NoTraffic System

Installation Guide

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Doc No. XXX01 Rev 1.0 NoTraffic System Installation Guide 30/12/2024

Table of Contents

1 General

1.1 Scope

This guide describes how to install the NoTraffic AI Mobility Platform system components.

1.2 Terminology

Term/Abbreviation	Description
DHCP	Dynamic Host Configuration Protocol
ESG	Environmental, Social, and Governance
ISI	Intersection Safety Insights
MOS	Mobility Operating System
NOC	NoTraffic Operations Center
NTCIP	National Transportation Communications for Intelligent Transportation System Protocol.
NU	Nexus Unit
RLR	Red Light Running
SDLC	Synchronous Data Link Control
SU	Sensor Unit
TLS	Traffic Light Status
TSC	Traffic Signal Controller

2   System Overview

NoTraffic has developed a comprehensive hardware and software solution for real-time traffic management using a network of cloud-linked sensors deployed at intersections, corridors, or grid networks. These intersections can operate in detection mode, passive data collection mode, or optimization mode.

The sensors are vendor-agnostic, compatible with any existing mounting hardware and infrastructure. The sensors communicate with the Nexus Unit mounted inside the cabinet through either Wi-Fi (up to 270 feet) or through an Ethernet connection. Additional Wi-Fi repeaters support further distances. Sensor units can be powered from luminaires using a NEMA Tap, eliminating the need for pulling cables to the cabinet. The sensors combine video and radar for object detection and classification, and each intersection has a sensor unit with a built-in Road-Side Unit (RSU) for Connected Vehicle applications.

All sensors connect to the cloud using integrated LTE communications, accessible anywhere via our Mobility Operating System (MOS) application. MOS monitors the traffic controller's functionality and provides alerts for abnormalities with the NoTraffic hardware or connected cabinet equipment, such as stalled vehicles, accidents, or road work that disrupts traffic flow.

The Nexus Unit (NU), installed in the cabinet, communicates with all NoTraffic devices and integrates with the existing traffic signal infrastructure. The NU controls the Power Box but does not supply the power.

MOS offers live viewing, detection zone creation and modification, data analytics, and exploration of new applications for your intersections.

A schematic diagram of the NoTraffic system appears in the following figure.
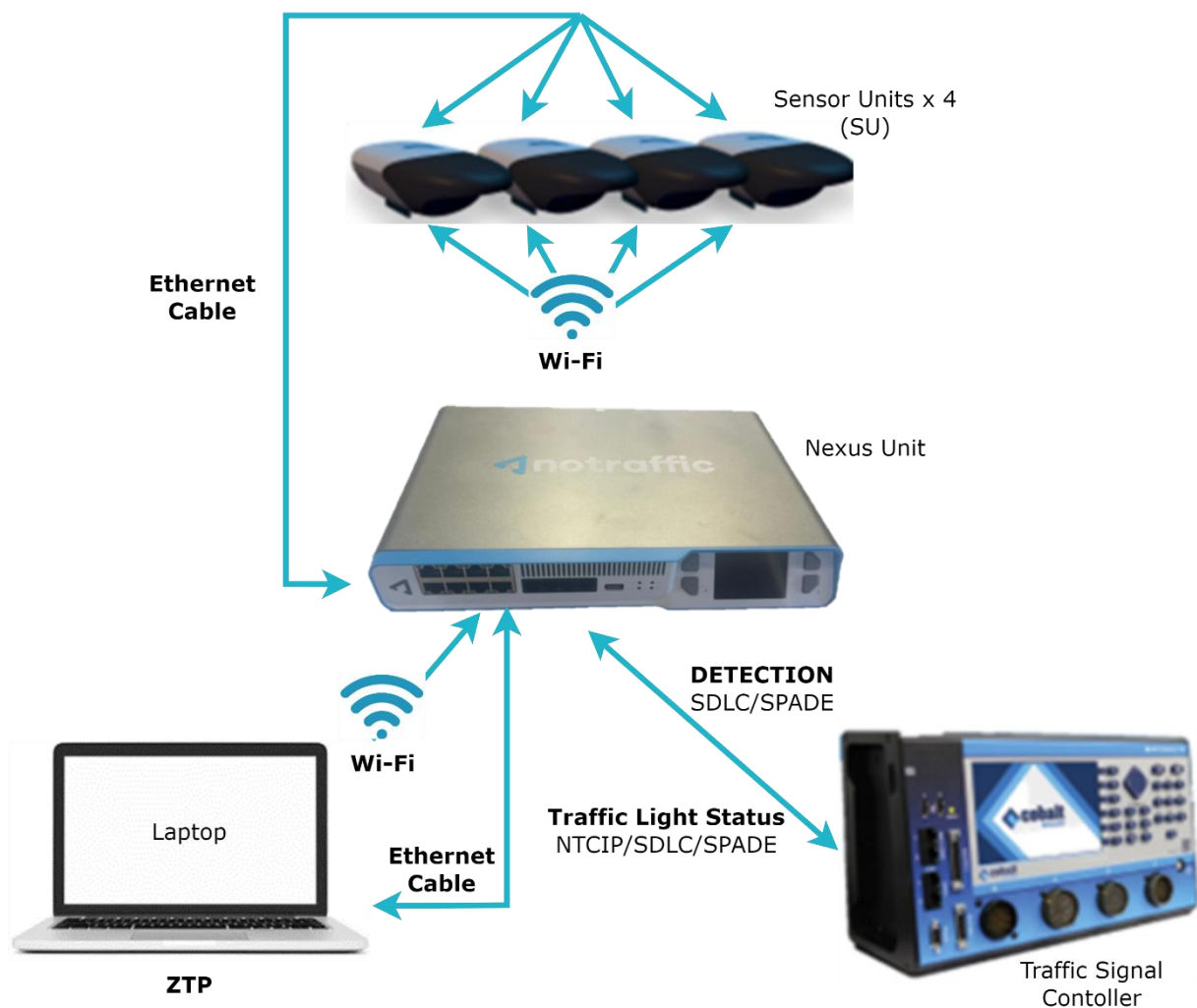
2.1 Nexus Unit

The Nexus Unit is the main processor of the NoTraffic System. It receives processed traffic demand data collected by the Sensor Units and serves as the interface to the traffic controller. In detection mode, it places calls and reads traffic light status from the controller. In optimization mode, it places phase calls to manage traffic flow efficiently.
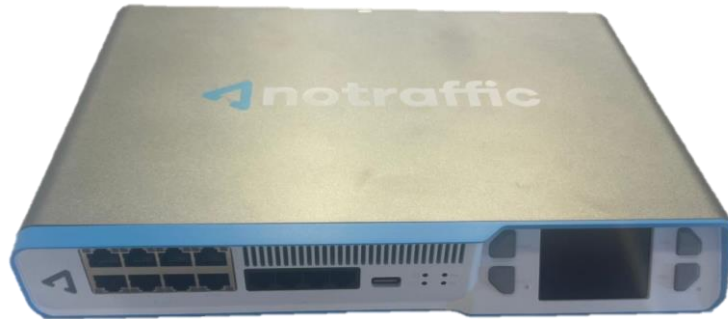
2.1.1 Nexus Unit Communication Ports

The Nexus Unit front panel includes ports to transfer detection, networking and TLS data. The following figure shows the available connector types:

- 8 x RJ45 Ethernet ports for detection and networking communication
- 4 x RJ25 communication ports for TLS
- 1 x USB port
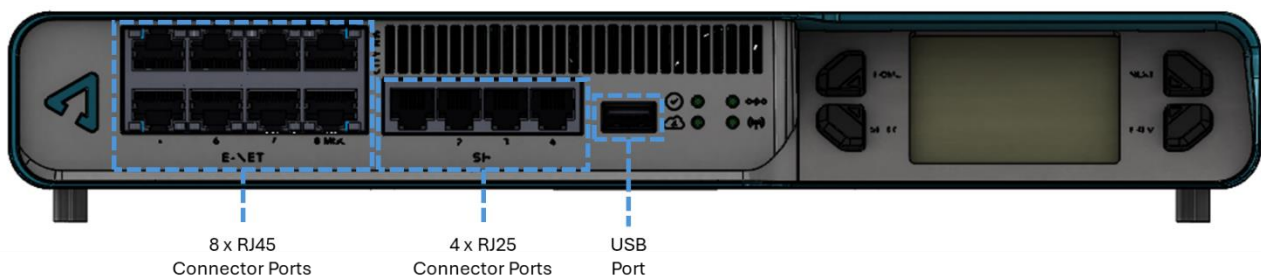
The Nexus Unit rear panel includes ports to communicate data. The following figure shows the available connector type:

2 x RJ25 communication ports for Power Box
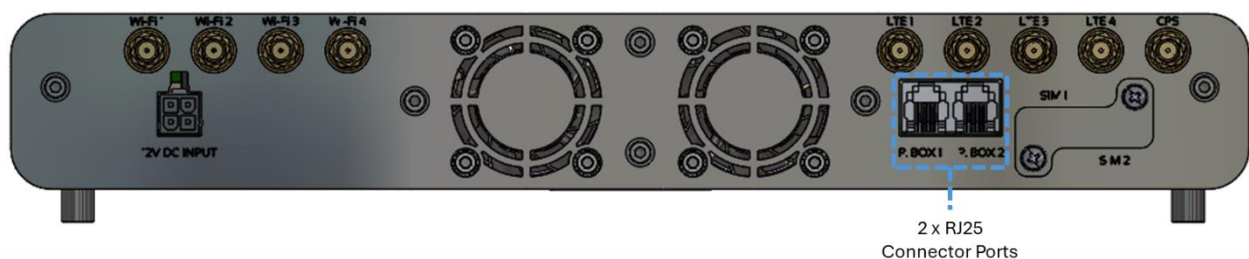
2.2   Sensor Unit (SU)

The SU is a combined video and radar sensor designed for roadway user detection and classification.

Each intersection includes one SU with an embedded Connected Vehicle Roadside Unit (SU – V2X).

The SU communicates with the Nexus Unit installed in the cabinet either wirelessly or via network cable, allowing for flexible installation at various locations with different power sources and mounting options.

The SUs are connected to either of the following power sources:

- Power Box installed in the cabinet adjacent to the Nexus Unit. It is a 110V AC power supply device that provides four output ports to power the SUs and controls the on/off to the SU's. The key features of the Power Box include:

    - Surge protection against power spikes.

    - A separate power unit that provides clean, balanced power to the SUs

    - Remote digital control of the on/off power to the SUs.

- Luminaire Power using a NEMA tap. NEMA taps are installed on a luminaire and contain a photocell.

    The key features of the NEMA tap include:

    - 10-foot, 2-wire, 16 AWG SOOW cord (durable and resistant to ozone, aging, and abrasion).

    - Simple twist-lock installation that does not interfere with normal luminaire photocontrol operation.

    - Compliant with ANSI C136.10 for roadway/street and area lighting, and C136.41 control pass-through.

2.3   Antenna

The Antenna ensures reliable signals for LTE, Wi-Fi and GPS. It has 4X LTE leads (for main modem and backup), 4X Wi-Fi leads, and 1 GPS/GNSS lead. All leads are 6 feet in length.

2.4   I/O Cables

The following cables are used to connect the Nexus Unit with the traffic signal infrastructure:

I/O Cable	Devices Connected	Purpose
NTCIP cable	1. SUs – Nexus Unit 2. Local switch – Nexus Unit 3. PC – Nexus Unit	1. Reads Traffic Light Status and vehicle and detector calls. Required for ATSPMs. 2. NTCIP 3. Required for optimization to place phase calls.
TSC – Nexus Unit I/O Cable	1. Power Box – Nexus Unit 2. SDLC or C1 Smart Harnesses – Nexus Unit	1. Controls SUs power. 2. Enables communication between TSC and Nexus Unit.
Smart Harness	Nexus Unit – TSC with 15PIN SDLC	Enables communication between TSC and Nexus Unit for: Reading TLS. Placing detection calls.
SDLC	TSC - SDLC Smart Harnesses – Nexus Unit	Enables communication between TSC and Nexus Unit for: • Reading TLS. • Placing detection calls.
C1 Smart Harness	TSC - .C1 Smart Harnesses – Nexus Unit	Enables communication between TSC and Nexus Unit for: • Reading TLS for Caltrans TEES software. • Placing calls.

2.5   SU Power Cable (Customer-Provided)

The power cable connecting the Power Box in the cabinet to the SU should be 14-to-18-gauge, 3 conductor stranded copper cable. Alternatively, a 2-conductor cable can be used between the cabinet Power Box and the SU if there is a grounding wire that can be terminated in the SU.

2.6   Cabinet Equipment

NoTraffic is compatible with various traffic cabinet equipment, including:

- Traffic Cabinets: NEMA TS1, TS2-1 & TS2-2, 332 / Caltrans cabinets, and ATC cabinets.

- Power: NoTraffic requires one 120 VAC socket to power all cabinet equipment.

- Detection I/O: SDLC (via SDLC bus, controller SDLC port, or 2070 module with SDLC port and a virtual BIU), or by terminating spades directly to the input file.

- Traffic Light Status I/O: NTCIP is used to read traffic light status and phase call information. SDLC can be used but it only reads traffic light status. For Caltrans TEES software, a C1 to C4 harness is used.

- Optimization & ATSPM requirements: NTCIP is required for intersections to run in optimization mode or collect ATSPMs.

2.7   Software

For an overview of the ZTP NoTraffic AI Mobility Operating System, see the ZTP User Guide.

3   Modes of Operation

The NoTraffic system operates in three modes:

- Detection Mode - SUs detect and classify all road users, providing inputs to the traffic controller for signal operations. Data is sent to MOS for performance measurement. The intersection continues to operate using the timing and detector plans programmed in the traffic controller.

- Optimization Mode - NoTraffic uses AI to autonomously optimize traffic signal operations in real-time based on actual demand and by predicting traffic patterns up to two minutes into the future, instead of following a fixed cycle or historical estimates. Advanced AI algorithms track and count vehicles, analyze incoming data, and respond appropriately, regardless of intersection geometries or traffic demand changes.

- Passive Mode - SUs collect data without actuating the traffic signal. This mode is typically used for roundabout or pedestrian signals. Data is still sent to the dashboard for access and performance measurement. Additionally, sensors pass traffic demand information to downstream intersections if the corridor or grid is in Optimization Mode.

4   Required Tools and Equipment

The following generic tools are required for installation:

- PH1 Phillips-Head Screwdriver

- 2.5mm hex screwdriver

- Cordless drill with step bit up to 1"

- Wire cutters and wire strippers

- Multimeter

- Banding Tool

- Silicone waterproof sealant

> ## Note
>
> Additional mounting hardware and associated tools may be required depending on the specific hardware purchased and the traffic cabinet in use.

5   Installation

Select mounting locations for the Nexus Unit, Antenna, Power Box and SUs.

5.1   Installing the Nexus Unit

1. Mount the Nexus Unit on a shelf inside the cabinet.

2. Connect one end of the power supply cord to the mains supply in the cabinet, and the other end – 12V DC - to the Nexus unit input port.
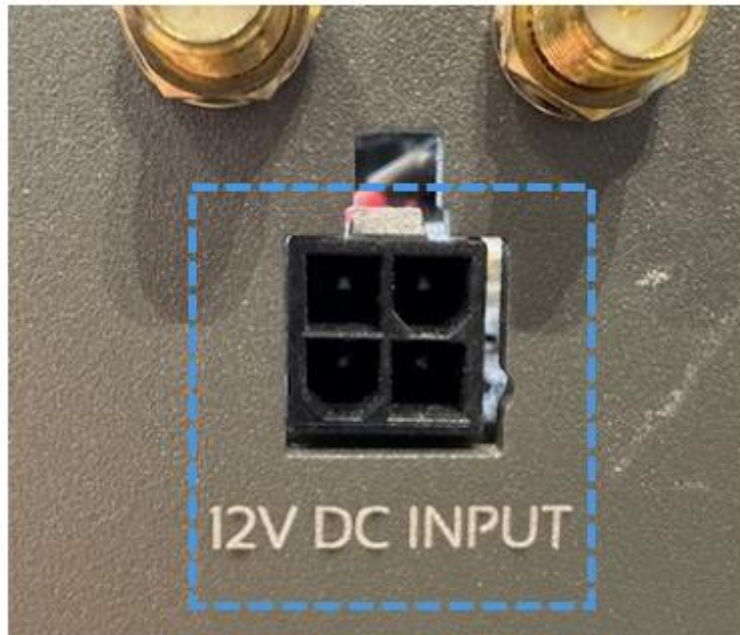
5.2   Installing the Antenna

The antenna can be mounted in one of two options as follows:

*   Roof mounted - this is the default mounting method.

*   Vertical mounted – used where roof drilling is not permitted or desirable, such as weatherproofing issues.

> **Note**
>
> Make sure that all nine 9 leads from the antenna can reach the Nexus Unit inside the cabinet.

To install the antenna on the roof:

1. Locate a position on cabinet top panel where the antenna will be mounted, as shown in the following figure.

2. Drill a 25 mm (1 inch) hole in the top of the cabinet.

3. Remove debris from the mounting surface and clean it with a fresh alcohol wipe.

4. Feed the antenna cable assembly wiring harness through the hole from the top side.

5. Place the antenna centrally over the hole on the cabinet top and firmly affix it using 3M adhesive.

6. Route the antenna cable inside the cabinet to the Nexus Unit.

7. Seal around the underside of the antenna using silicone waterproof sealant.

To install the antenna vertically:

1. Locate a position on the side of the cabinet where the antenna will be mounted, as shown in the following example figure.

> **Note**
>
> The integrator is responsible for creating their own plan and selecting the appropriate bracket.

Example for illustrative purposes

To connect the antenna leads:

1. Connect the following antenna lead connectors to the Nexus Unit rear panel Make sure each connector's color aligns with the matching color of the respective port on the Nexus.

   - 4G/5G-1 to LTE1 (red)

   - GNSS to GPS (blue).

   - 4G/5G-2 to LTE2 (red)

   - Wi-Fi-1 to WiFi1 (yellow).

   - Wi-Fi-2 to WiFi2 (yellow).

   - 4G/5G-3 to mobile on LTE Modem.

   - 4G/5G-4 to mobile on LTE Modem.

   - Wi-Fi-3 to Wi-Fi 1.

   - Wi-Fi-4 to Wi-Fi 2.
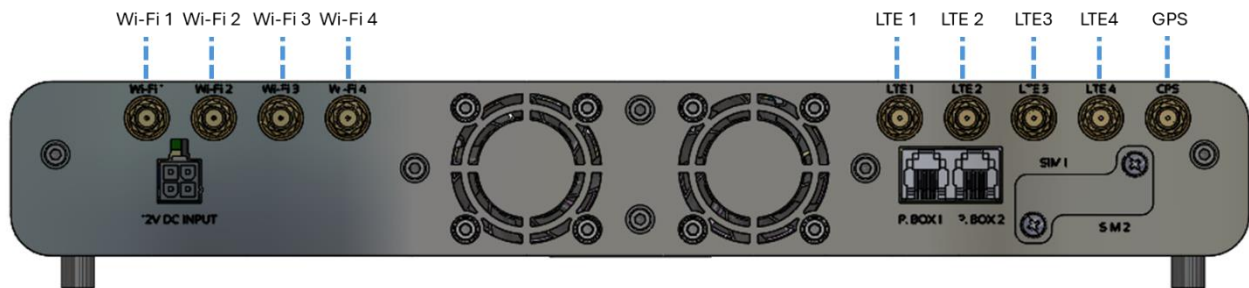
5.3   Installing SUs

To mount the SUs:

2. Choose a mounting location for each SU that is centrally aligned with the approach, positioned at the maximum achievable height, or offers optimal visibility of the approaching lanes and the intersection center.

    ▪ Each SU covers a single intersection approach, including right, through and left turn traffic.

    ▪ The V2X SU (1 per intersection) should be mounted facing the main street with minimal obstruction to field of view to provide the best possible range for V2I communications.
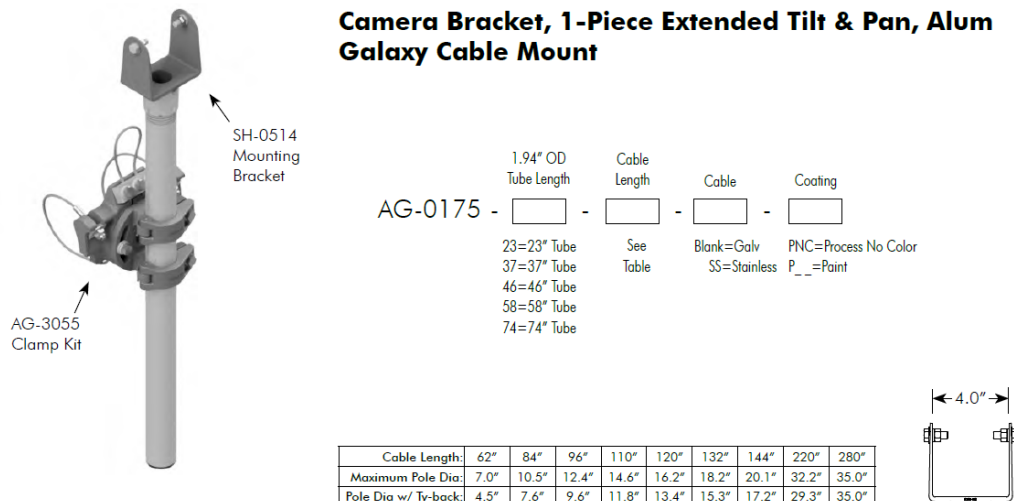

> **Note**
>
> If you require assistance in determining the best location for the SU, consult the No Traffic team.

3. Mount the mast arms or camera mounts at the selected SU location for each intersection approach. The following are recommended:

   ▪ Mast Arms – a Pelco Astro-Brac with a SH-0514 mounting bracket, and a 6-foot riser tube as shown in the following figure. The clamp kit may vary by agency preference. Most standard detection camera mounting brackets are compatible but should be reviewed on a case-by-case basis.

   > **Note**
   >
   > Make sure the mounting bracket has the same width (4-inches) and bolt size.as the SU's mounting brackets and bolt holes.

Camera Bracket, 1-Piece Extended Tilt & Pan, Alum Galaxy Cable Mount

| Cable Length:	62″	84″	96″	110″	120″	132″	144″	220″	280″
Maximum Pole Dia:	7.0″	10.5″	12.4″	14.6″	16.2″	18.2″	20.1″	32.2″	35.0″
Pole Dia w/ Ty-back:	4.5″	7.6″	9.6″	11.8″	13.4″	15.3″	17.2″	29.3″	35.0″

   ▪ Luminaires - the Iteris Universal Camera Mount MA/SOP-16. Equivalent products from other vendors (e.g., Sky-Bracket) are acceptable.

4. Fit the SU onto and over the mounting arm.

5. Align the holes of the locating plates with the holes on the mounting bracket.

6. Fasten the SU to mast arm or luminaire using standard detection camera mounting brackets and secure using the 2 bolts.
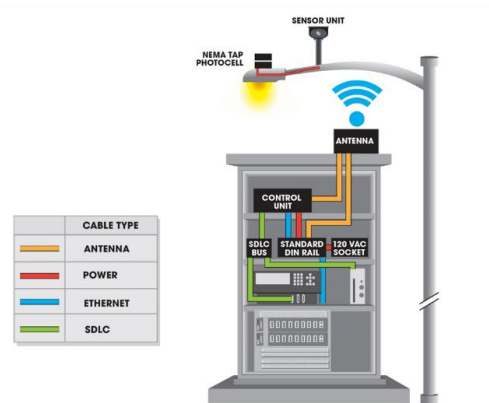
To run the power cable to the SU location:

There are two options to power the SUs:

- SUs powered from the cabinet:

   a. From the Power Box, run the power cable to the mast arm location where the SU is mounted.

- SUs powered using a NEMA tap:

   a. Attach the NEMA tap to the top of the photocell on the luminaire.

   b. Run the NEMA tap power cable to the mast arm location where the SU is mounted.

   c. Cut the power cable to an appropriate length to reach the mounting location of the SU.

Sensors Powered from Cabinet
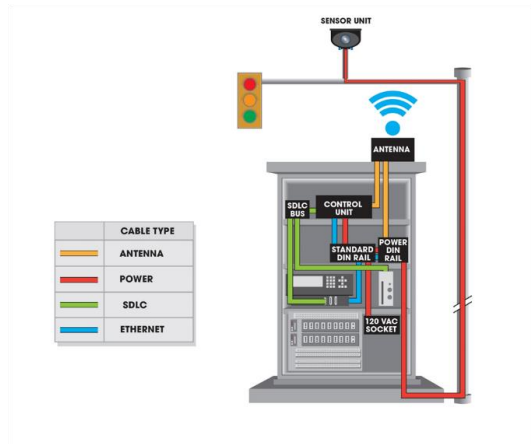
Sensors Powered from Luminaires

To connect the power cable to the SU:

1. On the SU, remove all 4 screws securing the rear panel to the SU.

2. Feed the end of the power cable through the power hole in the rear compartment, together with the rubber grommet and plastic nut as shown in the following figures.

3. Feed the end of the Ethernet cable through the Ethernet hole in the rear compartment, together with the rubber grommet and plastic nut as shown in the following figures
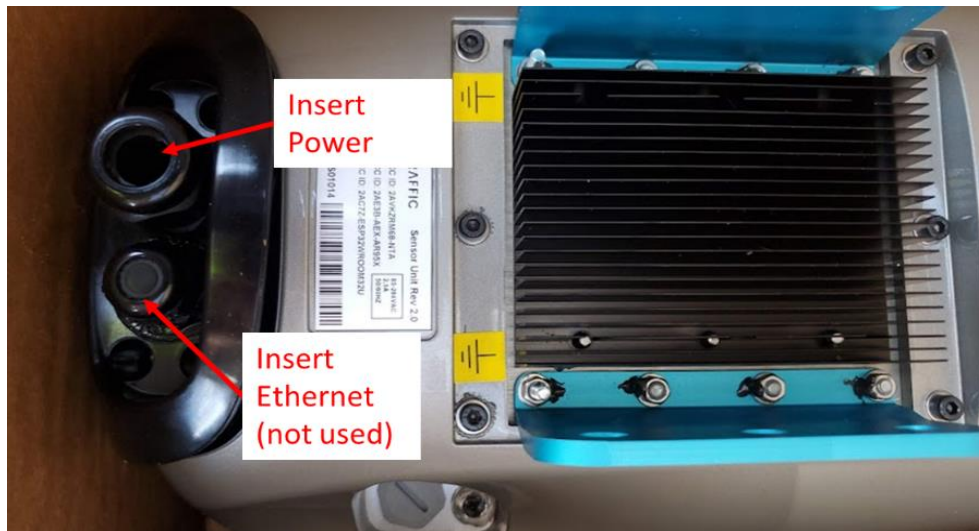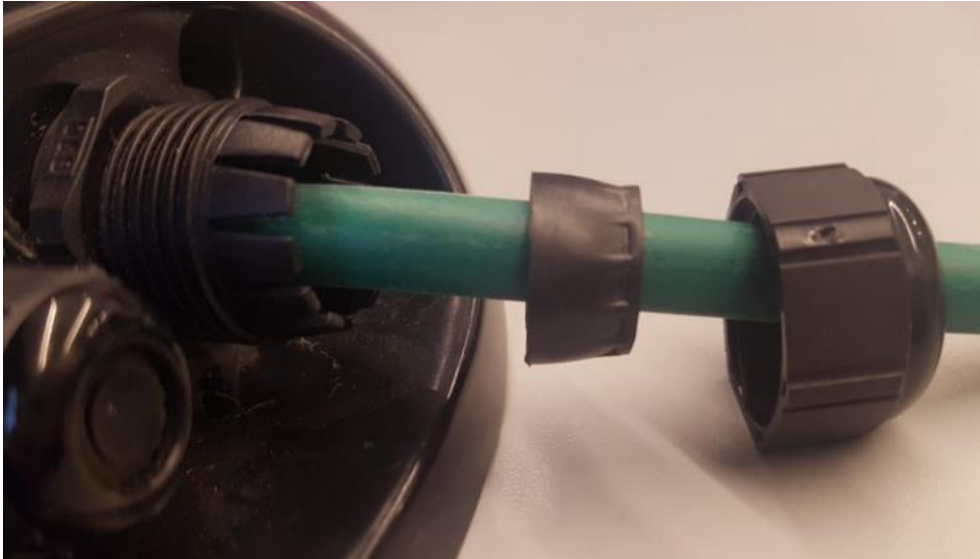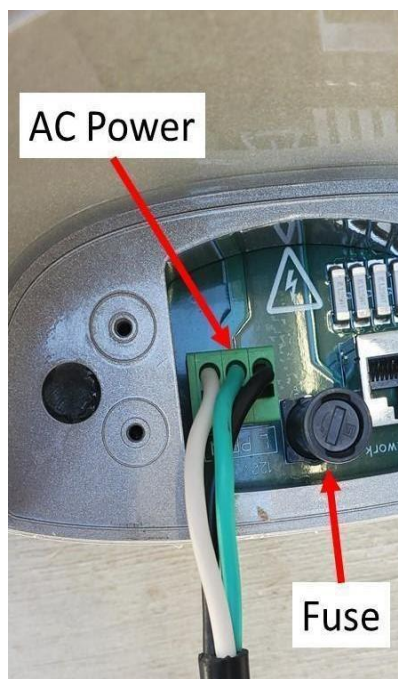
4. Strip down the end of the power cable, separating the live (black), neutral (white) and ground (green) wires.

> **Note**
>
> The NEMA tap cable does not include a ground wire. Grounding is performed at the luminaire.

5. Terminate the AC power wires at the terminal block on the SU.

> **Note**
>
> Newer sensors have orange push lever connectors, requiring no tools. Older push-pin connectors require a small flathead screwdriver to open and close the terminal.

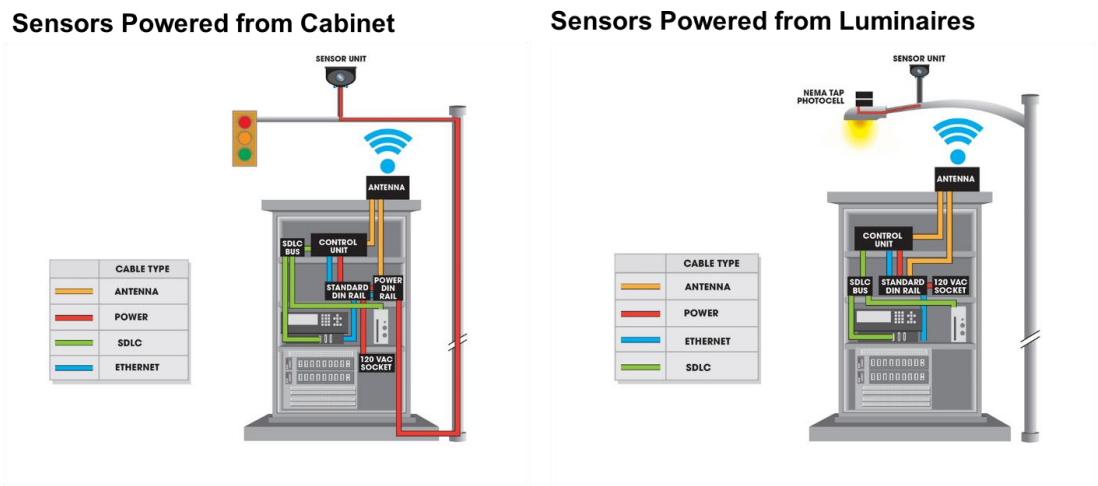6. Replace the rear compartment (4 Phillips-head screws), grommet, and nut as shown in the following figure.

> **Note**
>
> Ensure the rear compartment is securely fastened and the seal between the power cable and the nut is tight.
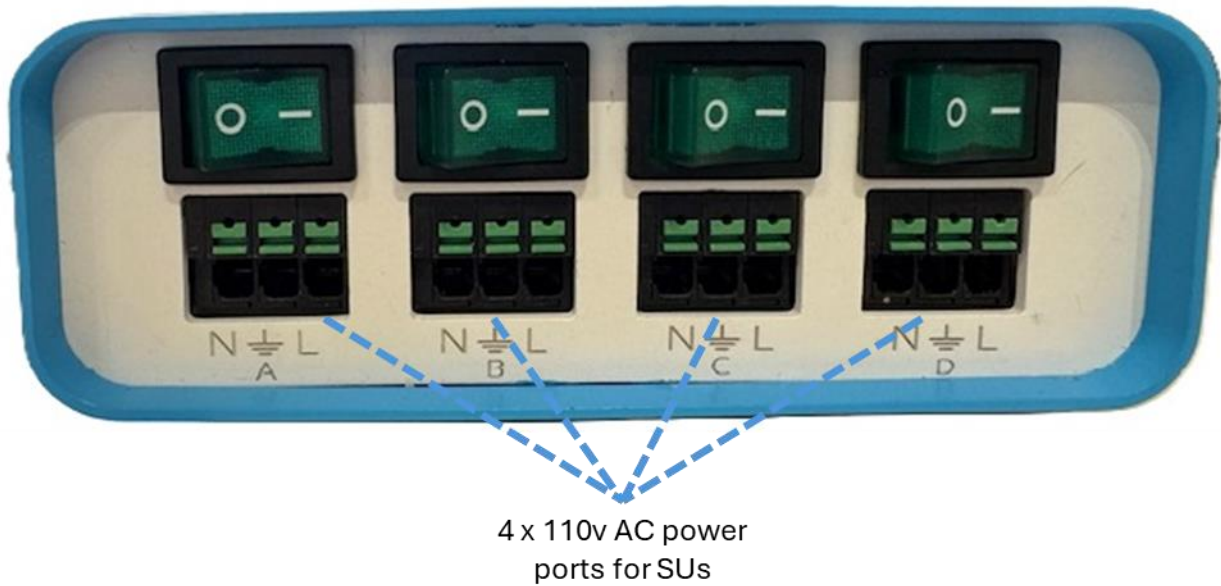
5.4   Connecting Cabinet Components

Cabinet equipment required for cabinet-powered SUs and luminaire-powered SUs are shown below.

5.4.1   Connecting SU Power Cables to Power Box

7. In the cabinet, strip down the 3-conductor cable and terminate the live (black), neutral (white) and ground (green) to the respective SU power ports on the Power Box.
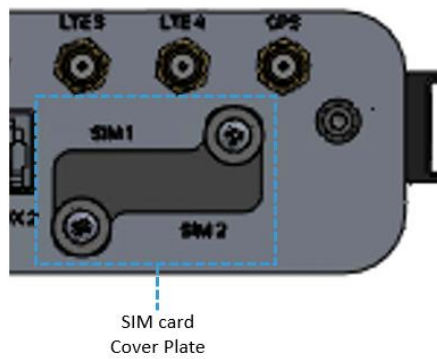

4 x 110v AC power
ports for SUs

5.4.2   Connecting Power Box to Nexus Unit

8. Plug one connector end of the RJ25 cable into the Power Box, and the other connector end of the RJ25 cable into the rear of the Nexus unit.

RJ25 Connection
to Power Box

TBD
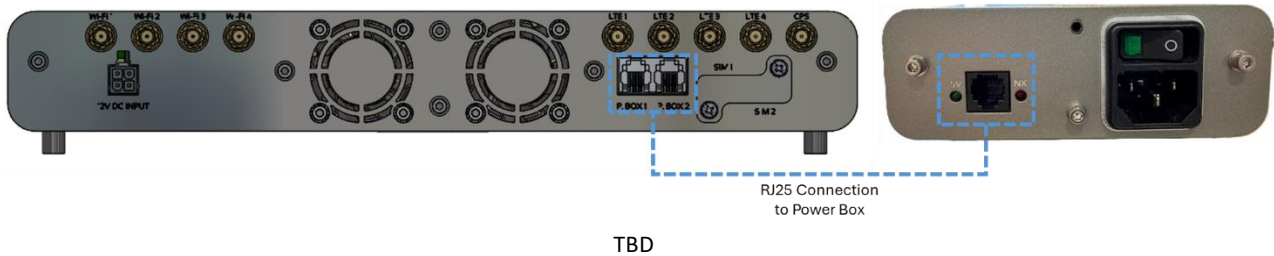
5.4.3   Connecting SIMs

1. Unfasten the screws on the SIM cover plate and remove the cover plate.
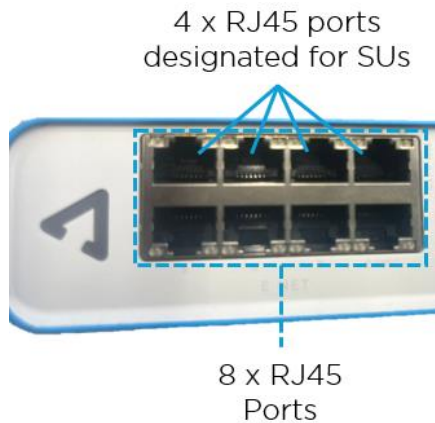

SIM card
Cover Plate

2. Insert the two SIM cards into the respective SIM1 and SIM 2 location slots.

3. Replace and re-fasten the SIM cover plate.

5.4.4   Connecting I/O for Detection and Networking Communication

1. Four RJ45 Ethernet ports are designated for connecting to the SUs via Ethernet cable

2. The remaining RJ45 Ethernet ports can be assigned for communications as follows:

   ▪ Using NTCIP to connect to the city network directly through the local switch.

   ▪ Connecting to a PC.

5.4.5   Connecting TSC – Nexus Unit I/O Cable

To connect the TSC – Nexus Unit I/O cable:

1. On the TSC, connect a suitable Smart Harness adaptor to the required NTCIP, SDLC, C1 and ABC ports.
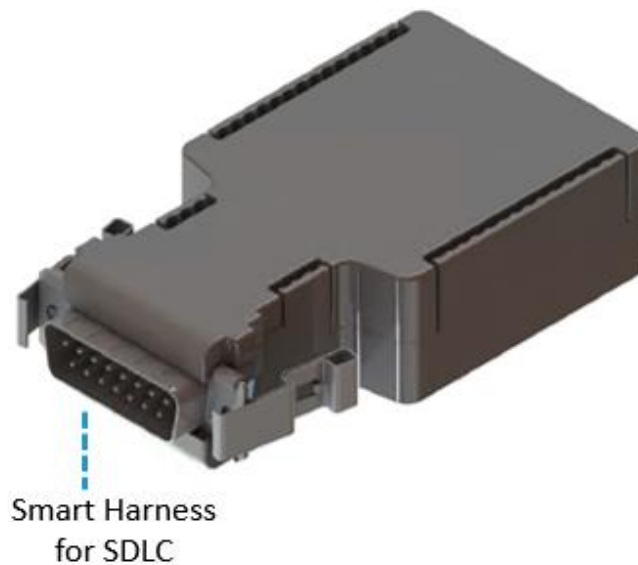
2. Connect one end of the TSC – Nexus Unit I/O Cable to the Smart Harness adaptor RJ25 port.

RJ25
Port

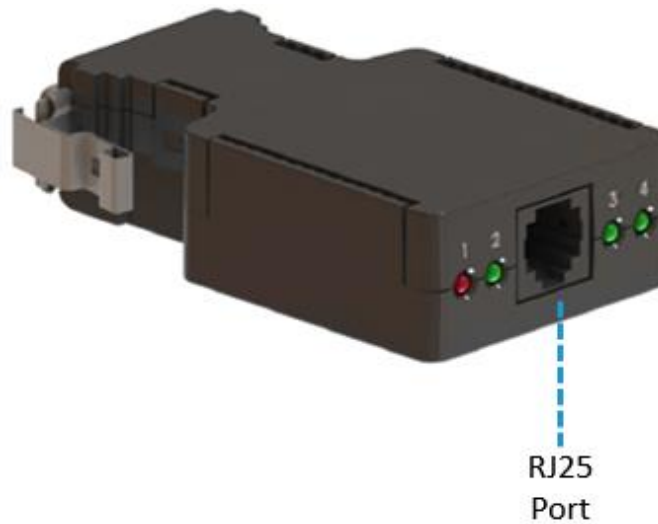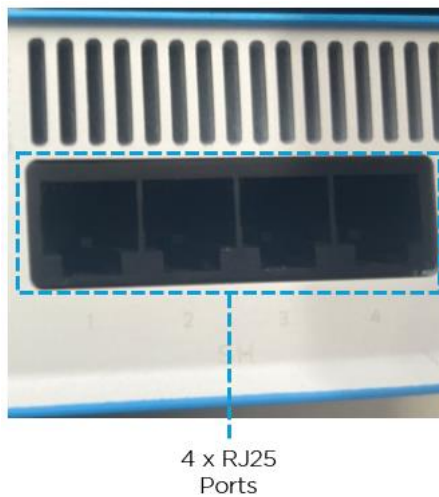3. Connect the other end of the TSC – Nexus Unit I/O Cable to one of the Nexus Unit front panel RJ25 ports.

4 x RJ25
Ports   .

5.5   Checking Connections and System Power Up

1. Ensure all antenna cables are tightened securely and gently pull all power cables to make sure they are not loose.

2. On the Nexus unit, check the screen display is on and the system status is set.

3. Connect the Power Box mains supply cord to the cabinet mains supply.

4. On the Power Box, turn on the power switch.

Power Box
Mains supply input
socket and power
switch
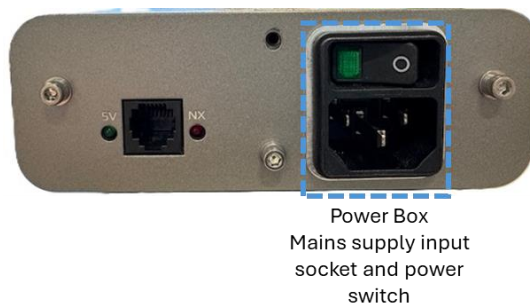
5.6   Aiming SUs

1. Tilt the SU towards the horizon, tapping it down slightly, as shown in the following figure.

2. Once connected call your colleague - at the intersection with a laptop - to assist with the aiming.

3. Keep the horizontal and vertical movements of the mounting bracket slightly loose

4. Once aimed secure all fasteners in accordance with required torques below to lock down the sensor mounting location:

   - 8-10 ft-lb / 96-120 lb-in: Allen wrench, section 5.

   - 12-15 ft-lb / 144-180 lb-in: section 9.

   - 20-22 ft-lb / 240-264 lb-in: sections 10 and 11.

5. Confirm with NoTraffic that the SU has not moved. Once confirmed, the task is complete.

6   Configuring the System

For instructions on configuring the ZTP NoTraffic AI Mobility Operating System, see the ZTP User Guide.
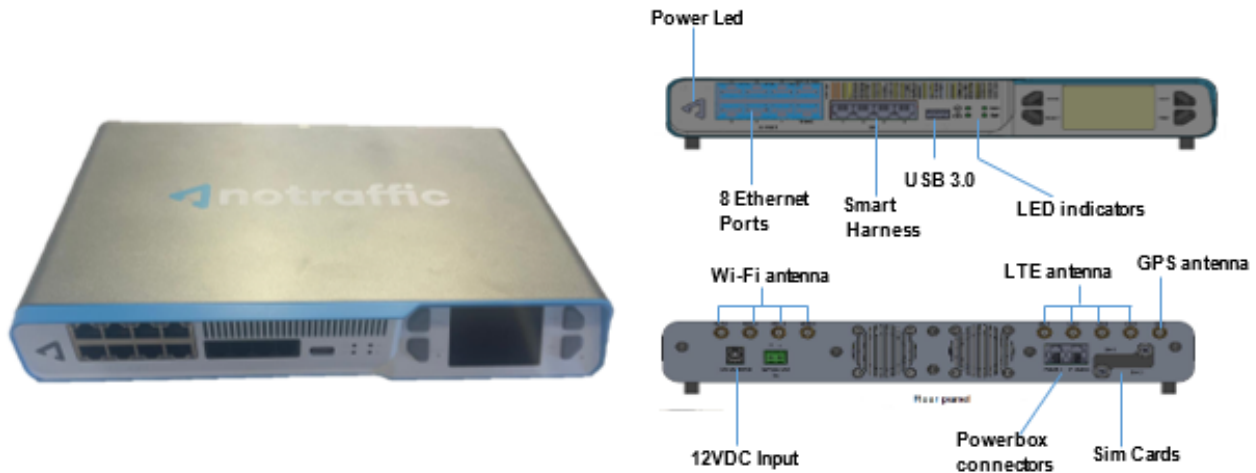
> ### Note
>
> - If using a switch, NoTraffic must be assigned a static IP address. Record the IP address of the controller and UDP port for NTCIP communication.
>
> - The Nexus has a pre-configured static IP address.
>
> - SUs get their IP addresses dynamically using DCHP.

7   Troubleshooting

TBD

Appendix A   Technical Data

A.1   Nexus Unit

Item	Detail
Wi-Fi	Wi-Fi 5 (802.11a/n/ac Wave2) 5GHz Wi-Fi 5 (802.11b/g/n/ac) 2.4GHz
Cellular Modem	LTE, DC-HSPA+/HSPA+/HSPA/UMTS (WCDMA)
I/O	Smart Harness 4 x RJ25 (SDLC, C1, C11*, ABC*) Front panel: 8 x RJ45 (NTCIP),1 x USB 3.0 Rear Panel: 2 x RJ25
Communication speed	10/100/1000 Mbps on RJ45
Antenna connections	LTE, GPS/GNSS, Wi-Fi
Power consumption	60W maximum
Input power	12Vdc 5A maximum
Output power	5V X 6 Ports, 200mA maximum per port
Power supply	110/230Vac 50/60Hz to 12Vdc 120W (External PSU)
Temperature and humidity	-30°F to +165°F, up to 95 % RH per NEMA TS2 (-34.4 degree Celsius + 73.8 degree Celsius)
Ingress protection	IP42 per IEC-60529
Dimensions	L 12" (305mm) x W 8.5" (215mm) X H 1.73" (43mm)
Weight	4.2lbs (1.9kg)
Regulatory	FCC (In Process), PTCRB (In process)
Ingress Protection (PSU)	Over Voltage Protection: 112-132% Overload Protection: 110-200%, Auto Recovery Short Circuit Protection: Auto Recovery
Installation	Outdoor cabinet
Mounting options	NEMA TS-2 style, Caltrans 332, Shelf Mounting, 19" rack mounting (on request), Vertical mounting (on request)

*Optional accessory required

Sensor Unit
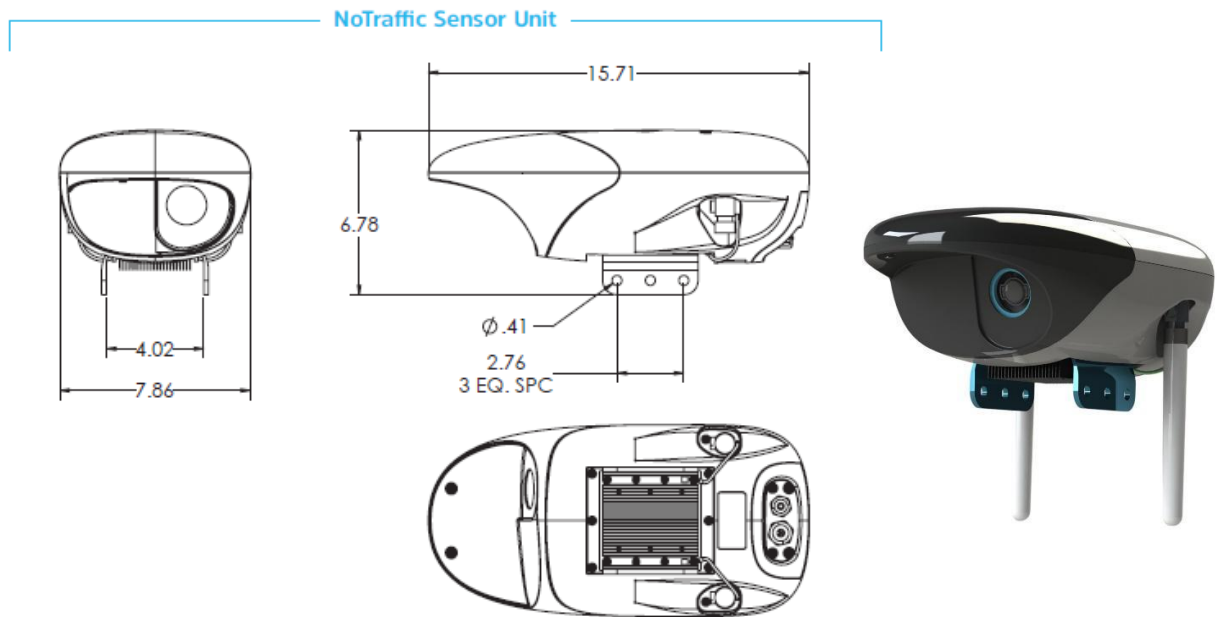
Specifications and Features	
Temp & Humidity	-30F to +165F, up to 95% RH
Ingress Protection	IP67
Dimensions	L 15.71" x W 7.86" x H 6.78"
Weight	Six lb. 13 oz. for SU, 7 lb. 15 oz. for SU with CV RSU
Video	1080p @ 30FPS MPJEG stream
Radar	60GHz Operating Frequency (V Band)
Wi-Fi	IEEE 802.11a/n/ac 5GHz
CV RSU	DSRC – SAE J2735, USDOT RSU v. 4.1 + C-V2X
Power	90V-264 VAC 50/60Hz
Power Cable	14-18 AWG stranded copper 3-conductor cable
Max Consumption	40W
Mounting	Compatible with 4" mounting yoke
Additional Ports	Optional Ethernet port if Ethernet cable is preferred

A.2   Antenna

Specifications and Features	
IP Rating	IP67 rated waterproof
LTE	4X 5G/4G (600MHz)
Wi-Fi	4X Wi-Fi 2.4GHz-5GHz with range of 250 feet
GPS	1X GPS/GLONASS patch antenna for location
Dimensions	Antenna: D 6.33" x H 2.2" A 7/8' hole is required for the leads and sealed using 3M adhesive and a locking nut.
Lead Length	6'

A.3   NEMA Power Tap

Specifications and Features	
Input Voltage (AC)	120 VAC
Input Voltage Range	90 - 480 VAC
Input Current	15 A
Output Voltage (AC)	120 VAC
Output Current	7 A
Weight	1 lb.
Output Cable Length	10 feet
Mounting	Twist-lock

A.4　Controller Connections

A.4.1　SDLC Cable

Specifications and Features	

A.4.2　Network cable for NTCIP

Specifications and Features	

A.4.3　DB37 to Spade Cable & C1/C4 Harness

Specifications and Features	

A.4.4   RJ25 Cable
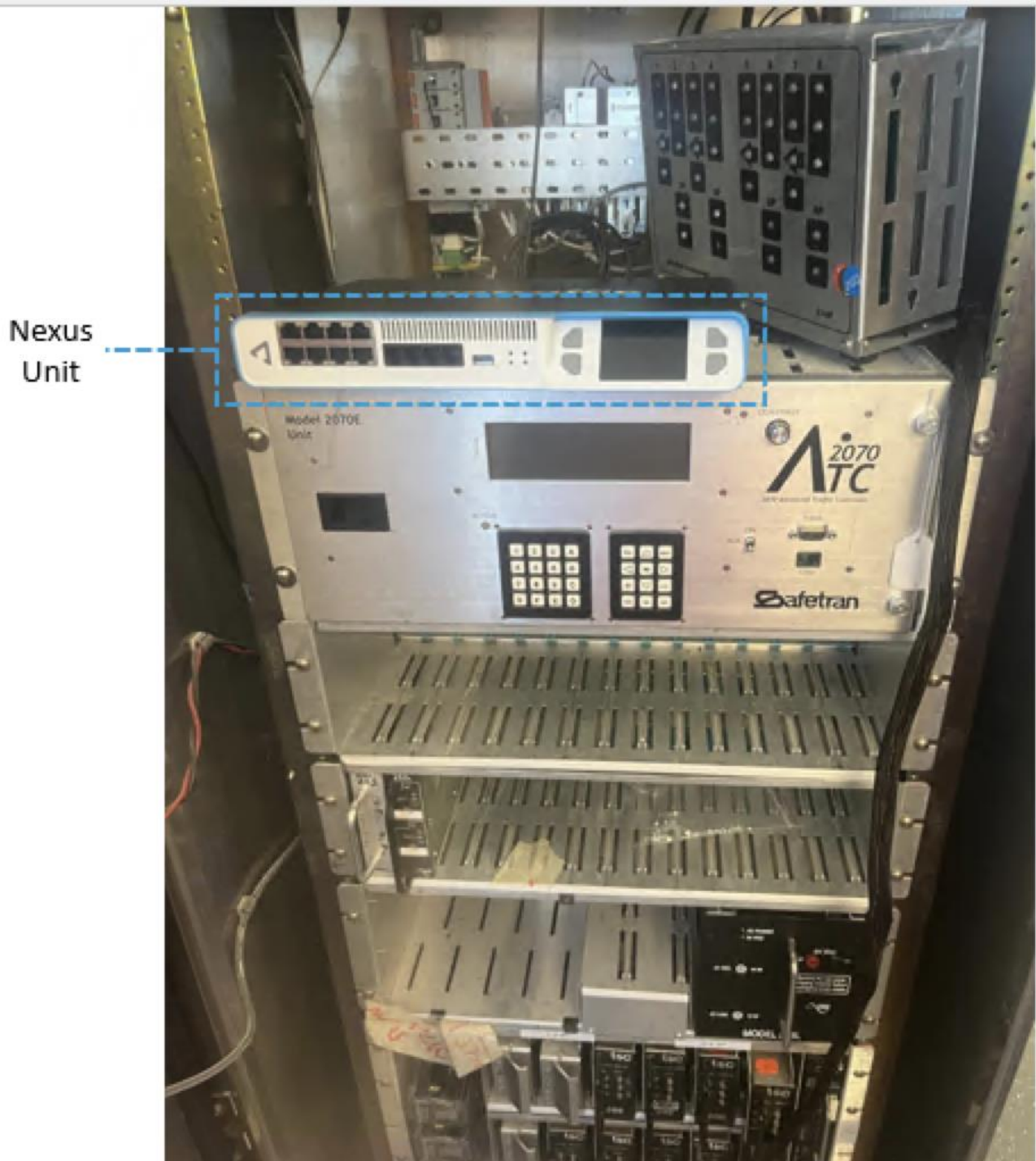
Specifications and Features	

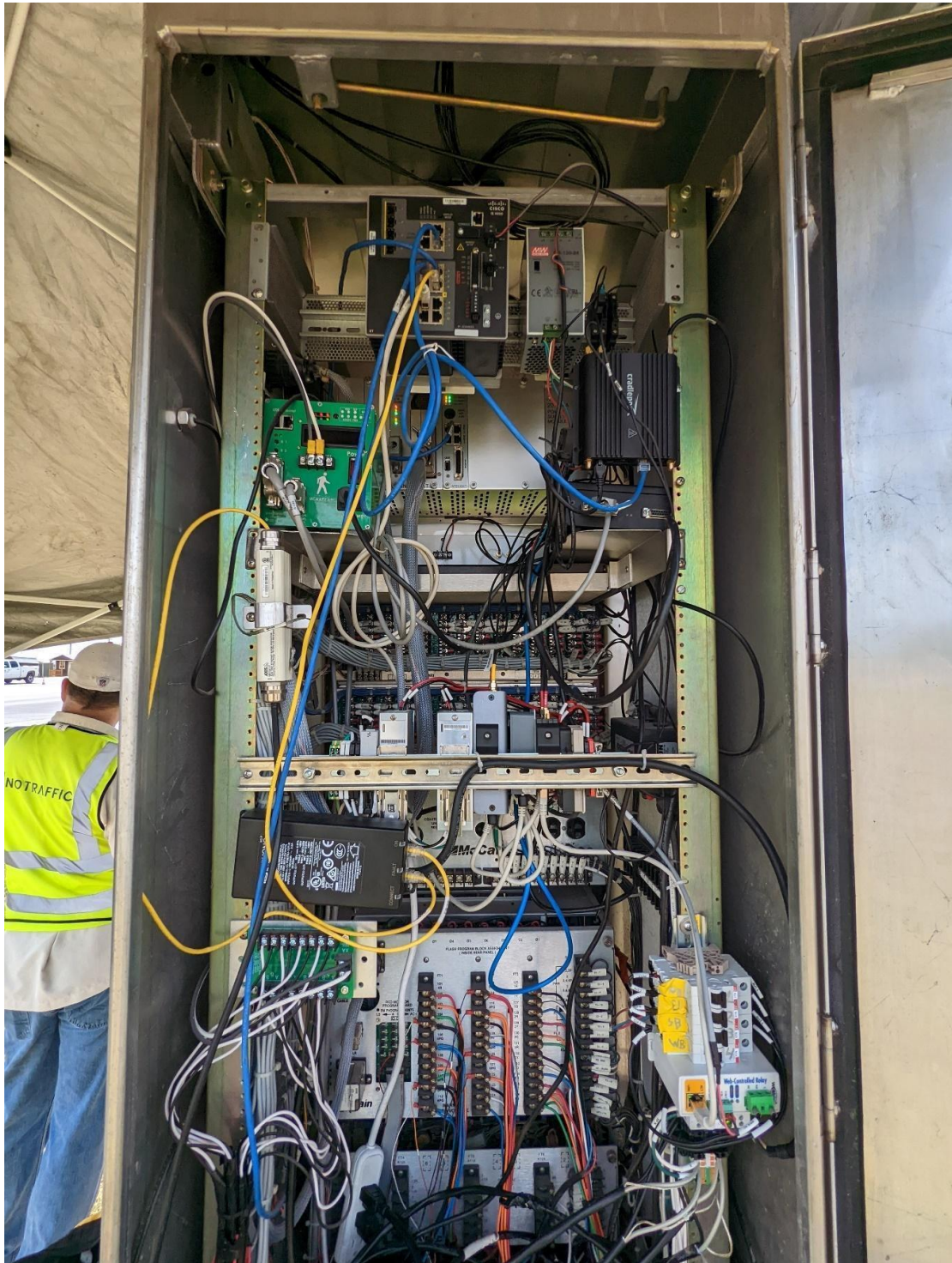# Appendix B   Installation Examples

B.1   Cabinet Equipment

B.2   ATC/332 Cabinet

Front view of 332 cabinet after installation is shown in the following figure.

Rear view of 332 cabinet after installation is shown in the following figure.

B.3   NEMA Cabinet with Power Box
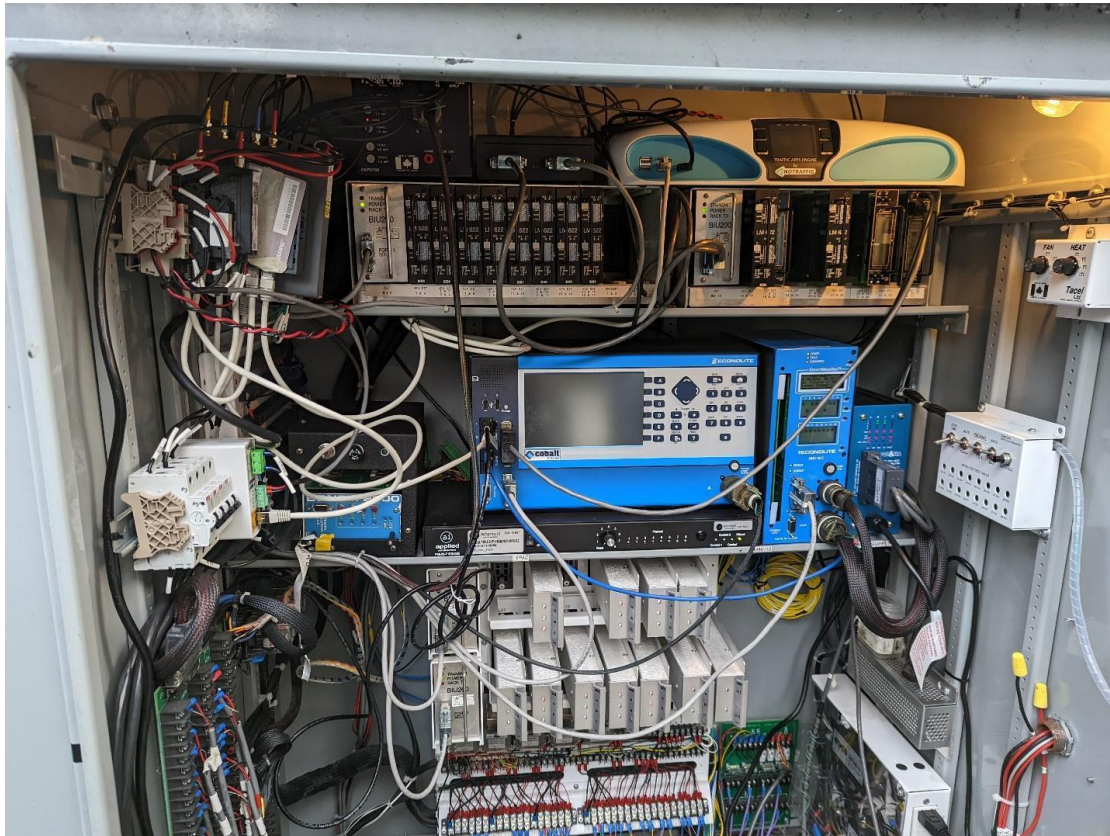
Cabinet equipment installed in a NEMA cabinet is shown in the following figure.
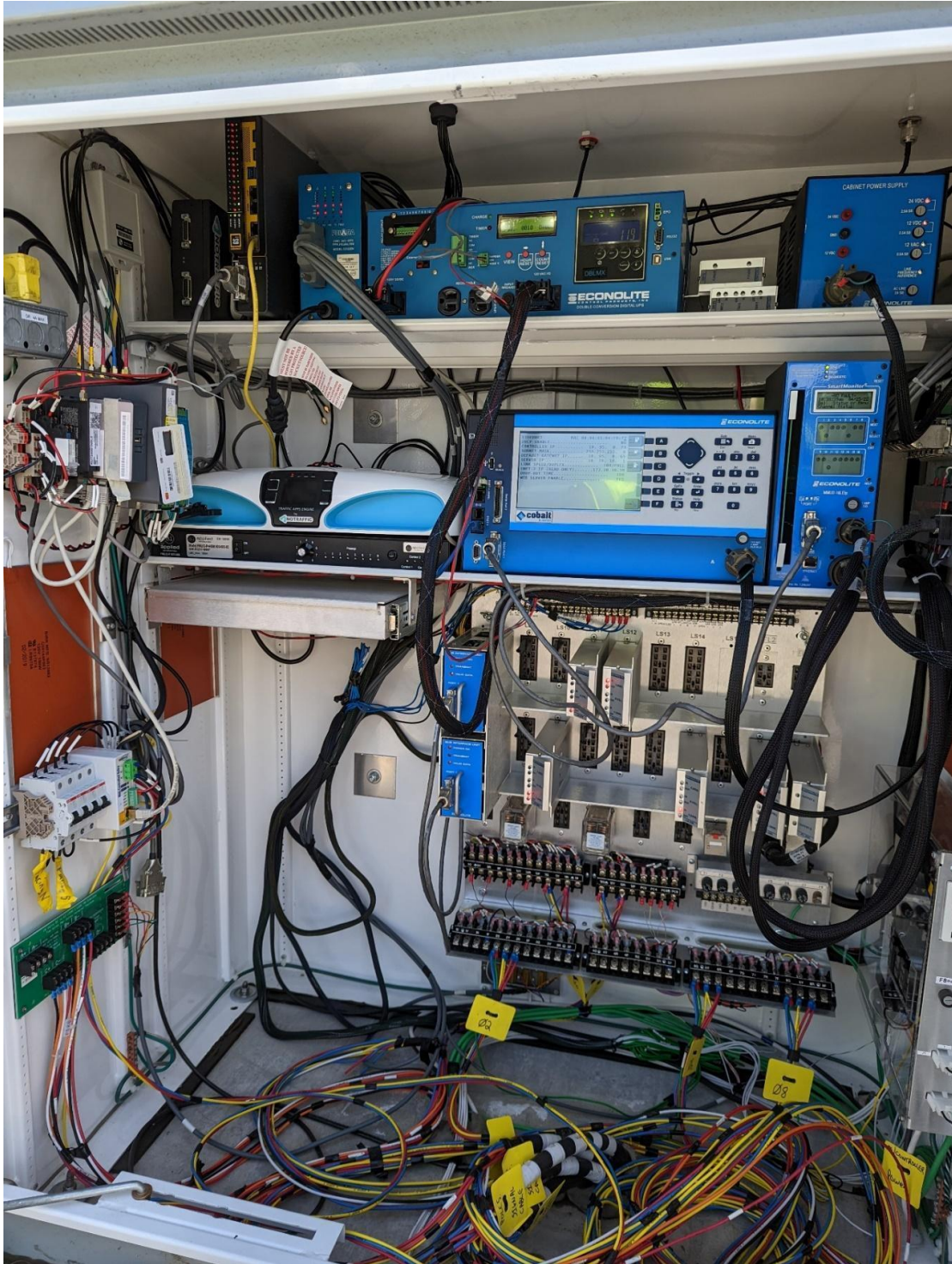
Cabinet equipment installed in a NEMA cabinet (2) is shown in the following figure.

B.4   SU Examples

Sensor unit installed at one approach is shown in the following figure.

Connected Vehicle SU (left), and regular sensor unit (right) is shown in the following figure.

Appendix C   Support

Technical support for troubleshooting is available 24/7/365 by phone or email. Certain restrictions and exclusions may apply.

Contact the support number 3 days in advance of aiming new SUs or renaming existing SUs.

Phone: +1 202-800-1890

Email: support@notraffic.tech

Appendix D   Installation Checklist

Use the table below to verify you have the correct quantities of NoTraffic provided hardware and to procure any necessary auxiliary hardware.

Equipment	Provided By	Guidance	Qty
Nexus	NoTraffic	1 per intersection	
Sensor Unit & Sensor Unit V2X	NoTraffic	1 SU for each approach, one of which is the V2X Sensor.Ex: A 4-leg intersection has 1 SU-V2X and 3 SUs	
Antenna	NoTraffic	1 per intersection	
SDLC Cable	NoTraffic	1 per intersection using SDLC for detection	
DB37 and C1/C4 Harness (uncommon)	NoTraffic	1 of each cable per Caltrans TEES cabinet	
Power Box	NoTraffic	1 per Intersection where at least 1 SU is powered from the cabinet	
NEMA Tap	NoTraffic	1 per SU be powered by a luminaire	
Power Cable	Agency / Contractor	# Feet to reach the cabinet-powered SUs from the cabinet through existing conduit. 14-18 /3, stranded copper, outdoor rated.	
Camera Mounting Assembly	Agency / Contractor	1 per SU that is mounted to the mast arm. Pelco Assembly AS-0170 with Bracket SH-0514. Typical riser height is 6 feet.	
Below – Auxiliary items only for large intersections or Ethernet cables to Sensors			
Ethernet repeater kit	NoTraffic	1 per 300 feet of ethernet cable	
Wi-Fi Repeater kit	NoTraffic	1 for any SUs further than 270 feet from cabinet	
Outdoor-rated Ethernet cable + RJ45 Plugs	Agency / Contractor	# Feet of to reach the Wi-Fi repeater or each Sensor Unit At least Cat 5e	

Appendix E   Regulatory

FCC Statements

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

— Reorient or relocate the receiving antenna.

— Increase the separation between the equipment and receiver.

— Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

— Consult the dealer or an experienced radio/TV technician for help.

WARNING – RF EXPOSURE COMPLIANCE: This equipment should be installed and operated with a minimum distance 20cm between the radiator and your body