APPLIED INFORMATION

# CONNECTED VEHICLE ROADSIDE UNIT (RSU)

**FCC Registration Number (FRN):** 0028431112

**FCC ID:** 2BHCM-500-095

## Quick Start Guide

APPLIED INFORMATION

# DUAL MODE DSRC/C-V2X ROADSIDE UNIT | AI-500-095

## QUICK START GUIDE

**AI-500-095**
**ROADSIDE UNIT**
**INSTALLATION**

REVISION 4

## TABLE OF CONTENTS



| REV | AUTHOR | REVIEWED BY | DATE | REVISION EDITS |
|---|---|---|---|---|
| 4 | D Kyriakou | | 06/10/2024 | Regulatory compliance and formatting update |
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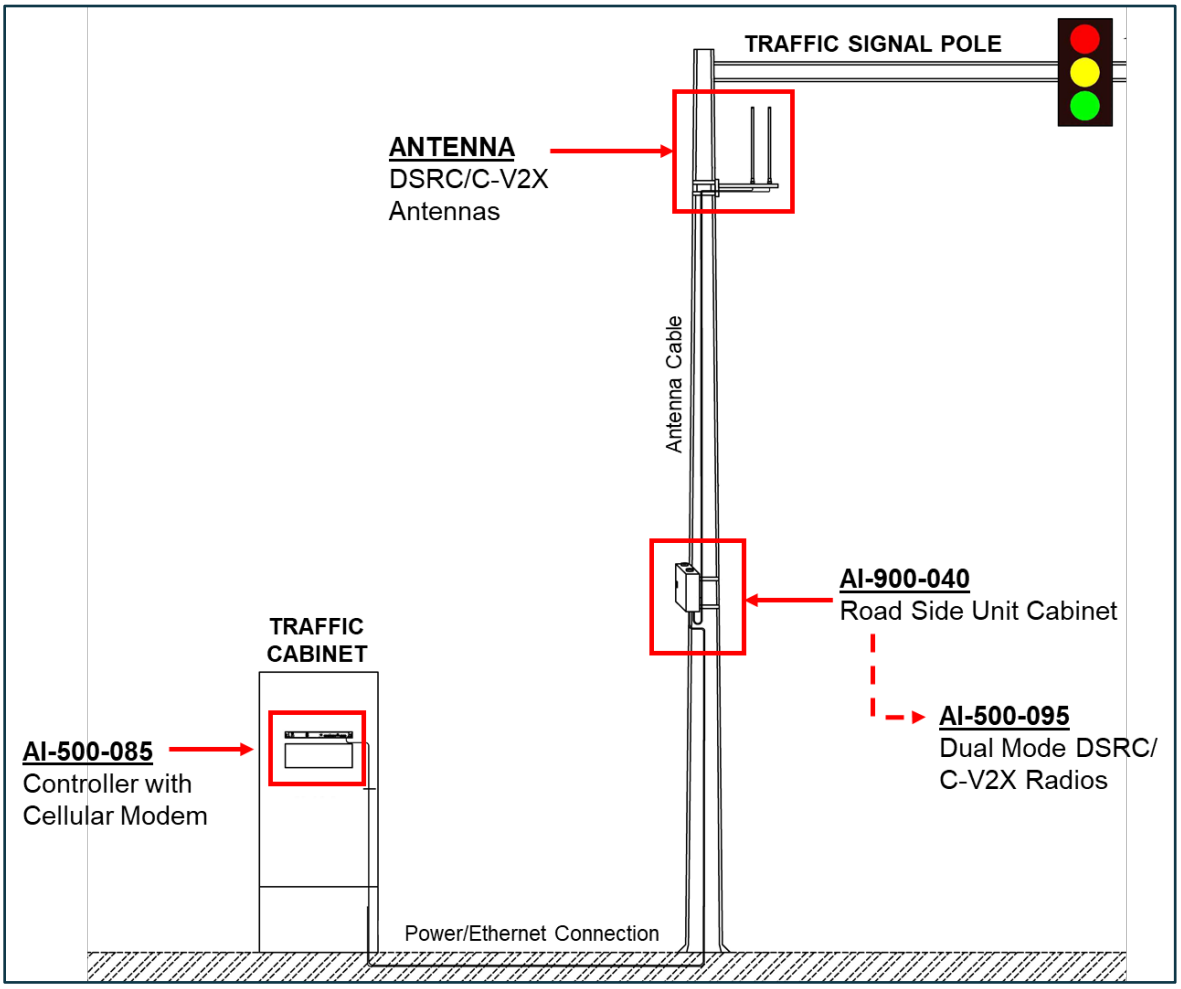
## AI-500-095 SYSTEM LAYOUT




## BEFORE GETTING STARTED

AI-500-085 Field Monitoring Unit (FMU) install:

- FMU to be installed prior to Dual Mode DSRC/C-V2X Road-Side Unit (RSU).
- FMU provides the cellular connectivity element of the system, as well as Ethernet and power connection.

See AI-500-085-02 Quick Start Installation Guide for installation details.

For the AI-500-095 RSU install you will need:

- ❖ Glance username and password
- ❖ Tools for unit installation
- ❖ Installation equipment
- ❖ Internet-connected device


## WHAT'S IN THE BOX?

- ❖ Road-Side Unit (RSU):
  - 1x AI-900-040 RSU Cabinet
  - 1x AI-500-095 RSU Controller
  - 1x RSU Backplate (already assembled as a single unit)

- ❖ Antenna:
  - 1x Antenna Mounting Bracket
  - 2x DSRC/C-V2X Antenna

- ❖ Ethernet Surge Protectors
- ❖ Ethernet Patch Cable (6 ft.)

## EQUIPMENT REQUIRED BY CONTRACTOR

- ❖ Equipment required for the installation can be seen below. A suitable supplier and part number
- ❖ (or description) for each part is given and marked with a *.
- ❖ Any equivalent supplier or part can be used. This information is given only as a recommendation/example of the appropriate equipment required for the installation.

**NOTE:** All hardware used for product installation should conform to standard traffic equipment installation practices. In all cases, Stainless Steel is preferred.

- ❖ Bandit Straps (Black)
  - Stainless Steel Bandit Strapping
  - Stainless Steel Bandit Strapping Clips

  *(**Uline**; Steel Strapping – Standard Grade)

- ❖ Ethernet Cable
  - CAT5 Ethernet Cable, suitable for outdoor use
  - Cable to run between traffic cabinet and RSU, length to be determined on-site after mounting location of RSU is finalized

  *(**Anixter**; Part#: CMP-00424AVA-7U-06)

- ❖ Ethernet Connectors
  - RJ45 Ethernet Connector

  *(**Digi-Key**; 380-1006-ND, 380-1098-ND, or 380-1192-ND)

- Power Cable
  - Standard Copper Braided Cable, 3 conductor, 18 AWG, suitable for outdoor use
  - Cable to run between traffic cabinet and RSU, length to be determined on-site after mounting location of RSU is finalized
    *(**Americord**; SKU#: 97-C)
- Ground Wire
  - Ground wire to be run from RSU housing to traffic signal pole. Length to be determined on-site according to the method of grounding
- Antenna Cable
  - LMR400 Coax Cable
  - Cable to run between RSU and antennas, maximum length to be no more than 15ft.
    *(**Anixter**; Part#: LMR-400)
- Antenna Connectors
  - N-Type Connectors for Coax Cable
    *(**Digi-Key**; Part#: ACX1129-ND)
- Bucket Truck - recommended for antenna installation and running of cables

## RECOMMENDED TOOLS

RJ45 crimper:
- Required to terminate CAT5 Ethernet Cable
  (**Home Depot**; Model 902-360)

LMR400-4 coax crimper:
- Required for fitting N-Type connectors on LMR400 Coax Cable

**EXTRA TOOLS THAT MAY BE REQUIRED**
- Bandit Strapping Toll
- Wire Strippers
- Screwdriver
- Fork terminals
- Wire Ties
- Drill

## SYSTEM MOUNTING

Mounting of the AI-500-095 series is dependent on intersection geometry and may differ between varying intersections.

## SELECTING THE APPROPRIATE TRAFFIC SIGNAL POLE

- RSU cabinet and associated antenna mounting bracket to be mounted on traffic signal pole, such that the following requirements are met:
  1. Mounted on the pole closest to the traffic signal cabinet
  2. LOS (line-of-site) of Antenna is 900ft. or greater

- If the pole closest to the traffic signal cabinet does not provide sufficient LOS:
  - Determine which pole will provide an LOS of 900ft. or greater
  - Select pole with least cable running distance to the traffic signal cabinet

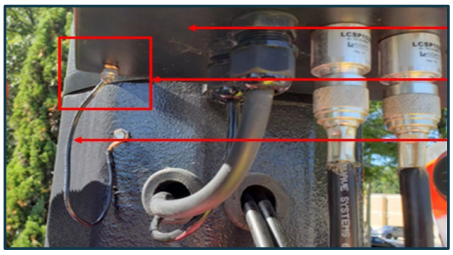
**NOTE:** Maximum distance of cable run from RSU Cabinet to traffic cabinet is 300 ft, and if requirements cannot be met, please contact your regional sales engineer for further direction.

## MOUNTING THE AI-900-040 RSU CABINET

- Mounting height:
  - Approximately 8ft up traffic signal pole (from ground level)
  - RSU should be accessible via a ladder

- Mount RSU cabinet to the traffic signal pole:
  - Secure with bandit strapping
  - Position in such a way as to allow technicians safe access to the cabinet without blocking traffic

- Install ground wire between RSU and signal pole:
  - Secure one end of the ground wire to the bottom left of the AI-900-040 RSU housing
  - Secure the other end to the traffic signal pole. This can be done in one of two ways:
    - Option 1: Secure to the traffic pole using a self-drilling/tapping stainless steel screw
    - Option 2: Run the grounding wire through the traffic pole and ground internally
      (If possible, it is best to attach the ground wire to a grounding rod or heavy gauge grounding wire rather than to the pole)
  - Keep ground wire as straight as possible with no loops or coils



Underside of RSU

Wire Grounded to RSU

Grounding Wire

**NOTE:** If unsure of which option to choose, contact your regional sales engineer for further direction.

## MOUNTING THE DSRC/C-V2X ANTENNA

- Mounting height of antenna bracket:
  - Approximately 18ft. above ground level, just below the traffic signal mast arm
  - Or, if the mast arm of the signal is lower than 18ft., position the top of the antenna 6in. below the mast arm

- Antenna bracket placement:
  - Antennas to point upwards with bracket being placed such that the greatest visibility towards all approaches is achieved (900ft. or greater is required)
  - Recommended positioning:
    - Bracket pointing toward center of the intersection
    - Roughly a 45° angle (with respect to each approach)

- Mount antenna mounting bracket:
  - Once satisfied with the placement, secure with bandit strapping

Refer to the "Remote Radio Dual Mode DSRC C-V2X - Road Side Unit" Diagram attached for further information on mounting details.

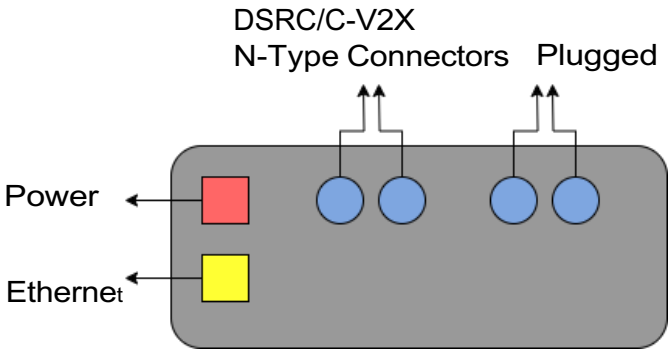
**NOTE:** All cables are to be run before wiring.

## CABLE RUNNING

Using best installation practices, run the power, Ethernet and antenna cables. Cables are to be run to the following position on the underside of the AI-900-040 Cabinet

- Running of power and Ethernet cables:
  - Power and Ethernet cables connect AI-500-085 and AI-500-095 devices

- Running of antenna cable:
  - LMR400 Coax Cable connects the AI-500-095 Controller to the antennas



## WIRING

**IMPORTANT:** Connect as per the attached wiring diagram.

Once the necessary cables have been run:

### WIRE UP THE AI-500-095 RSU CONTROLLER

**Power:**

- Select a cable gland to feed the power cables through
- (cable gland situated at the bottom of the RSU Cabinet)
- Feed the power cables through the cable gland
- Terminate power cables using spade lugs
- Connect to terminal strip:
  - Power In → Position 1 on terminal strip
  - +24V DC In → Position 2 on terminal strip

**Ethernet:**

- Feed the Ethernet cable through the remaining cable gland
- Attach the Ethernet connector to the end of the Ethernet cable
- Plug the Ethernet connector into the Ethernet surge protector inside the AI-900-040 RSU cabinet

### CONNECT THE AI-500-095 TO THE AI-500-085-02

**Power:**

- Terminate the other ends of the power cables using spade lugs
- Connect power cables to a 24V power source in the traffic signal cabinet

**Ethernet:**

- Attach the Ethernet connector to the other end of the Ethernet cable
- Plug the Ethernet connector into the Ethernet surge protector, and a patch Ethernet cable between the surge protector and the AI-500-085-02 (HSM) Controller

**NOTE:** In the case of an AI-500-085-01, plug the Ethernet cable from the surge protector
into the second port of the traffic controller.

- Connect the ground wire of the Ethernet surge protector to the traffic cabinet chassis ground.

### CONNECT ANTENNAS TO THE AI-500-095 CONTROLLER

- Connect one end of the LMR400 cable to the DSRC / C-V2X connectors
- Connect the other end of the LMR400 cable to the connectors on the bottom of the AI-900-040 RSU Cabinet

## AI-500-095 CONTROLLER STANDARD I/O ALLOCATION AND DESCRIPTION

**Rev B**

| TYPE | FUNCTION | PIN | COLOR | DESCRIPTION |
|---|---|---|---|---|
| Output 1 | Reserved | J6-1 | PINK | Reserved for future use (Open Collector Output) |
| Output 2 | Reserved | J6-2 | GREY | Reserved for future use (Open Collector Output) |
| Output 3 | Reserved | J6-3 | WHITE | Reserved for future use (Open Collector Output) |
| Output 4 | Reserved | J6-4 | ORG | Reserved for future use (Open Collector Output) |
| Output | 24VDC Out | J6-5 | YEL | 24VDC OUT Whetting voltage for door status/tilt sensor |
| Input | Cabinet Door Alarm Input | J6-6 | YEL | Door Alarm Input (external door switch NO when doors are closed) |
| Input | Tilt Sensor Alarm Input | J6-7 | GREY | Tilt Sensor Input (Connect to Output of Tilt Sensor when available) |
| Power | Power Ground (PGND) | J6-8 | BLK | Primary power input DC- (From Traffic Cabinet) |
| Input 1 | Reserved | J6-9 | GREY | Reserved for future use |
| Input 2 | Reserved | J6-10 | YEL | Reserved for future use |
| Analog 3 | Reserved | J6-11 | PINK | Reserved for future use |
| Analog 4 | Reserved | J6-12 | GREY | Reserved for future use |
| Analog 5 | Reserved | J6-13 | WHITE | Reserved for future use |
| Power | Logic Ground (DC) | J6-14 | BLK | Logic Ground Reference Output |
| Power | Logic Ground (DC) | J6-15 | BLK | Logic Ground Reference Output |
| Power | Power (+24V DC) | J6-16 | RED | Primary power input DC+ (From Traffic Cabinet) |

## REGULATORY COMPLIANCE

**IMPORTANT NOTE: FCC RF exposure statement**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End-users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must be at least 20 cm from the user and must not be co-located or operating in conjunction with any other antenna or transmitter.

**FCC ID of the product:** 2BHCM-500-095.

**IMPORTANT NOTE: FCC site license**
This device requires an FCC site license.

The AI-500-095 may only be used with the following external antennas and antenna cable:

- LTE Antenna: Data Alliance ALGP3
- C-V2X Antenna: OMB.5900 – Taoglas
- Antenna Cable: LMR400 (12ft.)

**Any changes or modifications made to this device that are not expressly approved by Applied Information, Inc. may void the user's authority to operate the equipment.**