and Ethernet connectors are disconnected from the enclosure.

The Savari SW-1000 RSU is compliant with the v4.1 US-DOT RSU Specification. It can be powered by using any 802.3at compliant PoE device. For any setup efforts related to PoE, refer to the setup guides for those specific models (PoE switch and/or injector).

1.4.2 Identify the Mounting Location(s)

To ensure optimal communication and reach, the RSU requires 'Line-of-Sight' to every approach when used at an intersection. If this is not possible with a single unit, multiple units may be used (deployed in a hub-spoke topology). For example, one unit can provide north-south coverage and another unit can provide east-west coverage. Refer to the user guide for configuration of RSUs in a hub-spoke topology.

When procured, by default, Savari supplied antennas are omnidirectional. From time to time, Savari may on request supply directional antennas. Before installation, please check the antenna specification for optimal installation if a directional antenna is to be used. The recommended orientation of the antennas is vertical, pointing to the sky. Site surveys and designs are not part of the installation document.

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[1] The Savari stock kit accessory will consist of the RSU mounting bracket. The choice of all other accessories is left to the customer.

The recommended mounting location is a traffic light or street light horizontal mast arm as close to the center of the road or intersection as possible. In addition, the mast arm that is closest to the traffic signal controller cabinet is used for installation.

Ethernet connectivity between each mounting location and the cabinet is required. Please make sure that an Ethernet cable is routed accordingly. If Power Over Ethernet (PoE) is used to power the device, Ethernet cable is the only cable required to be connected to StreetWAVE™ unit. This is the recommended method to power the RSU.

1.4.3 Optional Components

You may need to procure the following optional components if not already available at the installation site:

1. ~~Ethernet cable long enough to reach the RSU mounting location from the cabinet.~~
2. A CAT 6 weatherproof cable is required to connect the RSU to the traffic signal controller cabinet.
3. An 802.3at compliant PoE injector is required inside the traffic signal controller to interface between the traffic signal controller and the StreetWAVE™ RSU.

1.5 Various Parts and Functions

An ideal installation of the SW-1000 RSU will require the following parts/functions.

1. Mounting hardware: To enable mounting the RSU to the pole/mast. This consists of a mounting bracket, mounting bolts and a metal strap

2. 802.3at compliant PoE switch and/or injector: To enable power and communications to the RSU

3. DSRC antennas: N-type 5.9 GHz antennas for transmitting and receiving DSRC messages

4. GNSS antenna: An L-1 band, GNSS (GPS, GLONASS or both) antenna for positioning and timing

5. Self sealing electrical tape: To further ensure that there is no water seepage into the antenna connectors

6. Lighting arrestor (Optional): Used to protect the RSU by preventing the rise in voltage when struck by lightning.
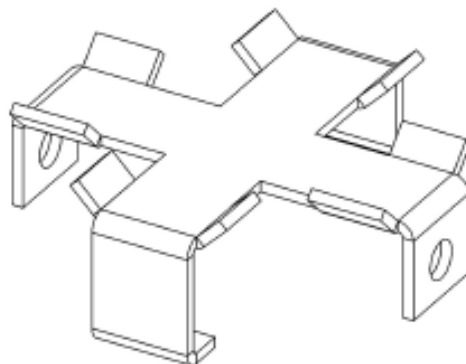
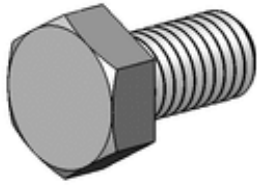*Figure 1 SW-1000 Kit with Antennas*

1.5.1 Mounting Kit

The mounting kit is made up of the mounting hardware, a metal strap and the sealing gland kit. The mounting hardware contains the following three (3) individual parts:

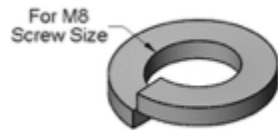1. Universal Mounting Bracket [1 per RSU) part #SW-RSU-1KB

Figure 2 Mounting Bracket

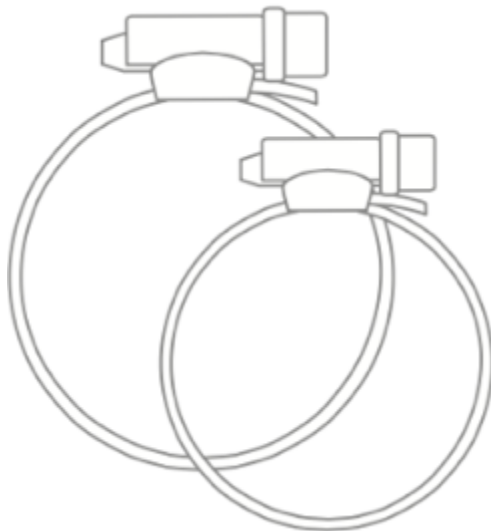2. Mounting Bolts, M8 x 16mm. [2 per RSU]

Figure 3 Mounting Bolt

3. Lock Washers, M8. [2 per RSU]

Figure 4 Lock Washer

The metal strap is used to wrap the RSU to a vertical or horizontal pole/mast.

Figure 5 Metal Straps

The sealing gland kit consists of a seal nut, seal, seal body and gasket and its main aim is to provide a liquid-tight connection of the PoE cable to the Ethernet jack.

1. [1 per RSU] part #SW-RSU-EWC
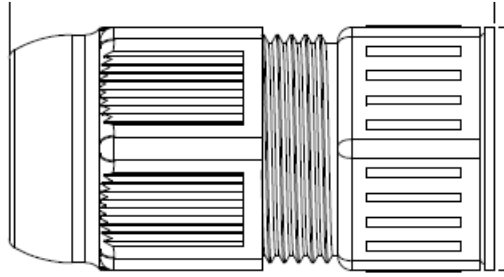
Figure 6 Sealing Gland Kit

2 Installing the StreetWAVE™

The following section describes the procedure to install the Savari StreetWAVE™ device.

2.1.1 Installing the Mounting Bracket to the Pole

The mounting bracket allows flexibility to install the RSU to a vertical or a horizontal mast. The bracket is attached to the RSU using the mounting bolt and the lock washer. The steps to be followed are:

Figure 7 Exploded View of the RSU with Mounting Bracket and Strap

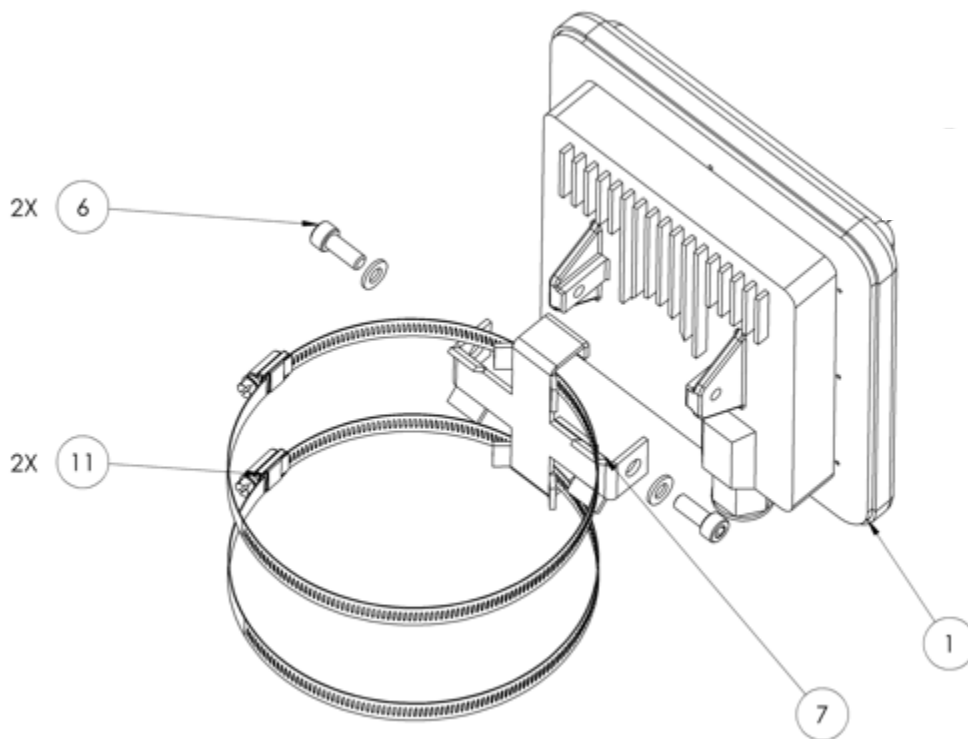| No.	Qty	Description
1	1	Roadside Unit main enclosure
6	2	Mounting Bolts
11	2	Mounting Straps
7	1	Mounting Bracket

Table 1 Main Parts of the RSU and Mounting Hardware

1. Hold the bracket up against the pole, and slide two metal straps through the top and bottom of the bracket as shown in Figure 7. Note: This example depicts installation of the bracket to a vertical pole [Figure 7].

2. Wrap the metal straps around the pole and lock them and lightly tighten the straps screws using a wrench. The screws should be lightly tightened to prevent the bracket from sliding down the pole.

2.1.2 Installing the Mounting Bracket to the RSU

1. Align the mounting bracket to the rear of the RSU such that the holes of the mounting bracket align with the holes in the ears of the RSU.

2. Align the M8 mounting bolt along with the lock washer and insert into the threaded hole of the RSU [Figure 7].

3. Using a wrench, tighten the bolt to the RSU securely. Tension?

4. At this point, the RSU should be securely coupled to the mounting bracket but may be a bit loosely coupled to the pole.

5. Place the RSU to its final desired position and further tighten the metal straps so that the RSU does not slide on the pole. Ensure that the strap screws are tight enough to prevent the RSU from moving or sliding. Tension ?

6. At the end of this step, the RSU, bracket and strap should resemble the illustration in Figure 8. Note that a vertical pole hasn't been depicted here.
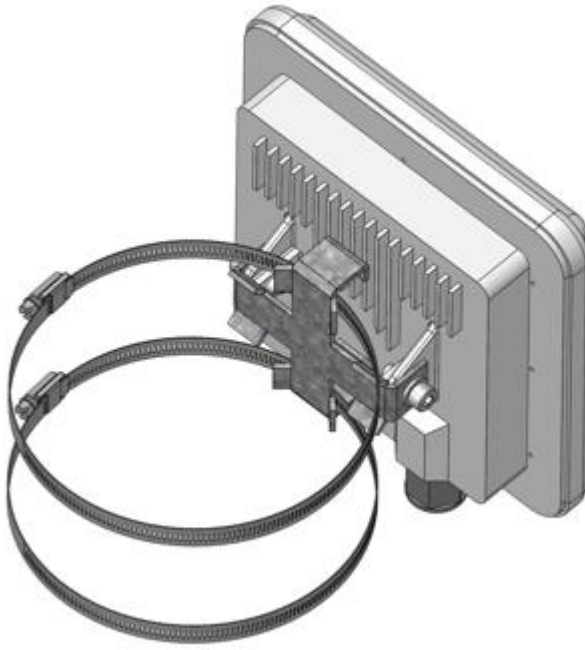
Figure 8 Rear of RSU with Mounting Hardware Installed

2.1.3 Installing the PoE Cable to the RSU

An exploded view is shown in [Figure 9]. To install the sealing gland to the Ethernet port of the RSU, follow the steps:

1. Ensure that you have an unterminated Ethernet cable from the PoE/cabinet to the RSU. ~~For optimal function, the diameter of the Ethernet cable must be between~~ ==<limits?>==

   Loosen the round end of the sealing gland kit by turning counter clockwise (but do not remove the round end). The thread end is towards the right and the round end towards the left in

2. Figure 6.

3. Insert the unterminated end of the Ethernet cable into the round end of the sealing gland and pull several inches of cable through the adaptor. The cable should have passed through the seal and the body housing.

4. Install an RJ-45 connector to the unterminated end of the Ethernet cable using an appropriate installation RJ-45 crimping tool.

5. Insert the RJ-45 cable connector into the Ethernet port receptacle of the RSU and ensure that the RJ-45 is locked into the internal RJ45 jack.

6. Slide the sealing gland kit towards the RSU and screw the threaded end into the RSU and hand-tighten.

7. Use an adjustable wrench to tighten the threaded end of the kit to 6 to 7 ft lbs.

8. Use an adjustable wrench and tighten the round end of the kit to about 3 ft lbs.
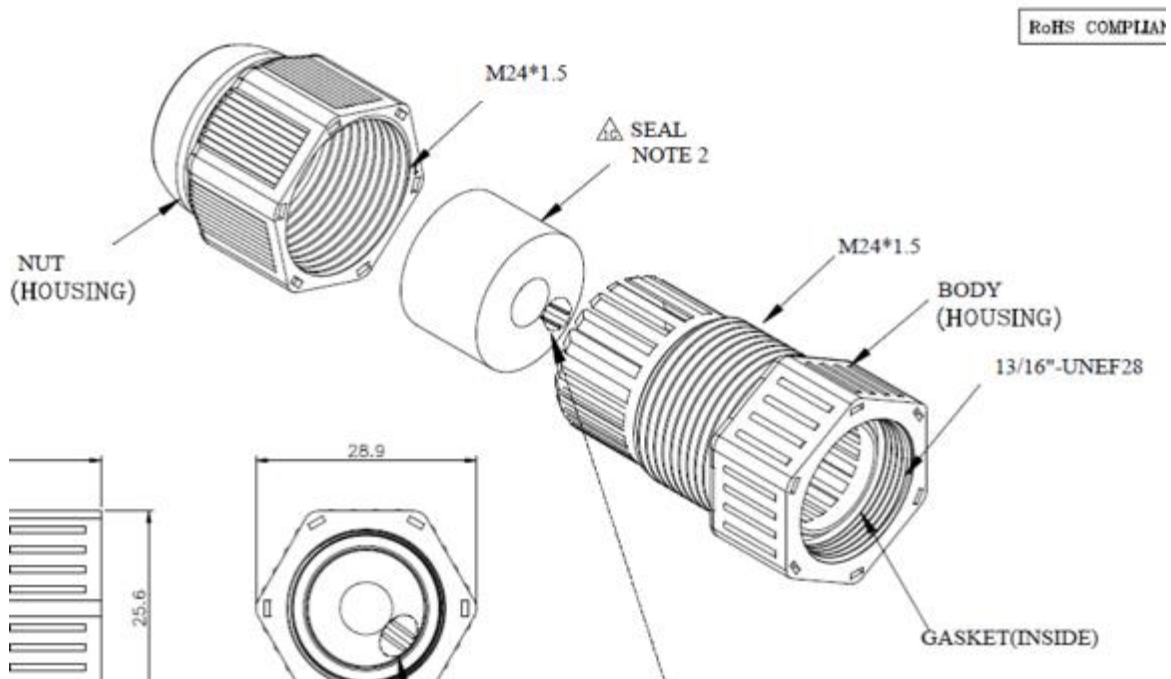
Figure 9 Exploded View of the Sealing Gland Installation

2.1.4 Installing the Ground Cable

Savari recommends proper grounding to prevent damage to the RSU. The grounding point for the RSU is located on the side. The RSU consists of a ground screw that can be loosened to attach a ground wire. Damage from static buildup can be prevented with proper grounding. Savari suggests installing a grounding strap from the antenna ground to a well-designed local earth ground. It is recommended to use a ground wire that is no more than a few meters and of suggested AWG 14 or better.

Grounding Point

Figure 10 RSU Showing Ground Point

2.1.5 Installing the Lightning Surge Arrestors

In the event of a lightning strike, the RSU can be protected through the use of a surge arrestor. A lightning surge arrestor can be installed on the base of the antenna between the antenna and the RF N-type connector of the RSU enclosure. The arrestor typically contains a fuse device that triggers during a strike. It should be noted that the surge arrestors have a small amount of signal loss but may be useful to have especially in areas prone to strikes. If an arrestor is used, the arrestor must be suitably grounded. Savari defers to the experience and accepted practice of the Operator with regards to the use of a lightning arrestor.

2.1.6 Installing the Antennas

The StreetWAVE™ accepts two (2) 5.9 GHz N-type DSRC antennas. These can be screwed in (clockwise) into the antenna connector on the top of the RSU enclosure. If the antennas need to be located at a height or an area that is different from the RSU, the antennas can be separately mounted (left to the operator) and a suitable low loss cable can be used to connect the antennas to the RSU. The antennas can be tightened by hand, a special wrench or tool is not required, however, please use caution to ensure that the torque is not more than 5 lbs pound when using the stock antennas.

Figure 11 Top View Showing DSRC Antenna Connectors

A suitable GNSS antenna with an SMA connector can be used to connect to the RSU. The SMA connector is found at the bottom of the enclosure. The operator may choose a magnetic mount antenna or an antenna with a separate mounting capability. When ordered, Savari typically supplies a magnetic mount GPS antenna with at least 1 meter RG-174 or equivalent cable. Ensure that the GNSS antenna is placed such that it has a clear view of the sky. It has been found that a GPS or a GPS + GLONAS antenna can be used.

Figure 12 Bottom View Showing the GPS and Ethernet Connector

For extra protection, wrap self-sealing electrical tape around the antenna connectors and the GPS connector to prevent water from entering. The tape should cover the entire RSU connector, the antenna connector and at least an inch of the antenna cable or the antenna itself.

3 Post-installation Steps

3.1 Powering On the StreetWAVE™

Once you mount the StreetWAVE™ on the location of your choice, ensure the following to power on the device:

- Turn on the power supply to the POE injector.

- The "PWR" LED on the StreetWAVE™ unit turns green. If the LED is off or in any other state, refer to the "*Savari StreetWAVE™ Roadside Unit User Guide*".

After powering on, the StreetWAVE™ device is ready to use.

For information on using the different features of the device, refer to the *Savari StreetWAVE™ Roadside Unit User Guide*.

4 Uninstalling the StreetWAVE™

The following is the procedure to uninstall the StreetWAVE™:

1. Disconnect the power from the StreetWAVE™.

2. Remove the self-sealing tape by slitting the tape and peeling it away from the connectors and cables.

3. Unscrew the DSRC and GPS antennas.

4. Unscrew the Ethernet sealing assembly.

5. Using a small, standard screwdriver, depress the RJ-45 locking tab inside the Ethernet receptacle, and gently pull the cable to disconnect.

6. Hold the StreetWAVE™ and unscrew the mounting straps.

APPENDIX A

Product Specifications

The following is the product specification sheet for the StreetWAVE™ roadside Unit:

Component	Description
Processor	800 MHz Dual Core iMX6
Memory	4 GB DDR DRAM
Storage	8 GB Flash
HSM	IFX SLI97 for secure storage and signing
DSRC Radios	Two (2), high-power, IEEE 802.11p compliant radios
DSRC Antennas*	6 dBi 5.9 GHz Omni Directional w/ N-type Male connector
Ethernet	One (1) 10/100 (RJ-45) ports
Power Supply	IEEE 802.3at
LED	- Multi-Color LEDs - For Power and Operational Status - Compliant to US-DOT v4.1 Specification
Weight	3.5 lbs
Temperature	-35C to +75C
Dimensions	220 mm x 220 mm x 95 mm
GPS*	CEP, 50%, 24 hours static – 2.0m with SBAS, 2.5m without assistance.
Standards Compliance	IEEE 802.11p, IEEE 1609.X, FIPS 140-2, US-DOT v4.1 RSU Specification.
Security	1609.2, MAC, and SSL
Enclosure	IP66 rating, pole mount.

If Supplied by Savari