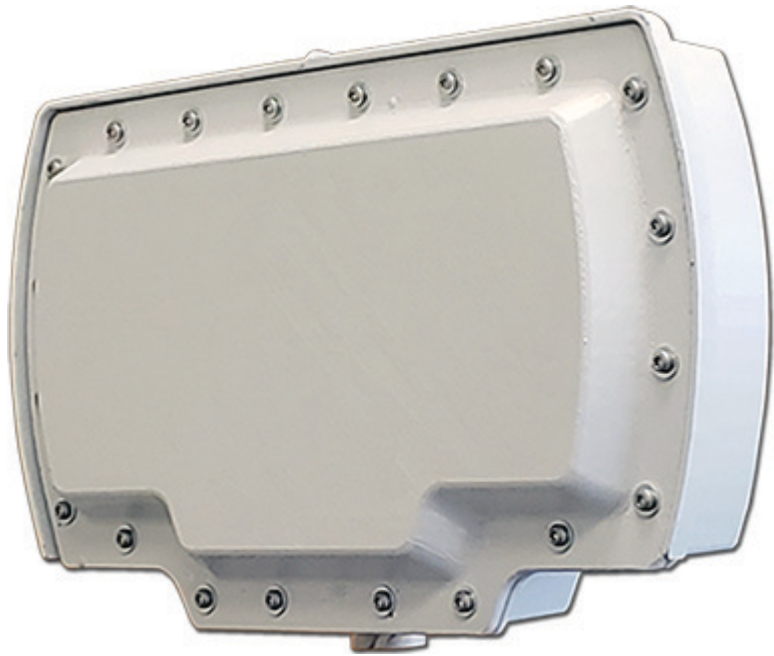




RTMS Echo
User Guide



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Record of Revisions

Revision	Date	Affected Pages	Description
A	12/2019		Initial release.



Table of Contents

Preface	vi
Federal Communication Commission (FCC) Notices	vi
Industry Canada (IC) Notices	vii
FCC and IC ID Numbers	vii
CE Certification	vii
Chapter 1: Introduction	1-1
General	1-1
Features/Benefits	1-1
RTMS Echo Technical Specifications	1-2
Electromagnetic Interference	1-3
Firmware Upgrade Capability	1-3
Chapter 2: Pre-Installation Considerations	2-1
General	2-1
Safety Information	2-1
Power Considerations	2-1
Cabling Considerations	2-2
Breakout Boxes	2-3
Surge Suppression/Filtering	2-4
Connecting Power and Communications	2-5
Providing a Proper Ground	2-7
Placement in Side-Fired Highway Configuration	2-9
Height, Setback, Tilt Requirements	2-11
Guardrails and Barriers	2-12
Sunken Road and Roadside Walls	2-12
Elevated Roadway	2-13
Installing RTMS Echo on Sign Structures	2-14
Grade Differentials	2-15
Trees	2-15
Chapter 3: Sensor Installation & Setup	3-1
General	3-1
Safety Information	3-1
Installing the Sensor	3-2
Setting Up the Sensor	3-4
Logging in to the Sensor For the First Time	3-5
Aiming the Sensor	3-6

Detect and Adjust Zones - - - - -	3-7
Verifying Vehicle Counts - - - - -	3-9
Configure Settings - - - - -	3-11
Chapter 4: Operations and Adjustments - - - - -	4-1
General - - - - -	4-1
Logging in to the RTMS Echo - - - - -	4-1
Home Tab - - - - -	4-2
Aim Tab - - - - -	4-4
Zones Tab - - - - -	4-5
Add a Zone - - - - -	4-6
Edit a Zone - - - - -	4-7
Remove a Zone - - - - -	4-7
Auto Detect Zones - - - - -	4-8
Calibrate Tab - - - - -	4-8
Optimizing Volume Count Accuracy - - - - -	4-10
Condition A: Over/Under Count in Adjacent Zones - - - - -	4-10
Condition B: Under Count in Near Zone - - - - -	4-11
Condition C: Under Count in Far Zone - - - - -	4-12
Condition D: Under Count in Several Zones - - - - -	4-13
Condition E: Over Count in Several Zones - - - - -	4-14
Condition F: Under Count in First Zone Past a Barrier - - - - -	4-15
Speed Calibration - - - - -	4-16
Length Calibration - - - - -	4-17
Data Tab - - - - -	4-18
Classification By Binned Speed Query - - - - -	4-19
Classification by Length Query - - - - -	4-22
Gap Average Query - - - - -	4-24
Headway Average Query - - - - -	4-26
Interval Data Query - - - - -	4-28
Per-Vehicle Data Query - - - - -	4-30
Speed 85th Percentile Query - - - - -	4-32
Speed Average Query - - - - -	4-34
Speed By Bin Query - - - - -	4-36
Voltage Query - - - - -	4-39
Volume Query - - - - -	4-41
Log Tab - - - - -	4-43
Settings Tab - - - - -	4-44
Install Firmware - - - - -	4-44

Local Area Network Setting - - - - -	4-45
Wi-Fi Setting - - - - -	4-46
Location Setting - - - - -	4-47
Date and Time Setting - - - - -	4-48
Traffic Data Storage Setting - - - - -	4-49
Interval Data - - - - -	4-50
Sx-300 Protocol Settings - - - - -	4-51
Region Setting - - - - -	4-52
Licensing - - - - -	4-52
Backup/Restore Device Configuration - - - - -	4-53
Download Diagnostics - - - - -	4-54
Reboot Device - - - - -	4-54

Preface

Federal Communication Commission (FCC) Notices

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.

Changes or modifications to this equipment not expressly approved by Image Sensing Systems, Inc. could void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement:

This transmitter complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

This transmitter should be installed and operated with a minimum distance of 30 centimeters (12 inches) between the radiator and your body.

Per FCC 15.19(a)(3) and (a)(4) 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.

Industry Canada (IC) Notices

English

Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) the user of the device must accept any interference suffered, even if the interference is likely to lead to undesired operation.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Francais

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet appareil est conforme aux normes RSS exempts de licence d'Industrie Canada. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

FCC and IC ID Numbers

Echo:

- FCC ID: J7TRTMSECHO
- IC ID: 1868A-RTMSECHO

Contains Transmitter Module:

- FCC ID: UAY-W8997-M1216
- IC: 6549A-W8997M1216

The FCC and IC IDs can also be found on the label affixed to the outside of the RTMS Echo.

CE Certification

Certified for the RTMS Echo.

Chapter 1: Introduction

General

The RTMS Echo is a side fire radar mounted on the roadside. Simultaneously, the sensor provides per vehicle data including volume, occupancy, speed and classification information in up to 12 detection zones. The installation of RTMS has never been easier with built-in aiming guidance, auto configuration of the sensor, and wireless configuration via mobile device or tablet. The data collected by the RTMS Echo is highly accurate and can be formatted to fit the needs of your organization or agency's objectives.

The RTMS technology provides meaningful and reliable data that maximizes the full potential of existing infrastructure and optimizes the safety and efficiency of every city.

Features/Benefits

Some of the features and benefits of the RTMS Echo include:

- Fast, safe installation on existing road-side poles with no traffic disruptions.
- Radar transceiver designed for traffic data collection.
- Built-in aiming guidance and auto configuration for easy installation and set up.
- Wireless configuration and management of sensor.
- Configurable using a mobile device or tablet eliminating the need to carry a computer or install complicated software.
- Single RJ-45 connection for TCP/IP communications and power.
- Data storage of up to one million per-vehicle records and ten thousand interval records.

RTMS Echo Technical Specifications

Table 1-1: Radar Frequency - Radar

Country	Bottom Frequency	Top Frequency	Power
USA/RUS	24.075 GHZ	24.175 GHZ	20 dBm max
FR/Other Europe	24.145 GHZ	24.245 GHZ	20 dBm max
UK*	24.145 GHZ	24.245 GHZ	20 dBm max

*RTMS Echo meets the requirements of the minimum sweep rate as specified by ERC recommendation (70-03) as specified in IR2030/12/9 2014/88/UK June 2014.

Table 1-2: Wi-Fi Frequencies

Country	Channels	Bottom Frequency	Top Frequency	Power
North America	1 - 11	2412 MHZ	2462 MHZ	20 dBm max
Europe	1 - 13	2412 MHZ	2472 MHZ	20 dBm max

Table 1-3: Specifications

Measurement	Dimensions
Mechanical	Width: 12.5 in. (32 cm) Height: 7.25 in. (19 cm) Depth: 2.5 in. (7 cm) Weight: 4.5 lbs (1.5 kg) with bracket
Electrical	Voltage: 12-24 V DC Power: Max = 7.9 Watts; Avg = 7.3 Watts
Temperature Range	-40 to +165°F (-40 to 74C°)
Humidity	Up to 95% Relative Humidity
Ingress Protection	IP67

(Table continues on the next page.)

Table 1-3: Specifications (Cont'd)

Measurement	Dimensions
Vibration	Resonance: Tested per NEMA TS2 2.2.8.3 Endurance: Tested per NEMA TS2 2.2.8.4 Shock: Tested per NEMA TS2 2.2.9.3
Frequency Bands	K band; operates in the 24 GHZ band
Field of View	Elevation angle: 57 degrees Azimuth: 17 degrees Range: 0 to 250 ft (0 to 76 m)
Regulatory	FCC 15.107:2019, FCC 15.109:2019, FCC 15.109(g):2019, FCC 15.207:2019, FCC 15.245:2019 RSS-210:2016 +A1:2017 ICES-003:2016 updated April 2017 EN 50293:2012 Radio Equipment Directive (2014/53/EU) EN 300 440 V2.2.1:2018, EN 301 489-51 V2.1.0:2017, EN 300 328 V2.1.1:2016, EN 301 489-17 V3.1.1:2017, EN 303 413 V1.1.1:2017, EN 301 489-19 V2.1.0:2017 RoHS (2011/65/EU)

Electromagnetic Interference

Certified under US FCC Rule part 15 Class B; Canadian CSA C108.8 M1983 Class A; CE. For additional information, see [“Preface” on page vi](#).

Firmware Upgrade Capability

User upgrades of firmware is available through the same web interface used to set up and configure the RTMS Echo (see [“Install Firmware” on page 4-44](#)).

Chapter 2: Pre-Installation Considerations

General

The following information on power, cabling, communications and placement should be taken into consideration prior to installing the RTMS Echo.

Safety Information

Please review the following information before installation.

- Read all instructions before using.
- Heed all warnings in these instructions.
- Save these instructions for future reference.
- RTMS Echo units must be installed and adjusted in accordance with the installation instructions contained in this manual.
- Use the RTMS Echo only for its intended purposes as described in this manual. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.
- Consult Technical Support before using the RTMS Echo or other RTMS Echo-related products for any purpose not expressly described in this manual or any other RTMS Echo product manual. Do not use the RTMS Echo to control or operate a gate-opening mechanism. Use of the RTMS Echo for any unauthorized purpose may cause injury to personnel or damage to equipment.
- For optimal accuracy, it is strongly recommended that only trained personnel survey the sites and install all RTMS Echo-related products.
- For more information about our installation, surveying, and training programs, contact your RTMS Echo sales representative.

Power Considerations

The RTMS Echo is a constant power device that requires in its basic configuration a maximum of 8 watts of power. Electrical power has two components, voltage and current; both must be available in the correct ranges to operate the RTMS Echo. The voltage must be between 12 and 24 volts DC with the voltage level read at the RTMS Echo. Voltages below 12 volts will be insufficient to power the RTMS Echo. Voltages above 30 volts could cause damage to the sensor. Losses in the cable must be addressed in setting the voltage to be supplied to the unit.

Current in sufficient quantity must be available: at 12 volts, the RTMS Echo will draw roughly 660 mA of current; at 24 volts roughly 330 mA. Using an adaptor that provides 12 volts and 100 mA of current means that the total power to the RTMS Echo will be $12 \times 0.1 = 1.2$ watts, or roughly 15% of the power needed to turn on the RTMS Echo.

On power up, there will be an inrush current that will be several times higher than the operating current. The power supply must be able to handle this temporary current flow. If the power supply is unregulated (such as a simple step-down supply from 120 VAC to 24 volts DC), the output voltage may be higher than specified when the current draw is less than maximum available from the supply. This may cause the RTMS Echo to sense an overvoltage condition and shut down to protect itself.

Cabling Considerations

The RTMS Echo uses an outdoor rated CAT5e or CAT6 cable that provides both power and Ethernet communications. The recommended cable has the following features:

- CAT 5e rating
- Polyethylene jacket for moisture, water and UV protection
- Foil shield to protect from EMI/RFI interference
- 23AWG solid connectors fit for PoE applications
- Ground wire

The cable provided by ISS is 50 ft (15.24 m) in length and comes with an 8-pin RJ-45 connector on the end that connects into the RTMS Echo. The connector also contains an element to which the ground wire is attached. The other end of the cable is what needs to be connected to power, communications and ground in the breakout box. Cable pinout is a combination of standard Ethernet and custom. The green and orange pair are wired like standard Ethernet for 100Mbps per second data transfer. The wiring and pinouts for the connector are shown in the Figure below.

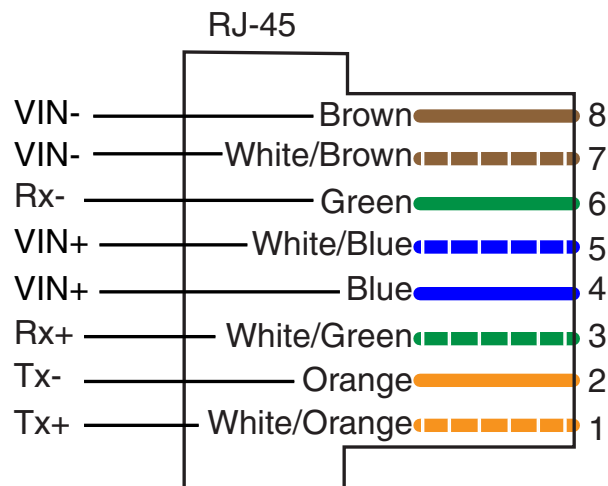


Figure 2-1: RJ-45 Connector Pinouts

The non-colored wire in the cable must be connected to Earth ground in the breakout box if the cable is not terminated with an RJ-45 connector. If it is

terminated with an RJ-45 connector, the connector must have an element to which the ground wire can be connected (see examples below).

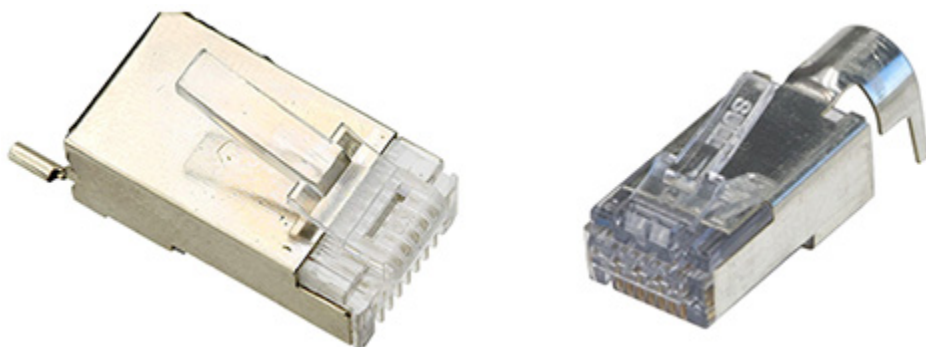


Figure 2-2: Example RJ-45 External Ground Connectors

Breakout Boxes

The design of an RTMS Echo installation should include a breakout box close to the RTMS Echo that can be used for setup and maintenance purposes, and can include surge suppression circuitry and external communications devices as required. Reference designs are available. The breakout box should be no more than 50 ft (15.24 m) from the RTMS Echo sensor (see [Figure 2-3](#)).



Figure 2-3: Typical Breakout Box Installation

Each breakout box should contain a manufacturers approved surge suppression package, filters, power supply and communications equipment.

Surge Suppression/Filtering

Surge Suppression: The CITELE MJ8-POE-B has been tested and is the recommended transient suppressor for RTMS Echo sensors.



Figure 2-4: Citel Surge Suppressor

- Power over Ethernet surge protector
- RJ-45 connection for PoE-A or B
- 10/100/1000 Mbps compatible
- Max DC power:
 - 7.5 VDC for pins 1, 2, 3, 6
 - 60 VDC for pins 4, 5, 7, 8
- Max DC current: 1200mA
- Frequency: 100 MHz
- Bi-directional protection
- Shielded enclosure and connectors
- Din rail mountable
- UL497B listed

Filtering: The COSEL SNR-10-23-DT line noise filter has been tested and is the recommended filter for RTMS Echo sensors.



- Voltage rating: 50VDC
- Current rating: 10A
- Leakage current: 50 uA
- Capacitance: 0.022 uF
- Din rail mountable
- RoHS compliant

Connecting Power and Communications

After the RTMS Echo has been mounted to the pole the connections for power and data communications must be made. For cable pinouts see [“Cabling Considerations” on page 2-2](#).

A 50 ft (15.24m) Cat 5e cable containing wires for both power and communications is included with the RTMS Echo sensor. It is strongly recommended that surge suppression be provided for both power and communications. In addition, if the power source in the breakout box is solar or if the source provides power to other equipment in addition to the Echo sensor, a filter is recommended (see [“Surge Suppression/Filtering” on page 2-4](#)).

[Figure 2-5](#) below shows a block diagram of the connections if separate surge suppressors are used for power and communications. [Figure 2-6](#) shows the same diagram if a single surge suppressor is used.

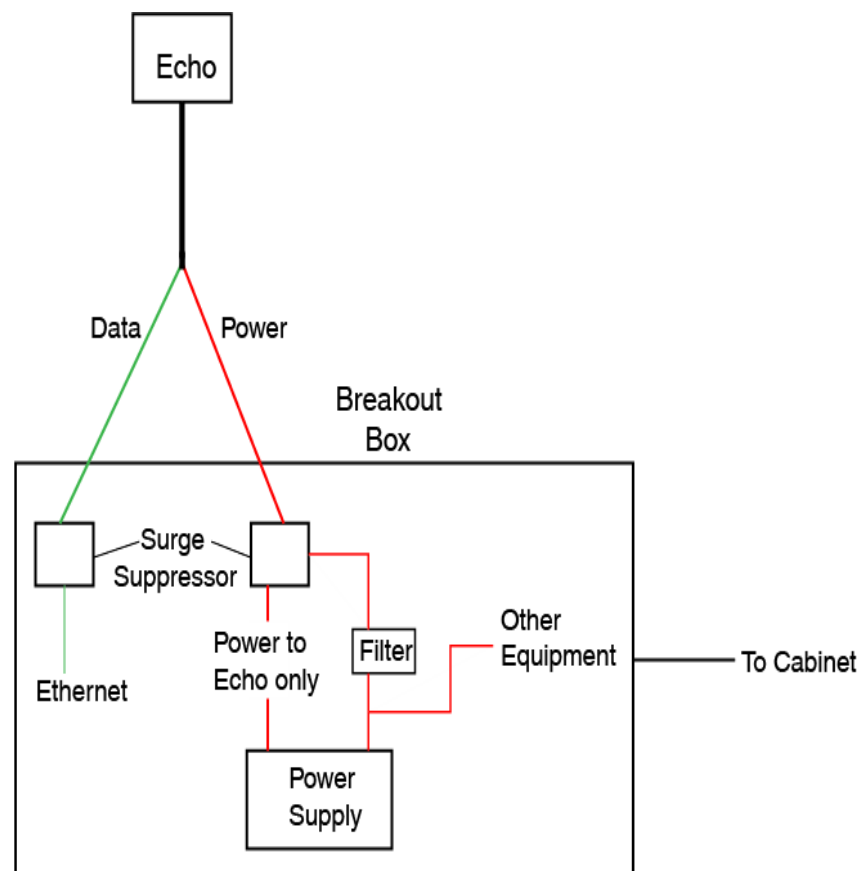


Figure 2-5: Separate Surge Suppressors

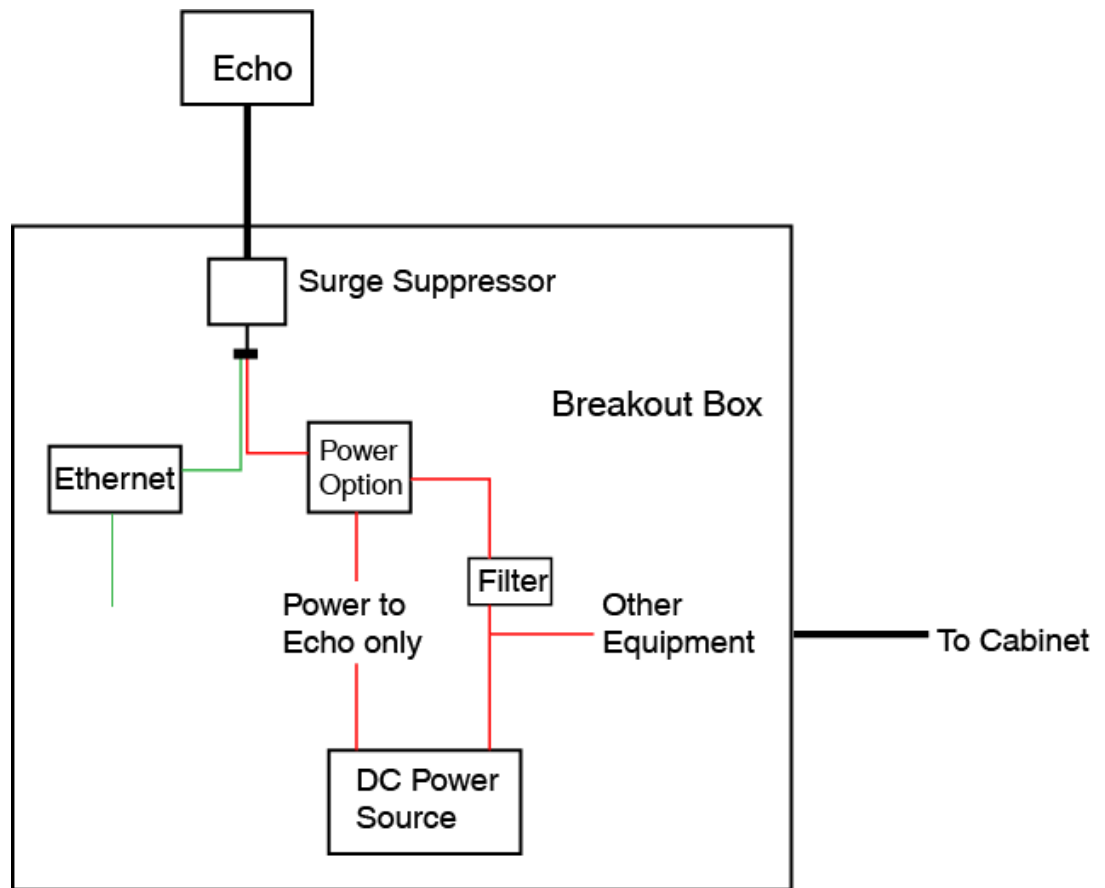


Figure 2-6: Single Surge Suppressor

Providing a Proper Ground

Providing a low resistance earth ground connection is essential to achieving effective surge protection. Total resistance from the protected circuit to the earth should be <5 ohms.

A grounding rod (see [Figure 2-7](#)) should be at least 1.83 m (6 ft) in length and placed as close as possible to the base of the RTMS Echo mounting pole. The grounding conductor should be flexible copper braid or copper wire 12AWG or larger.

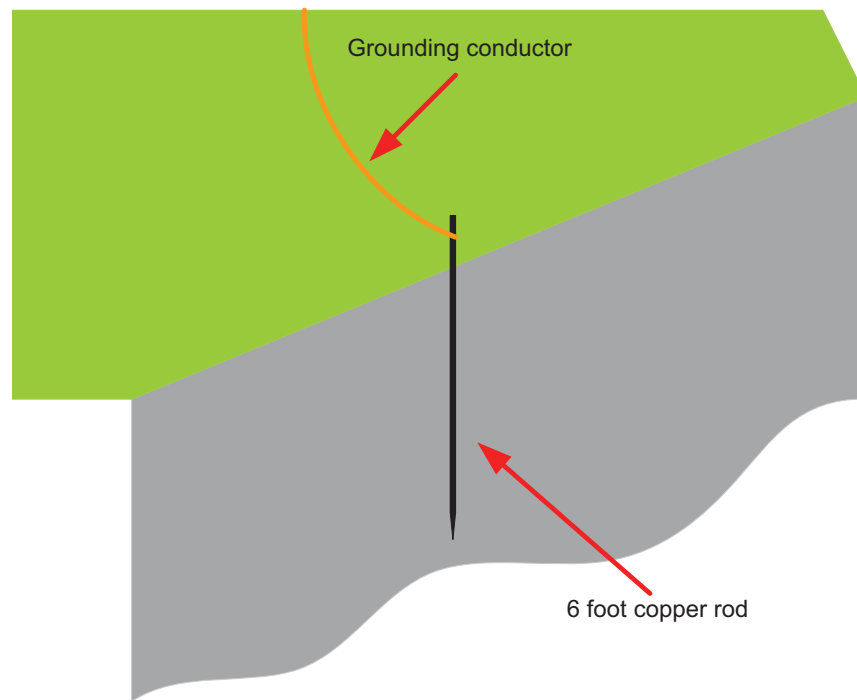


Figure 2-7: Earth Ground Connection

The earth grounding rod, together with proper ground of the breakout box, and surge protecting devices installed in close proximity of the mounting pole, create a barrier or 'sink hole' for any charges and surges coming towards the sensor from the surrounding area (see [Figure 2-8](#)). These charges and surges may be caused by industrial noise, power surges, or lightning.

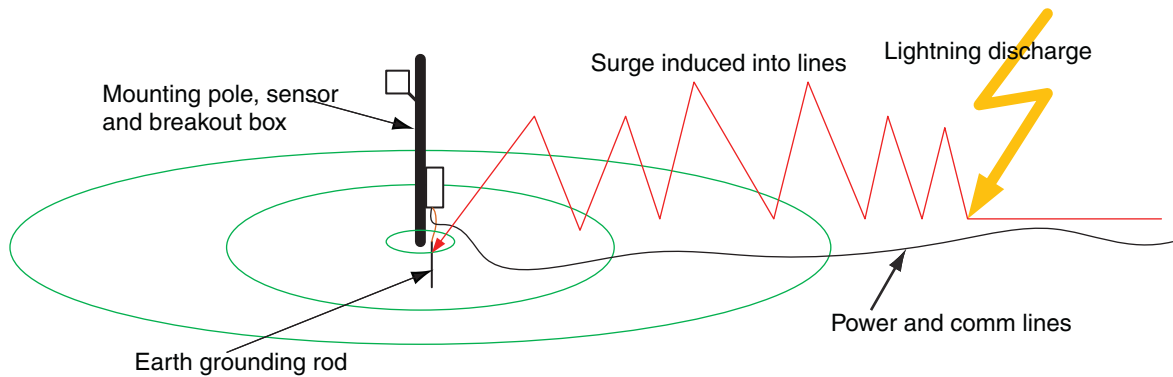


Figure 2-8: Surge Channeled into Earth Ground

Thunderstorm lightning is in its own class of destructive forces to sensors. Typically, it can generate 30 to 300 kA of current, far beyond the capabilities of any surge protecting devices. Therefore, a direct or near direct lightning hit may cause equipment damage even in the presence of surge/transient protecting devices.

Because lightning is a major influence on power line surge, it is important to understand the exposure to thunderstorms in the area where the RTMS Echo sensor is being installed. In areas that are exposed to large number of thunderstorms, protecting sensors will be more challenging.

Placement in Side-Fired Highway Configuration

RTMS Echo is designed to mount on existing poles and road structures. [Figure 2-9](#) shows typical cases of RTMS Echo side-fired/highway sites. The design considerations for each case are:

- **Case 1** — Maximal utilization of the RTMS Echo zone capability. Limitations are as follows:
 - A 12-zone coverage may require a larger setback (the distance to the first lane) mounting height and/or greater tilt setting (see [“Height, Setback, Tilt Requirements” on page 2-11](#)).
 - In almost all cases, the RTMS Echo can resolve the barrier return signal from that of the vehicles in the lane immediately behind it as long as 50% of vehicle can be seen (see [“Guardrails and Barriers” on page 2-12](#)).
- **Case 2** — Overpass installations: Do not mount the RTMS Echo on a perpendicular overpass. Instead, use poles located at least 5 m (17 ft) from the overpass to avoid multi-path. Multi-path is a situation in which the reflected signals from vehicles can also reach the RTMS Echo by a secondary reflection from a large flat surface (such as a sign or overpass).
- **Case 3** — Using median poles to mount two RTMS Echo sensors, one per direction may save poles but the designer should verify available set-back (see [“Height, Setback, Tilt Requirements” on page 2-11](#)).
- **Case 4** — Sign-structure installations (see [“Installing RTMS Echo on Sign Structures” on page 2-14](#)).
- **Case 5** — Typical ramp metering site.

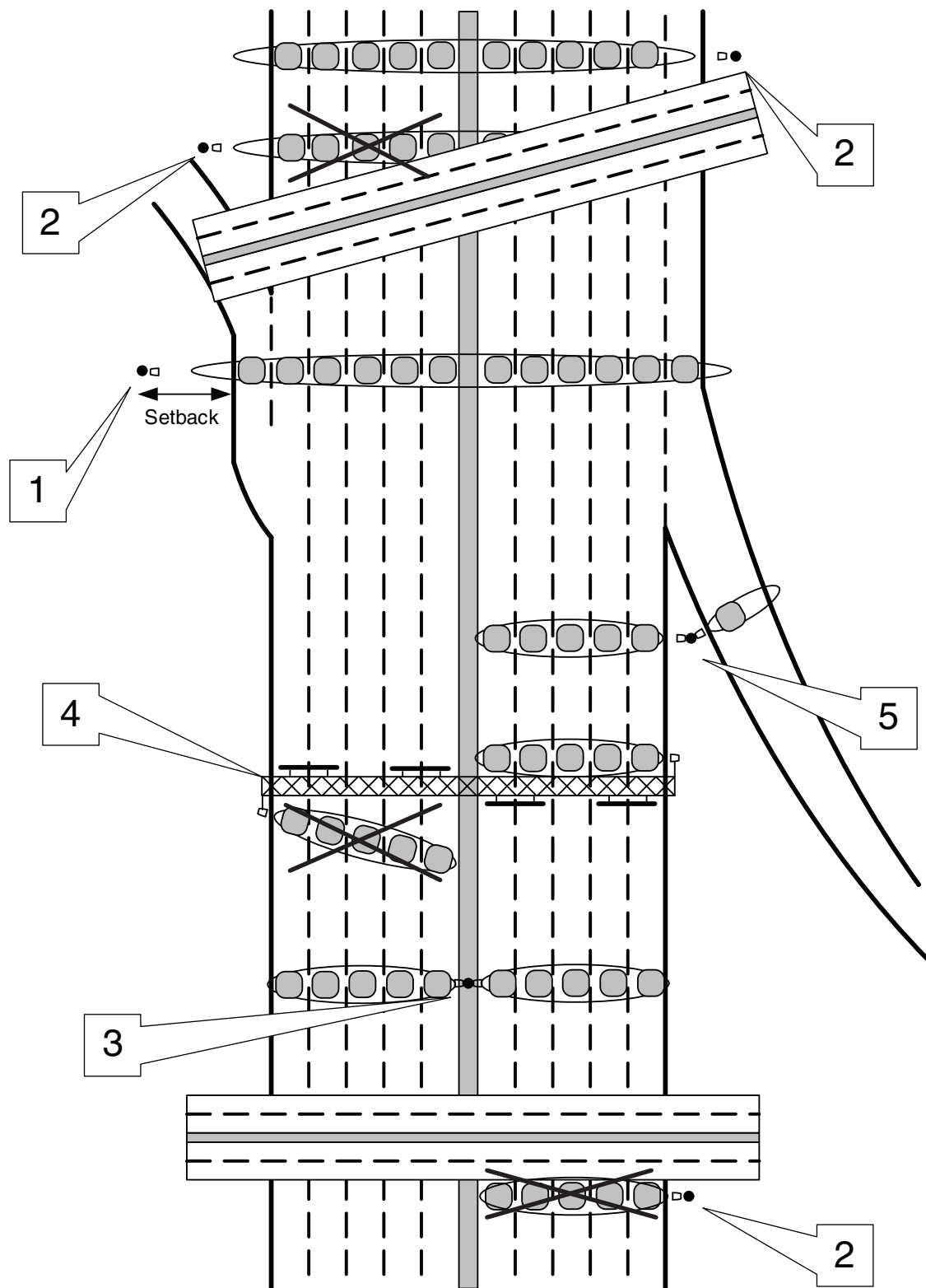


Figure 2-9: RTMS Echo Side-Fired Highway Sites

Height, Setback, Tilt Requirements

The RTMS Echo has a detection area of 250 ft (76 m), and is able to detect up to 12 lanes of traffic within that distance. ISS recommends mounting the Echo sensor between 15 and 35 ft (4.6 and 10.7 m) from the ground. The height is based on the distances from the closest and furthest zones. The mounting height and zone distances determine the angle (tilt) at which the sensor should be set.

If the closest zone is 6 ft (1.8 m) or less and the furthest zone is less than 75 ft (22.9 m), the suggested mounting height is 15 ft (4.6 m) with a tilt of 27 degrees. If the closest zone is greater than 6 ft (1.8 m) but less than 30 ft (9.1 m), the suggested mounting height and tilt is also 15 ft (4.6 m) and 27 degrees.

The following table shows the ISS recommend mounting height (up to 35 ft [10.7 m]) when the closest zone is greater than 6 ft (1.8 m) and the furthest zone is between 35 ft (10.7 m) and 250 ft (76.2 m).

Table 2-4: Height, Setback, Tilt when Closest Zone is Greater Than 6 ft (1.8 m)

Furthest Zone (ft / m)	Mounting Height (ft / m)	Tilt (degrees)	Furthest Zone (ft / m)	Mounting Height (ft / m)	Tilt (degrees)
35 / 10.7	15 / 4.6	23	145 / 44.2	27 / 8.2	11
40 / 12.2	15 / 4.6	21	150 / 45.7	28 / 8.5	11
45 / 13.7	15 / 4.6	18	155 / 47.2	29 / 8.8	11
50 / 15.2	15 / 4.6	17	160 / 48.8	30 / 9.1	11
55 / 16.8	15 / 4.6	15	165 / 50.3	31 / 9.4	11
60 / 18.3	15 / 4.6	14	170 / 51.8	31 / 9.4	10
65 / 19.8	15 / 4.6	13	175 / 53.3	32 / 9.8	10
70 / 21.3	15 / 4.6	12	180 / 54.9	33 / 10.1	10
75 / 22.9	16 / 4.9	12	185 / 56.4	34 / 10.4	10
80 / 24.4	16 / 4.9	11	190 / 57.9	35 / 10.7	10
85 / 25.9	17 / 5.2	11	195 / 59.4	35 / 10.7	10
90 / 27.4	18 / 5.5	11	200 / 61.0	35 / 10.7	10
95 / 29.0	19 / 5.8	11	205 / 62.5	35 / 10.7	10
100 / 30.5	20 / 6.1	11	210 / 64.0	35 / 10.7	9
105 / 32.0	21 / 6.4	11	215 / 65.5	35 / 10.7	9
110 / 33.5	21 / 6.4	11	220 / 67.1	35 / 10.7	9
115 / 35.1	22 / 6.7	11	225 / 68.6	35 / 10.7	9
120 / 36.6	23 / 7.0	11	230 / 70.1	35 / 10.7	9
125 / 38.1	24 / 7.3	11	235 / 71.6	35 / 10.7	8
130 / 39.6	25 / 7.6	11	240 / 73.2	35 / 10.7	8
135 / 41.1	26 / 7.9	11	245 / 74.7	35 / 10.7	8
140 / 42.7	26 / 7.9	11	250 / 76.2	35 / 10.7	8

Guardrails and Barriers

In almost all cases, median guard-rails or barriers do not interfere with traffic detection. In the few cases in which such interference may occur, e.g., large metal barrier, very tall barriers or movable metal fences, a good solution is to use a second sensor on the other side of the road. Each of the sensors can monitor lanes on its side of the barrier, requiring a smaller setback to cover fewer lanes, as shown below.

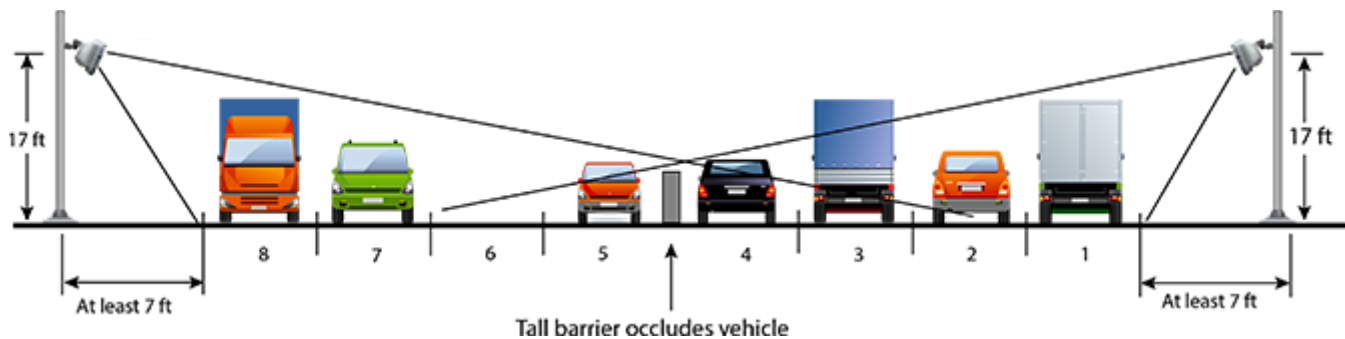


Figure 2-10: Two-Sided Placement

Sunken Road and Roadside Walls

When vertical surfaces reflecting microwaves (e.g., dense chain link fences or retaining walls of a sunken roadway) are present, multi-path reflections from large vehicles in close lanes cause additional false (ghost) detection in farther detection zones.

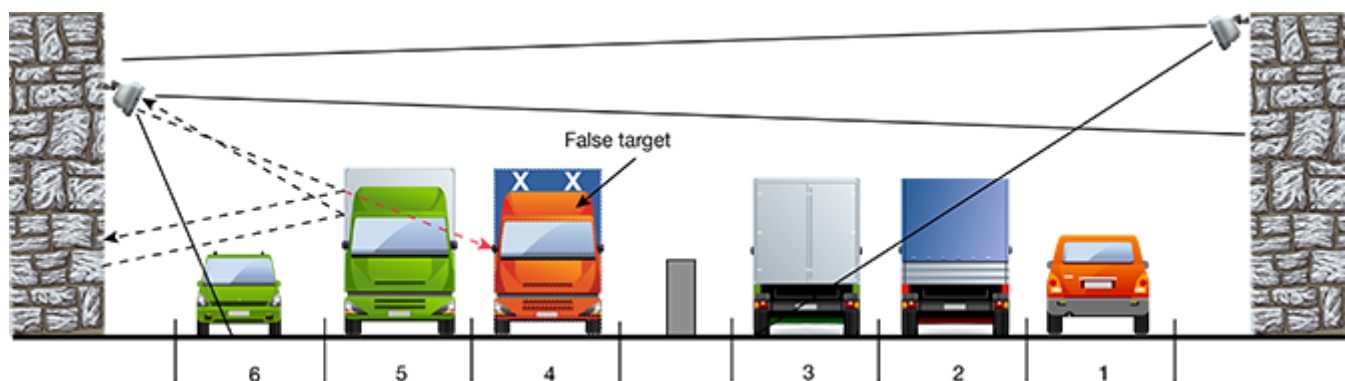


Figure 2-11: False Target Generated by Fence Or Wall

To avoid this problem install the RTMS Echo higher and increase the elevation angle to detect the far lanes of traffic excluding the nearest lanes, as shown on the right in [Figure 2-11](#).

Elevated Roadway

On elevated or sunken roadways with insufficient outside shoulders, it may be an impossible job for a single sensor. Two RTMS Echo units, configured as shown by [Figure 2-12](#), will cover all lanes if detection zones are defined as shown in [Figure 2-12](#).

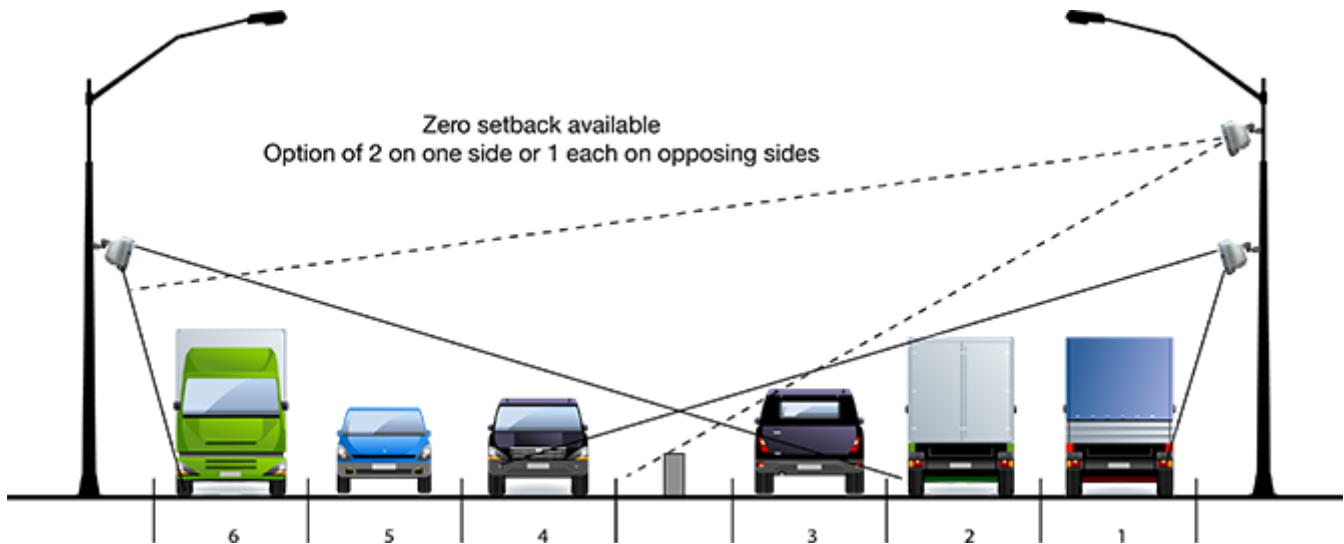


Figure 2-12: RTMS Echo on Elevated Roadway

RTMS Echo can also monitor elevated highways from tall poles erected on the lower level. However, in this case the setback should be less than 8 m (26 ft), to avoid the strong reflection from the side of the structure.

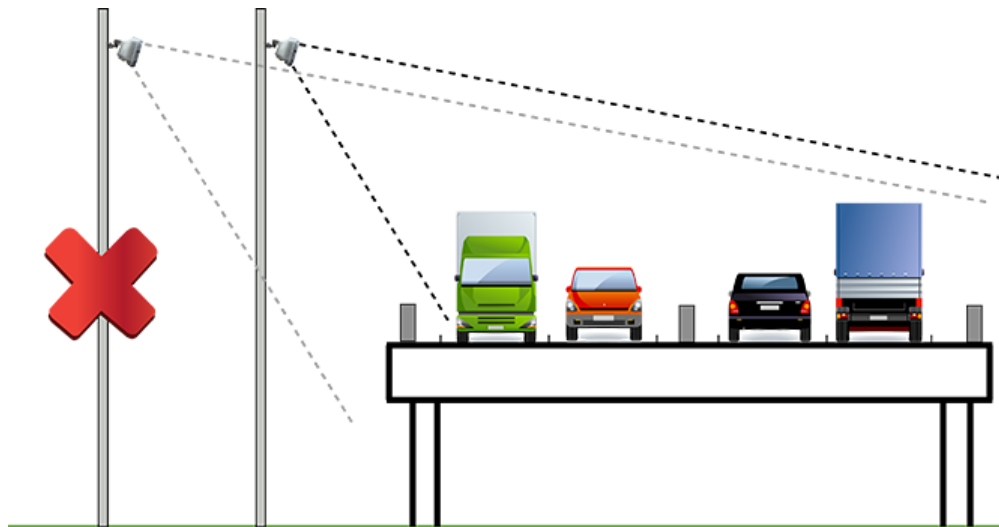


Figure 2-13: Pole Location for an Elevated Roadway

Installing RTMS Echo on Sign Structures

The installation of the RTMS Echo on Message Sign structures is acceptable only if the RTMS Echo is mounted to be offset from the overhead span of the structure. Structures can reflect the microwave signal and distort the accuracy of detection. Some structures such as DMS units have very wide, flat metal bottoms to the structure that are similar in nature to bridges, these type can cause more interference than other lattice work type structures and may require consultation with RTMS Echo Technical Support.

The best way to mount the RTMS Echo is to place a horizontal mast arm or pipe approximately 1.3 m (4 ft) away from the structure (1.8-2.4 m [6-8 ft] if DMS), ideally on the back of the structure away from any lighting or signs. Ensure the detector is aimed perpendicular to the traffic flow.

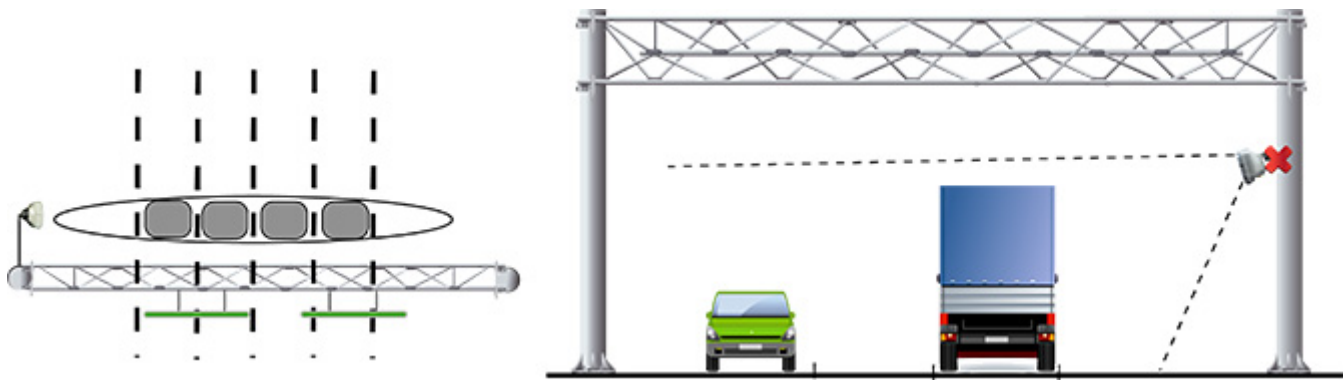


Figure 2-14: RTMS Echo on Sign Structures

Grade Differentials

When grade differences are small, a single unit on the high side may work, provided all lanes are within range.

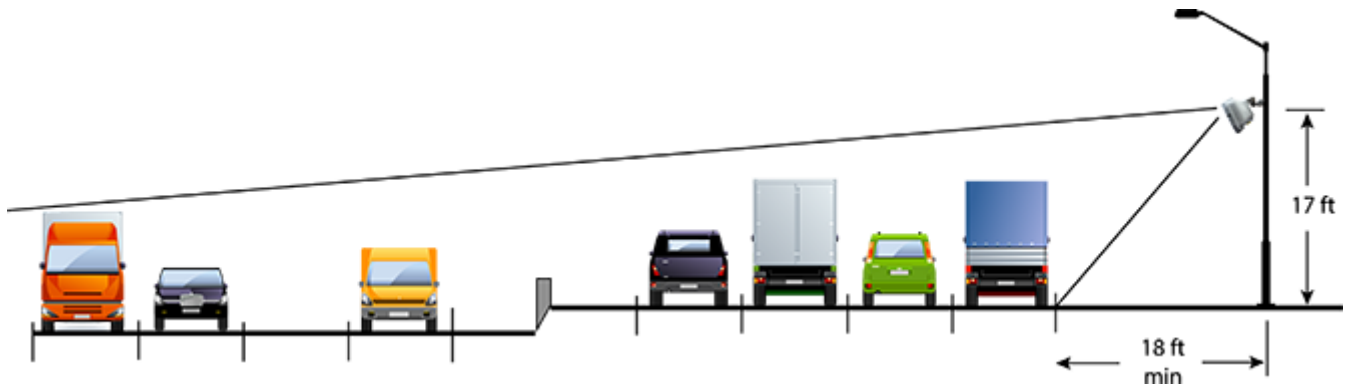


Figure 2-15: Small Grade Differentials

When the grade differential is large enough to put a part of the lower level in a “shadow”, two RTMS Echo units are required as shown by the following.

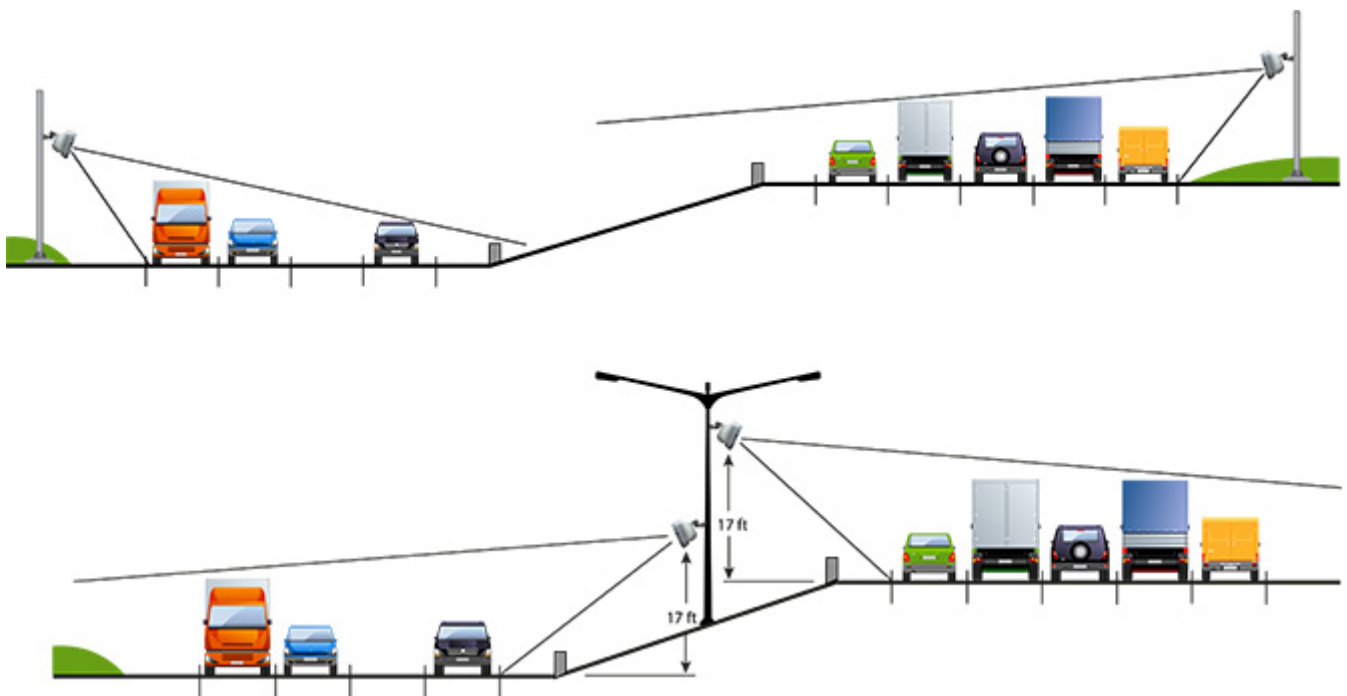


Figure 2-16: Large Grade Differential

Trees

Trees and bushes in the path of the microwave beam (in the setback or in medians) must be avoided. RTMS Echo units must be relocated or a gap in vegetation maintained in the path of the beam.

Chapter 3: Sensor Installation & Setup

General

This chapter describes the procedure for installing and setting up the RTMS Echo sensor.

Safety Information

Please review the following information before installation.

- Read all instructions before using.
- Heed all warnings in these instructions.
- Save these instructions for future reference.
- RTMS Echo units must be installed and adjusted in accordance with the installation instructions contained in this manual.
- Use the RTMS Echo only for its intended purposes as described in this manual. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.
- Consult Technical Support before using the RTMS Echo or other RTMS Echo-related products for any purpose not expressly described in this manual or any other RTMS Echo product manual. Do not use the RTMS Echo to control or operate a gate-opening mechanism. Use of the RTMS Echo for any unauthorized purpose may cause injury to personnel or damage to equipment.
- For optimal accuracy, it is strongly recommended that only trained personnel survey the sites and install all RTMS Echo-related products.
- For more information about our installation, surveying, and training programs, contact your RTMS Echo sales representative.

Installing the Sensor



Warning

Installation of RTMS Echo hardware may require that you work above the ground on a ladder or bucket truck. Please make sure you have all the required equipment and are aware of potential safety issues before starting any installation. **DO NOT** install any RTMS Echo hardware if you are unsure how to complete the installation or lack appropriate safety equipment. It is recommended that you do **NOT** install this hardware during inclement weather.

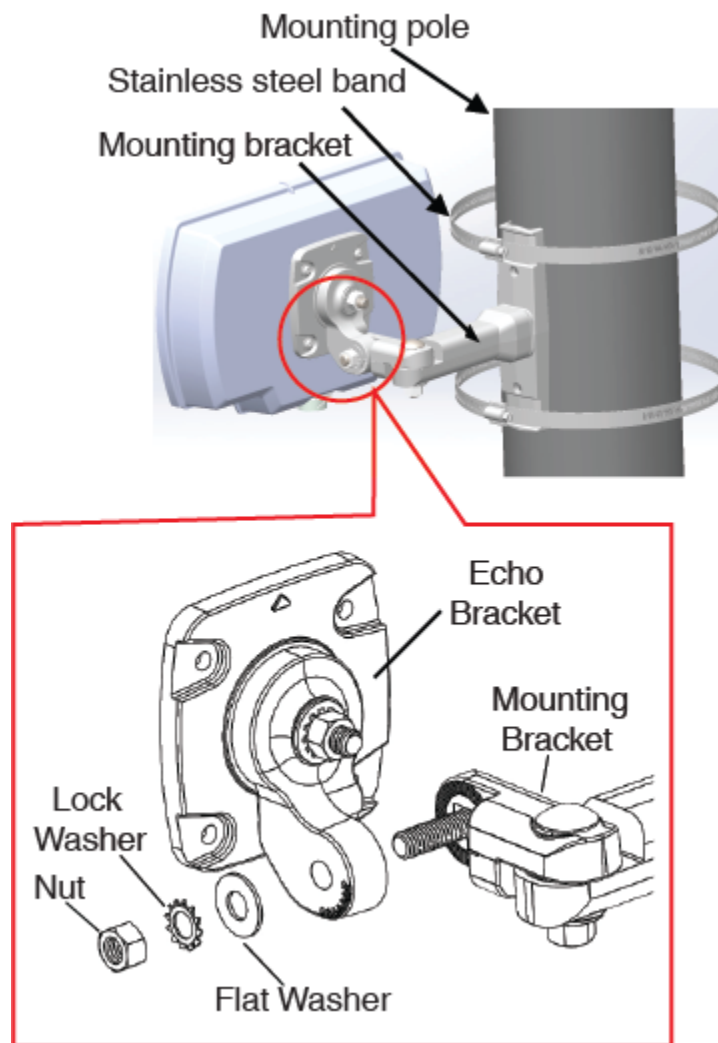
The following equipment is required to install the RTMS Echo sensor.

- Provided: RTMS Echo unit, bracket, washers, nut and bolts and 50 ft (15.24 m) cable.
- Not Provided:
 - Bolts or stainless steel banding to mount to a pole. The bolt specifications depend on the mounting requirements: for example, different bolts may be required when the RTMS Echo unit is mounted on a wooden pole than when the RTMS Echo unit is mounted on a concrete wall. 7/16" wrench, 1/2" wrench, assorted tools to be determined by mounting specifications.
 - Surge suppressors, noise filters, power supplies, etc.

The recommended mounting height for the RTMS Echo sensor is between 15 and 35 feet (4.6 and 10.7 meters) from the ground. For installations with a setback less than 6 feet (1.8 meters) to the nearest zone, a mounting height of 15 feet (4.6 meters) is recommended. For all other installations, a height of 20 to 35 feet (6.1 to 10.7 meters) is recommended. For installations with more than 8 lanes of traffic, the recommended height is 30 to 35 feet (9.1 to 10.7 meters). Additionally, the angle at which the sensor is tilted is determined by mounting height and distances from the closest and farthest zones. For a complete height and tilt angle mounting chart see ["Height, Setback, Tilt Requirements" on page 2-11](#).

NOTE: Always follow local wiring codes and local standards that apply to the location in which the RTMS Echo is being installed.

1. Attach the bracket to the roadside pole (or another specified location) using bolts or stainless steel banding.



2. Secure the RTMS Echo to the mounting bracket using the flat washer, lock washer and nut.

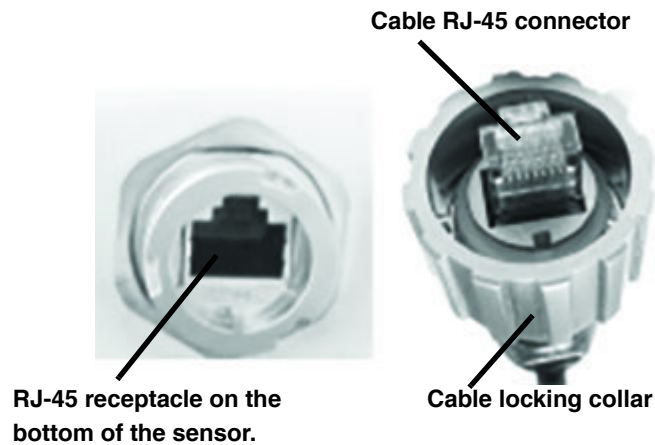
NOTE: Make sure that the cable connector is on the bottom of the unit when it is mounted.

3. Adjust the RTMS Echo to be perpendicular to the travel lanes and level side to side.
4. Tilt the RTMS Echo so that the top of the sensor is aimed at the farthest monitored zone.

NOTE: Steps 3 and 4 are general guidelines. Actual mounting and tilt may need to be adjusted based on multiple factors such as obstacles and number of lanes.

5. Secure the position by hand tightening the nuts. Once the aiming process has been completed the nuts can then be securely tightened.

6. Undo the protective cap on the sensor's connector.
7. Insert the RJ-45 connector from the cable to the RJ-45 receptacle on the bottom of the sensor.



8. Tighten the cable's locking collar by turning it a quarter turn to the right.



Warning

Make sure the mains are turned off prior to connecting wires from the Echo cable to the breakout box.

9. Connect the other end of the cable to power and communications in the breakout box (see [“Connecting Power and Communications” on page 2-5](#)).

Setting Up the Sensor

The set up process consists of the following:

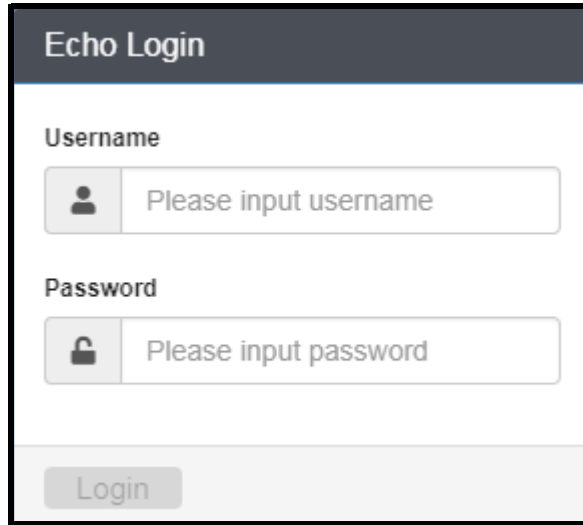
- Logging in to the Sensor for the first time
- Aiming the sensor
- Detecting zones
- Verifying vehicle counts
- Configuring the settings

The following equipment and personnel will be needed in order to perform the configuration process.

- At least two persons
- A hand-held tally counter
- Light Detecting and Ranging (LIDAR) radar gun
- Stop watch

Logging in to the Sensor For the First Time

1. Start your internet browser. **Note**, the screen shots shown below are taken from Google Chrome and Firefox.
2. In the address field, type the IP address of the RTMS Echo.
The default is 192.168.0.10.
3. Press **Enter**.
The RTMS Echo login window appears.

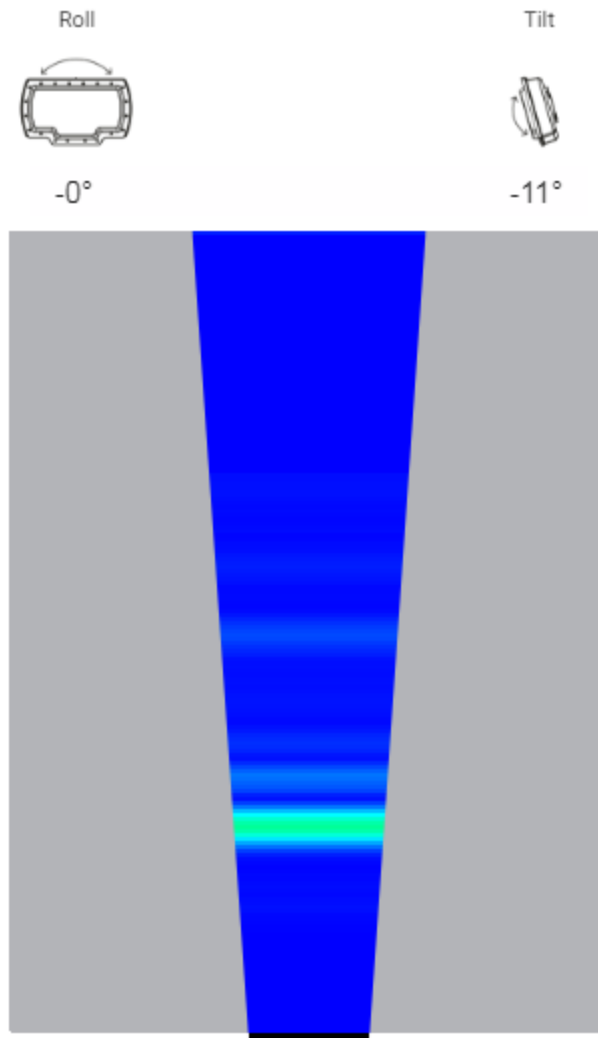


The screenshot shows a web-based login interface for the RTMS Echo. It features a dark gray header with the text "Echo Login". Below the header, there are two input fields. The first field is labeled "Username" and contains a person icon and the placeholder text "Please input username". The second field is labeled "Password" and contains a lock icon and the placeholder text "Please input password". At the bottom of the form is a "Login" button.

4. Enter the User name and Password. The defaults are:
 - User name: **admin**
 - Password: **admin**
5. Click **Login**.

Aiming the Sensor

1. Log in to the sensor.
2. Select the **Aim** tab.



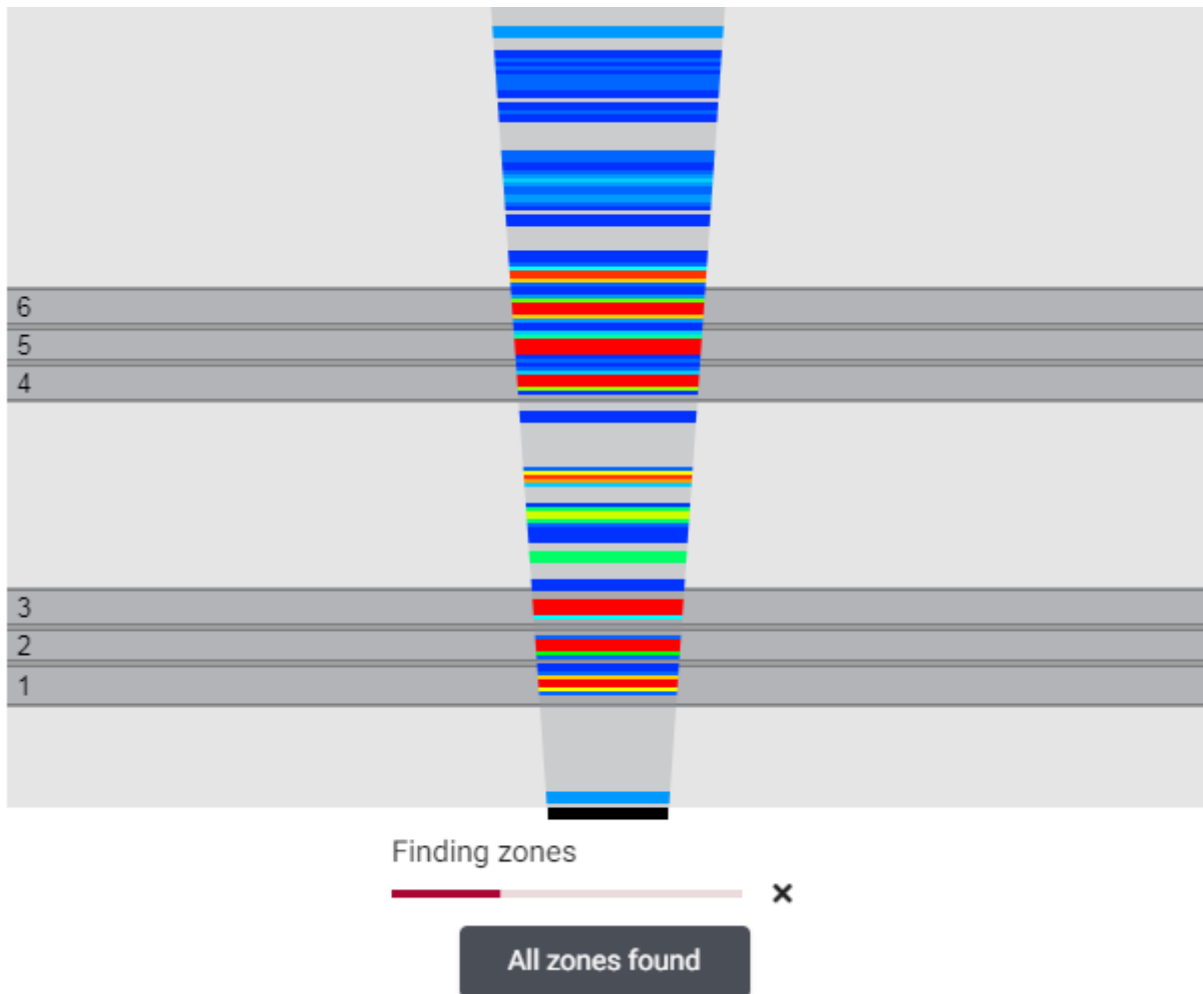
3. Move the left/right side of the sensor up or down to adjust the roll according to the slant of the road.
For a level road, the roll should be set to -0.
4. Tilt the sensor forward or back to adjust the tilt to match the specifications in [“Height, Setback, Tilt Requirements” on page 2-11](#).
5. Tighten the nuts securing the sensor to the mounting bracket.
6. Detect and adjust zones.

Detect and Adjust Zones

The automated zone setup process requires free flowing traffic in all lanes of interest. It scans the range of the RTMS Echo beam and positions up to 12 detection zones, representing lanes where vehicles are detected.

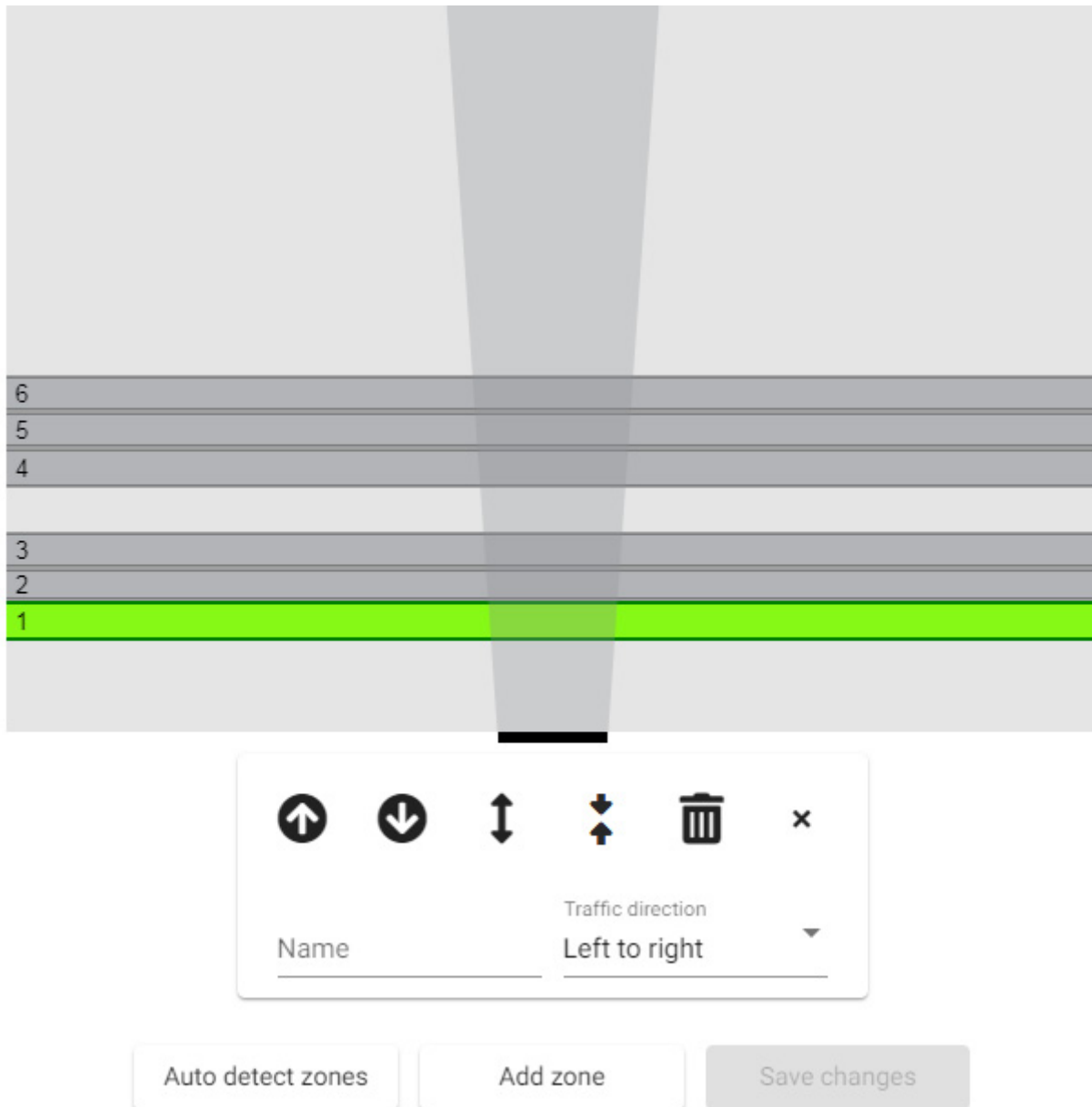
IMPORTANT: If the auto detect function is run after a zones configuration has already been established (auto detect was run once before), a new set of internal zone identifiers is established. The data associated with the previous zones is no longer available through the queries on the Data page. However, the data can still be retrieved through use of the Echo APIs if the zone identifiers of the previous zones are known (see the Zones Identifier query in the *RTMS Echo API Guide*).

1. Select the **Zones** tab.
2. Click **Auto Detect Zones**.



There will be about 1 minute of prep time before detection begins. As objects are detected the detection heat map appears in the radar beam image. Zones will appear when the system has determined that the detected objects are vehicles instead of stationary objects (i.e., barriers, etc.). The full process takes approximately 7 minutes; however, if all zones in the detection area appear, you can click All zones found to stop the process.

3. Click on the first zone.



4. Enter a name for the zone. A maximum of 25 characters can be entered.

5. Click the drop-down under **Traffic direction** and select the direction of traffic in the zone.
6. Repeat Steps 3-5 for the remaining zones.
7. To widen, shorten, or adjust zone positions, use the controls provided on the page.
8. When complete, click **Save changes**.
9. Verify vehicle counts.

Verifying Vehicle Counts

The vehicle count verification of a successful zone setup is an essential part of the installation. During the process you will compare RTMS Echo volume counts over a period of time to a manual (visual) count for the same interval. Use of a hand-held tally counter is recommended.

IMPORTANT: The recommended and most accurate method of verifying vehicle counts is to perform the verification individually on each zone. However, if a sufficient number of personnel are available, all zones can be verified simultaneously. This alternate process requires at least one person per zone for manual count purposes.

1. Select the **Calibrate** tab.

Vehicle counts Speed calibration Length calibration (?)					
	Zone	Sensor count	Manual count	Difference	% Difference
☐	6	0	0	0	-
☐	5	0	0	0	-
☐	4	0	0	0	-
☐	3	0	0	0	-
☐	2	0	0	0	-
☐	1	0	0	0	-

2. To ensure that all columns are set to zero, click **Clear all**.
3. Select the check box for the zone(s) for which vehicles are to be counted.

NOTE: There should be one person with a hand-held counter monitoring each zone selected.

4. Click **Start** and immediately begin manually counting vehicles as they cross the radar beam.
5. Continue counting until a minimum of 50 vehicles have been counted for each selected zone.
6. Click **Stop**.
7. Enter the number(s) from the counter into the Manual Count column.

The difference between the Sensor Count and Manual Count in difference and percentage of deviation is immediately calculated.

If the Sensor Count is greater than the Manual Count by 5% or more, this could be caused by:

- “Splashing” (vehicles in one zone are shown as being detected in an adjacent zone)
- Lane changing
- Reflections from fixed objects

If the Sensor Count is less than the Manual Count by 5% or more (negative percentage), this could be caused by:

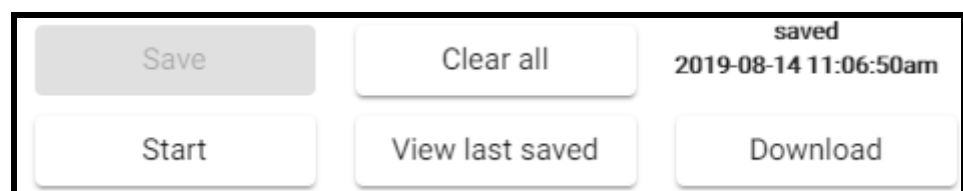
- Missed small vehicles
- Occlusions
- Incorrect aiming

8. Are any of the percentages over five percent (either plus or minus)?

Yes	No
You should make corrections before continuing. See “Optimizing Volume Count Accuracy” on page 4-10. After adjustments have been made, repeat the verification process.	Continue with the next step.

9. To save the accumulated results of verification to a file in the sensor's memory, click **Save**.

A download option appears.



10. To download the saved file to your computer, click **Download**. The file is saved to your default folder as a CSV file.

Configure Settings

The settings that can be defined by the user include IP address, time zone, message period, classifications, etc. For complete information on the various settings and how to change them, see [“Settings Tab” on page 4-44](#).

NOTE: At minimum, the setting for **Local area network** should be changed to set the IP address of the sensor for your network.

Chapter 4: Operations and Adjustments

General

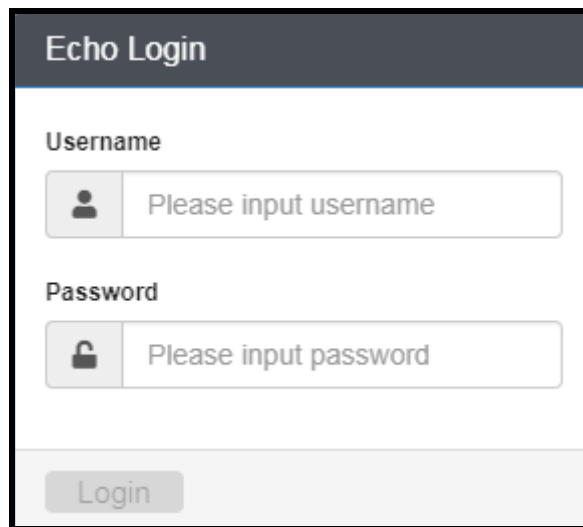
This chapter describes operations that can be performed and adjustments that can be made after the RTMS Echo is installed and configured.

Logging in to the RTMS Echo

The following describes the procedure for logging in to the RTMS Echo. after you have set the network parameters for the sensor (see [“Local Area Network Setting” on page 4-45](#)).

1. Start your internet browser. **Note**, the screen shots shown below are taken from Google Chrome and Firefox.
2. In the address field, type the IP address of the RTMS Echo.
3. Press **Enter**.

The RTMS Echo login window appears.



4. Enter the User name and Password. The defaults are:
 - User name: **admin**
 - Password: **admin**
5. Click **Login**.

Home Tab

The Home page provides a display of the current vehicle detections occurring for each zone. The display can be set to show either the speed or length of each detected vehicle. This page also shows how much of the sensor's memory has been used and the input voltage for the sensor.



Figure 4-1: Home Page

Table 4-1: Home Page Descriptions

Item	Description
1	Zone indicators.
2	Representation of real vehicles in the zone.
3	Radar beam.
4	Select whether the live vehicle display shows vehicle speed or length.
5	Percentage of the number of aggregated records currently in this data table. One record is created for each zone during each period as defined by the interval period in the Settings tab.
6	Percentage of the number of per vehicle records currently in this data table.
7	The input voltage to the sensor. The best performance is when the value is between 12V and 24V.

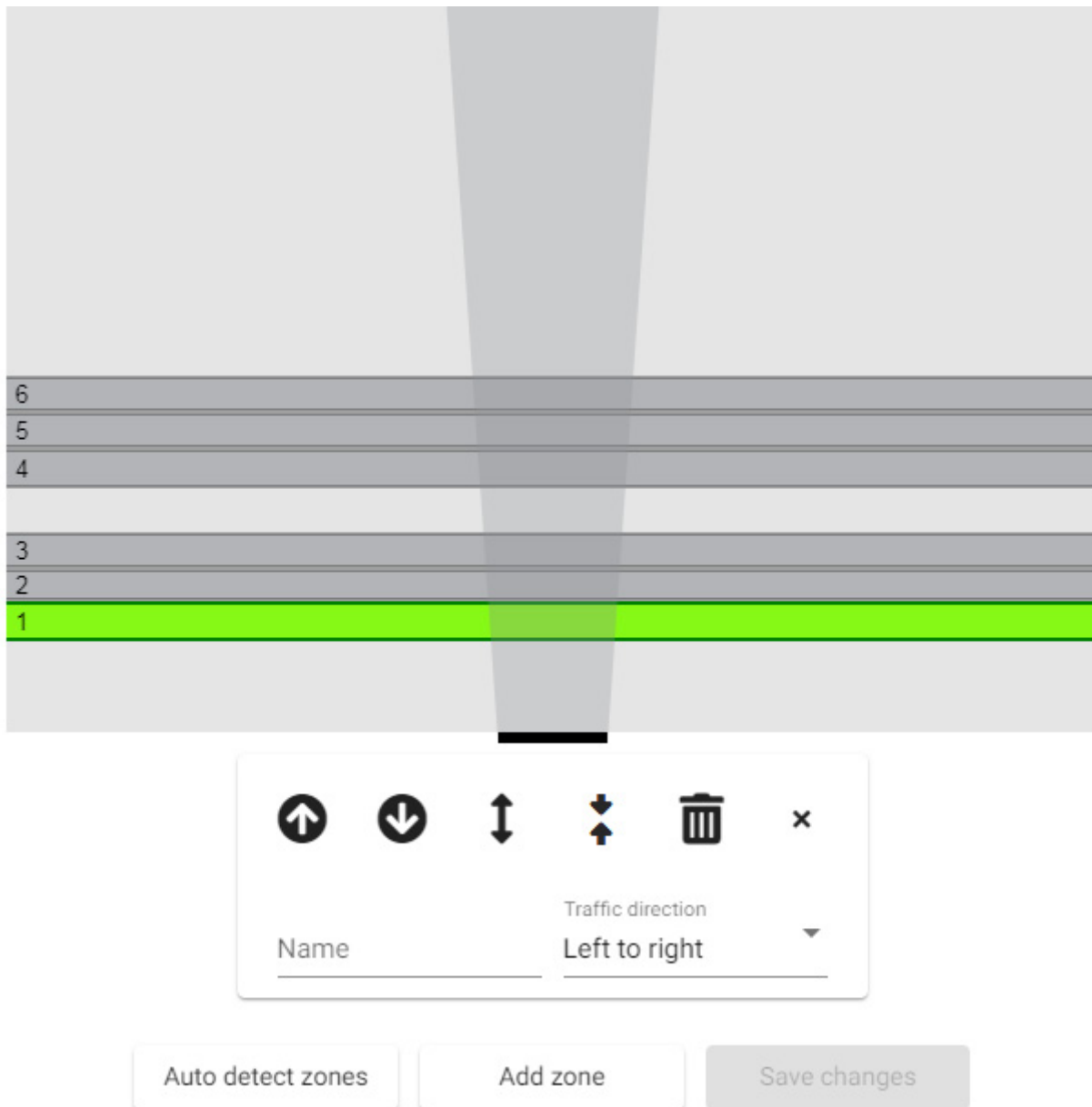
Aim Tab

This page is used to set the roll and tilt of the sensor during the installation process. For more information see [“Aiming the Sensor” on page 3-6](#).



Zones Tab

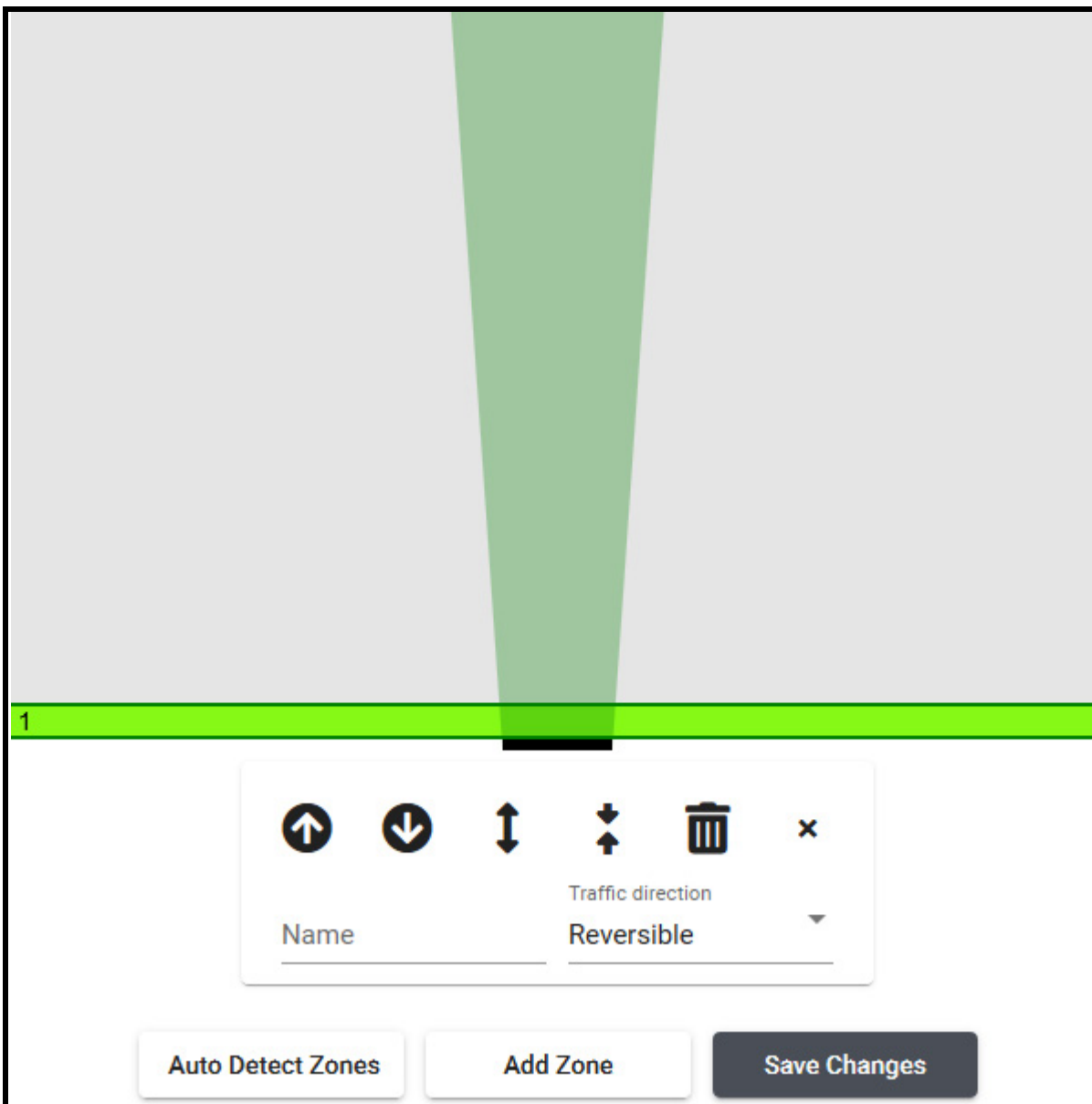
This tab is used to add, remove and edit zones, and to set the direction of traffic for a zone. This tab is also used to start the automatic zone detection operation.



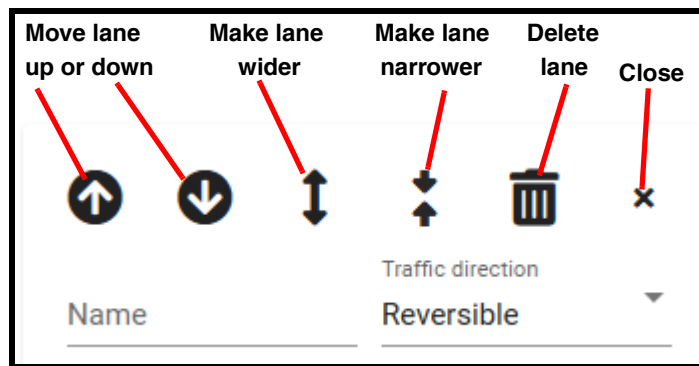
Add a Zone

This function is used to add a zone manually to the configuration.

1. Click the **Zones** tab.



2. Click **Add Zone**.
3. Move the cursor onto the zone until a hand icon appears, then click the zone to select it and display the control panel.



4. Use the controls to move the position of the lane up or down, to widen the lane or make it narrower. **Note**, the lane can also be moved by clicking on it then moving it with the mouse.
5. To add a name for the zone, enter a maximum of 25 characters, including alphanumeric, special and space characters.
6. Click the drop-down under **Traffic direction** and select the direction of traffic in the zone.
7. Repeat steps [Steps 2 – 6](#) to add other zones.
8. After all zones have been added, click **Save changes**.

Edit a Zone

This function is used to change the position, name, or traffic flow indicator for a zone.

1. Click the **Zones** tab.
2. To change the position of the zone, click on it and when the hand icon appears, move the zone up or down as needed, or use the controls to move or widen or make the zone narrower.
3. To change the name, highlight it and enter a new name.
4. To change traffic flow direction, click the drop-down to the right of the current flow indicator and select a new direction.
5. After all changes have been made, click **Save changes**.

Remove a Zone

This function removes a zone permanently from the configuration.

1. Select the zone to be removed.
2. Click the remove (trash can) icon.
3. Click **Save changes**.

Auto Detect Zones

This function is used to automatically detect and add zones to the configuration. Zones are added as traffic is detected. For more information, see [“Detect and Adjust Zones” on page 3-7](#).

Calibrate Tab

This tab is used to verify vehicle counts in the defined zones and to adjust the calibration of vehicle speeds and lengths.

Zone (8)	Sensor Count (9)	Manual Count (10)	Diff (11)	% Diff (12)	Measured Speed (13)	Measured Length (14)	Adjustment (15)
☐ zone7	0	0	0	0	0	0	0
☐ zone6	0	0	0	0	0	0	0
☐ zone5	0	0	0	0	0	0	0
☐ zone4	0	0	0	0	0	0	0
☐ zone3	0	0	0	0	0	0	0
☐ zone2	0	0	0	0	0	0	0
☐ zone1	0	0	0	0	0	0	0

Figure 4-2: Calibration Page

Table 4-1: Calibration Page Descriptions

Item	Description
1	Click to save the values in the sensor's memory.
2	Click to start or stop the operation.
3	Click to clear all values.
4	Click to view the last saved set of values.
5	Select to perform lane count verification.
6	Select to perform vehicle speed calibration.

(Table continues on the next page.)

Table 4-1: Calibration Page Descriptions (Cont'd)

Item	Description
7	Select to perform vehicle length calibration.
8	Select the check box next to each zone for which the operation is to be performed.
9	Vehicle count provided by the sensor. Only appears when Vehicle Counts is the selected operation.
10	Vehicle count provided by the user. Only appears when Vehicle Counts is the selected operation.
11	The difference between the Sensor and Manual counts. Only appears when Vehicle Counts is the selected operation.
12	The percentage of the difference between the Sensor and Manual counts. Only appears when Vehicle Counts is the selected operation.
13	The speed of a vehicle as determined by the sensor. Only appears when Speed Calibration is the selected operation.
14	The length of a vehicle as determined by the sensor. Only appears when Length Calibration is the selected operation.
15	The adjustment the sensor is to make when reporting the data for each detection. For Speed, the adjustment is in MPH or Kp/h. For length, the adjustment is in feet or meters.

Optimizing Volume Count Accuracy

The most common reasons for vehicle count discrepancies are:

- Zone boundaries overlap or are too close – When this occurs, vehicles in one zone are shown as being detected in an adjacent zone. This is referred to as “splashing.” In this case, changing the zone by increasing or decreasing the boundary can eliminate splashing.
- Improper sensor aiming – When this occurs vehicle counts are below what is expected. If the sensor is aimed too low or high, or is not perpendicular to the zone, vehicles may not be detected.
- Obstruction between the sensor and zone – An obstruction, such as a concrete lane divider may cause smaller vehicles to be missed.
- Occlusion – This is when a vehicle is hidden from view by another vehicle or object. A large truck can occlude (hide) the detection of a small car hidden behind.

The following provides information about the possible cause and solution for various conditions that can cause inaccuracies in the volume count.

Condition A: Over/Under Count in Adjacent Zones

In the situation shown in [Figure 4-3](#), zone 3 shows an over count, while zone 2 shows an under count.

Vehicle counts		Speed calibration		Length calibration	
Zone	Sensor count	Manual count	Diff	% Diff	
✓ Zone 6	61	61	0	-	
✓ Zone 5	62	62	0	-	
✓ Zone 4	55	56	1	2	
✓ Zone 3	63	67	4	6	
✓ Zone 2	55	50	5	9	
✓ Zone 1	51	51	0	-	

Figure 4-3: Over/Under Count: Adjacent Zones

The above could indicate that vehicles from zone 2 are being detected in zone 3. Fine tune the zone boundary between the two zones.

Condition B: Under Count in Near Zone

In the situation shown in [Figure 4-4](#), the count for zone 1 is well below what is expected; vehicles are being missed.

Vehicle counts		Speed calibration		Length calibration	
Zone	Sensor count	Manual count	Diff	% Diff	
☒ Zone 6	61	61	0	-	
☒ Zone 5	62	62	0	-	
☒ Zone 4	55	56	1	2	
☒ Zone 3	63	63	0	-	
☒ Zone 2	55	55	0	-	
☒ Zone 1	38	51	13	34	

Figure 4-4: Under Count: Near Zone

The above is probably due to aiming issues. The sensor may be missing small profile vehicles. Check the aiming of the RTMS Echo and make sure it is aimed down enough to view the first zone of traffic (zone 1).

Condition C: Under Count in Far Zone

In the situation shown in [Figure 4-5](#), the count for zone 6 is well below what is expected; vehicles are being missed.

Vehicle counts		Speed calibration		Length calibration	
Zone	Sensor count	Manual count	Diff	% Diff	
✓ Zone 6	61	66	5	8	
✓ Zone 5	62	62	0	-	
✓ Zone 4	55	56	1	2	
✓ Zone 3	63	63	0	-	
✓ Zone 2	55	55	0	-	
✓ Zone 1	51	51	0	-	

Figure 4-5: Under Count: Far Zone

The above is probably due to aiming issues. The sensor may be missing small profile vehicles. Check the aiming of the RTMS Echo and make sure it is aimed up enough to view the last zone of traffic (zone 6).

Condition D: Under Count in Several Zones

In the situation shown in [Figure 4-6](#), the count for many zones is below what is expected; vehicles are being missed.

Vehicle counts		Speed calibration		Length calibration	
Zone	Sensor count	Manual count	Diff	% Diff	
✓ Zone 6	61	66	5	8	
✓ Zone 5	62	64	2	3	
✓ Zone 4	55	58	3	5	
✓ Zone 3	63	67	4	6	
✓ Zone 2	55	59	4	7	
✓ Zone 1	38	51	13	34	

Figure 4-6: Under Count: Many Zones

In the above situation the signal strength reflection may be too low. This could be caused by the aiming angle is not perpendicular to the traffic.

Condition E: Over Count in Several Zones

In the situation shown in [Figure 4-7](#), the count for many zones is above what is expected.

Vehicle counts		Speed calibration		Length calibration	
Zone	Sensor count	Manual count	Diff	% Diff	
✓ Zone 6	61	61	0	-	
✓ Zone 5	62	60	2	3	
✓ Zone 4	55	53	2	3	
✓ Zone 3	63	58	5	8	
✓ Zone 2	55	51	4	7	
✓ Zone 1	38	37	1	3	

Figure 4-7: Over Count: Many Zones

In the above situation the signal strength reflection may be too high, causing “splashing” into adjacent lanes.

Condition F: Under Count in First Zone Past a Barrier

In the situation shown in [Figure 4-8](#), the count for zone 4 is lower than what is expected.

Vehicle counts		Speed calibration		Length calibration	
Zone	Sensor count	Manual count	Diff	% Diff	
✓ Zone 6	61	61	0	-	
✓ Zone 5	62	61	1	2	
✓ Zone 4	55	62	7	12.7	
✓ Zone 3	63	62	1	2	
✓ Zone 2	55	55	0	-	
✓ Zone 1	51	51	0	-	

Figure 4-8: Under Count: First Zone Past Barrier

The above could indicate there is some kind of barrier between zones 3 and 4. The signal from the barrier is imposing on zone 4, causing smaller vehicles to be missed. Moving the zone boundary away from the barrier should help resolve this situation. Fine tune zone 4 by moving the zone boundary closest to the barrier further away from the barrier (move away +1). A slight adjustment can make a large improvement.

Speed Calibration

This function is used to adjust the vehicle speed detected by the Echo sensor if required.

NOTE: RTMS Echo cannot be used for speed enforcement.

1. Click the **Calibrate** tab.
2. Click **Speed Calibration**.

	Zone	Measured speed	Adjustment (%)
☐	6	-	0
☐	5	-	0
☐	4	-	0
☐	3	-	0
☐	2	-	0
☐	1	-	0

3. Select the check box to the left of each zone for which speeds are to be checked.
4. Click **Start**.
5. If the value in the Measured Speed column is not correct, enter the difference in the **Adjustment** column.
 The value must be expressed as a percentage between +/- 10 and must be a whole number (e.g., 4 is OK but 4.5 is not).
 All detected speeds for the lane will be adjusted by the amount specified.
6. To save the values, click **Save**.

Length Calibration

This function is used to adjust the vehicle length detected by the Echo sensor if required.

1. Click the **Calibrate** tab.
2. Click **Length Calibration**.

Save Clear all			
Start View last saved			
Vehicle counts		Speed calibration	Length calibration ?
	Zone	Measured length	Adjustment (feet)
☐	6	-	0
☐	5	-	0
☐	4	-	0
☐	3	-	0
☐	2	-	0
☐	1	-	0

3. Select the check box to the left of each zone for which lengths are to be checked.
4. Click **Start**.
5. If the value in the Measured Length column is not correct, enter the difference in the **Adjustment** column.

The value specified can be between +/- 10 and can have one decimal place (e.g., 3.2, 1.4, etc.).

All detected lengths for the lane will be adjusted by the amount specified.

6. To save the values, click **Save**.

Data Tab

This tab is used to generate reports based on the collected data. Two types of data is stored; interval and per-vehicle.

The interval data table can hold ten thousand records and contains data that has been aggregated for all zones for the interval period (see [“Interval Data” on page 4-50](#)).

The per-vehicle data table can hold one million records and contains data that has been accumulated for each vehicle in each defined zone.

The various types of data that can be generated are:

- Classification by binned speed data
- Classification by length data
- Gap average data
- Headway average data
- Interval Data
- Occupancy data
- Per-vehicle) Data
- Speed 85% data
- Speed average data
- Speed bin data
- Voltage data
- Volume data

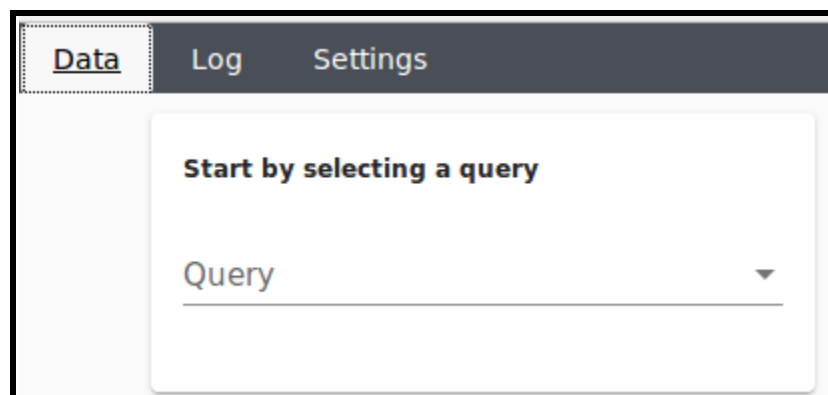


Figure 4-9: Data Page

Click the drop-down indicator to the right of **Query** to see a list of available queries. In the list that appears there are two date ranges shown. The Interval Data Range indicates the earliest record available when doing an Interval Data query. The Per-vehicle Date Range indicates the earliest record available for all queries except Interval Data.

Classification By Binned Speed Query

This query returns speed data spread over several user-customizable bins based on vehicle classification. The results can be reported for individual zones or aggregated over all zones.

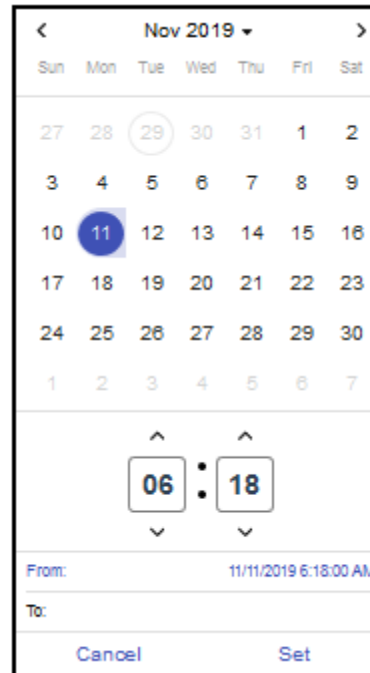
1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Classification, binned by speed**.

The screenshot shows a web-based configuration interface for a query. At the top, there is a 'Query' label and a dropdown menu currently set to 'Classification, binned by speed'. To the right of the dropdown is a help icon (question mark). Below the dropdown, the text 'Vehicle classification counts binned by speed' is displayed. A dark blue 'Download' button is positioned below this text. The section is titled 'Optional parameters' and contains several input fields: 'Save as file name', 'Start and end date/time' (with a calendar icon), 'Zones', 'Time interval' (with a unit dropdown set to 'Minutes'), 'Max length for class bins', 'Max speed for 1st speed bin', 'Number of additional speed bins', and 'Speed increment for additional speed bins'.

3. Click **Save as file name** and enter a name for the file.

The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is speed-class-bin.

4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the From field.
6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.
8. Enter the zone(s) for which data is to be included in the download.
To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).
To specify all zones, leave the field blank.
9. Select the time frame and enter the interval for which data is to be binned.
The value must be less than or equal the difference between the start and end times. If omitted, the default is 15 minutes.
10. Enter the length of each class bin.
Multiple bins can be specified by separating the bins with a space (e.g., 5 7 10, etc.).If omitted, the default class bins will be 5, 7, 10, 15, and 20.

11. Enter the speed of the initial bin.

If omitted, the default value is 20.

12. Enter the number of speed bins to be included in the result.

If omitted, the default is 15. The query will always include one additional bin, the $N_{th} + 1$ bin, where N is the speed-bin-count, to indicate the number of vehicles with speeds greater than the N_{th} bin.

13. Enter the speed increment of each bin after the initial setting.

If omitted, the default is 5.

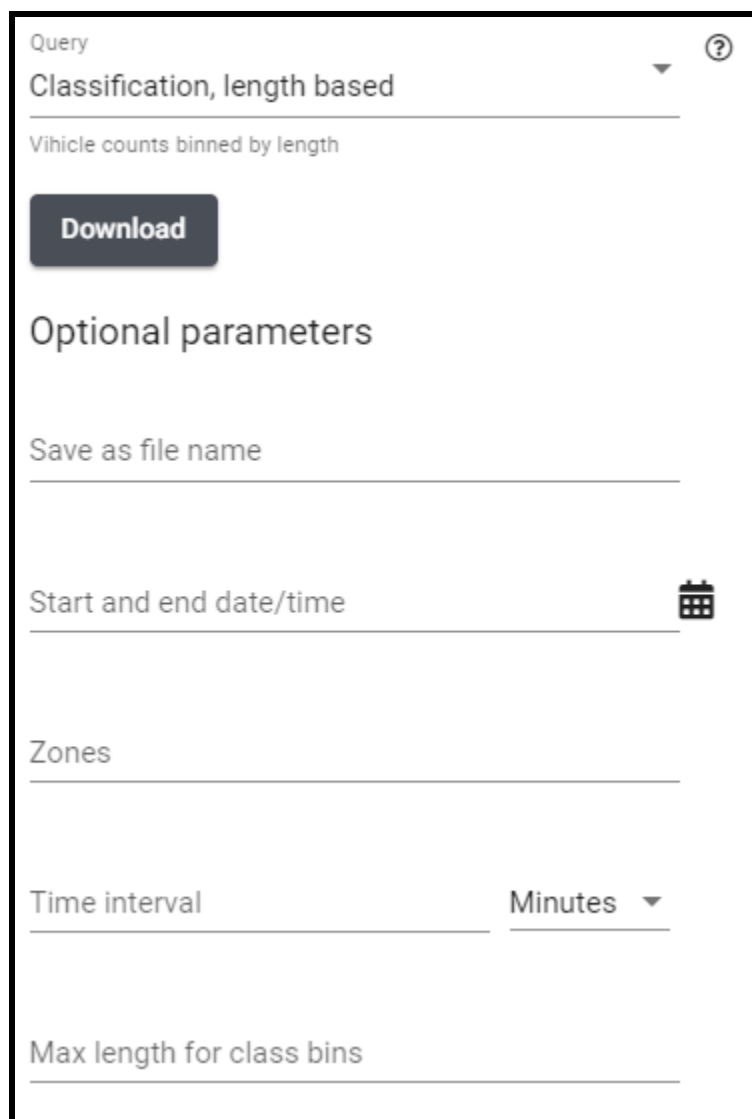
14. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder. The requested data is saved as a CSV file in the Downloads folder.

Classification by Length Query

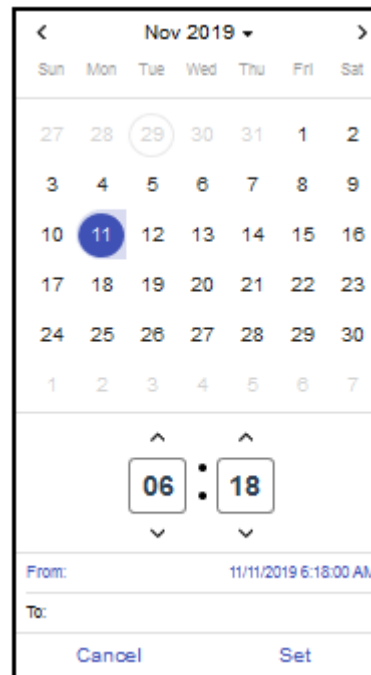
This query returns the count of the different classes of vehicles, according to length, detected in one or more zones over a statistical interval.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Classification, length based**.



The screenshot shows a web interface for configuring a query. At the top, there's a 'Query' section with a dropdown menu set to 'Classification, length based' and a help icon. Below this is the title 'Vehicle counts binned by length' and a 'Download' button. The 'Optional parameters' section includes a 'Save as file name' text input field, a 'Start and end date/time' field with a calendar icon, a 'Zones' text input field, a 'Time interval' field with a 'Minutes' dropdown menu, and a 'Max length for class bins' text input field.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is class-bin.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the **From** field.

6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.

8. Enter the zone(s) for which data is to be included in the download.

To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).

To specify all zones, leave the field blank.

9. Select the time frame and enter the interval for which data is to be binned.

The value must be less than or equal the difference between the start and end times. If omitted, the default is 15 minutes.

10. Enter the length of each class bin.

Multiple bins can be specified by separating the bins with a space (e.g., 5 7 10, etc.). If omitted, the default class bins will be 5, 7, 10, 15, and 20.

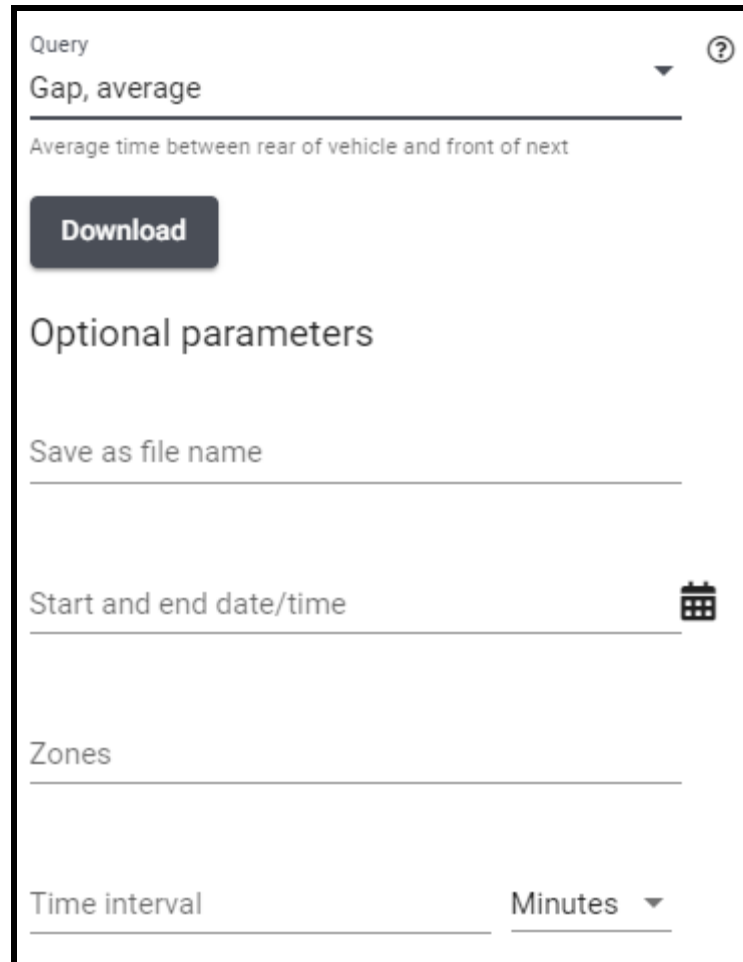
11. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

Gap Average Query

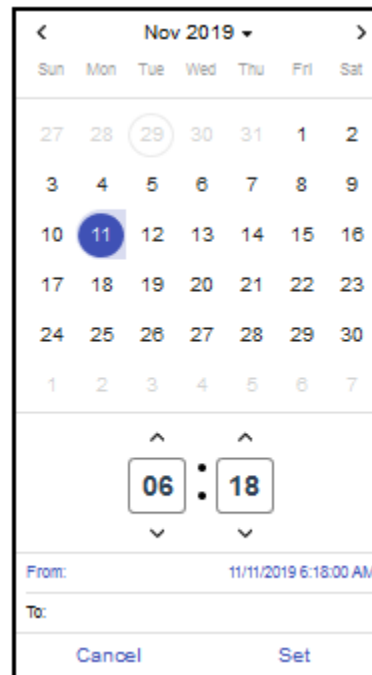
This query returns the average of gaps over a statistical interval. The gap is the difference between the time when the rear of a vehicle leaves at a point on the highway and the time the front of the next vehicle arrives at the same point (in seconds).

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Gap, average**.



The screenshot shows a web interface for a 'Gap Average Query'. At the top, there is a 'Query' label and a dropdown menu currently set to 'Gap, average'. Below this, a description reads 'Average time between rear of vehicle and front of next'. A dark 'Download' button is positioned below the description. Under the heading 'Optional parameters', there are four input fields: 'Save as file name', 'Start and end date/time' (with a calendar icon to its right), 'Zones', and 'Time interval' (with a unit selector set to 'Minutes' and a dropdown arrow). The interface is clean with a white background and grey text for labels and descriptions.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is average-gap.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the **From** field.

6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.

8. Enter the zone(s) for which data is to be included in the download.

To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).

To specify all zones, leave the field blank.

9. Select the time frame and enter the interval for which data is to be included in the download.

If omitted, the default is 15 minutes.

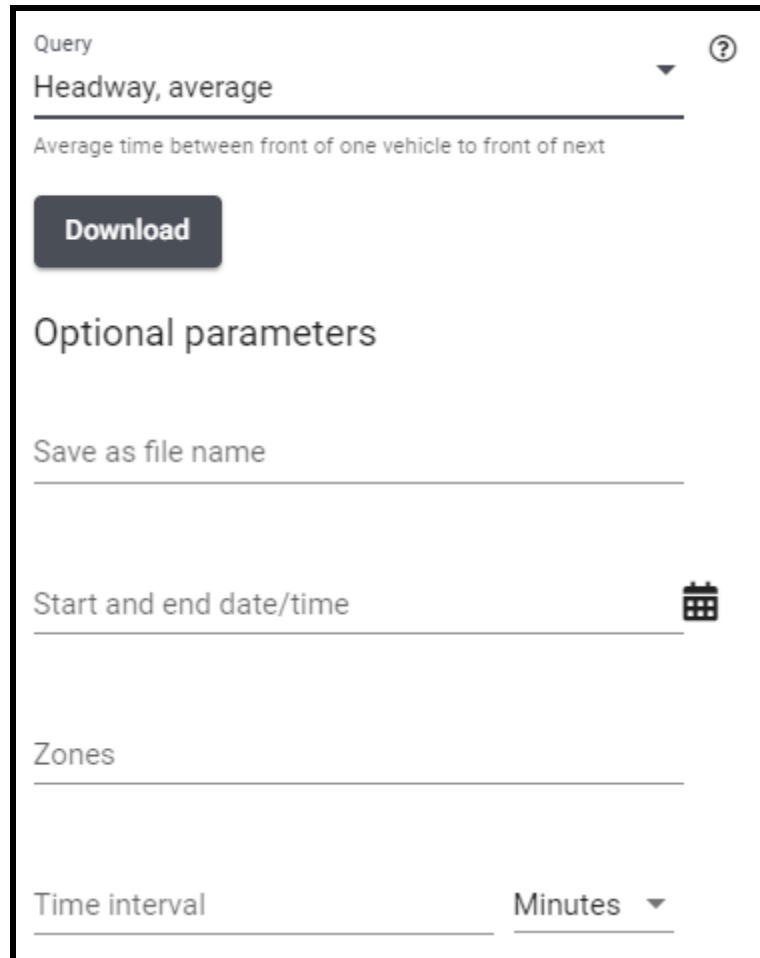
10. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

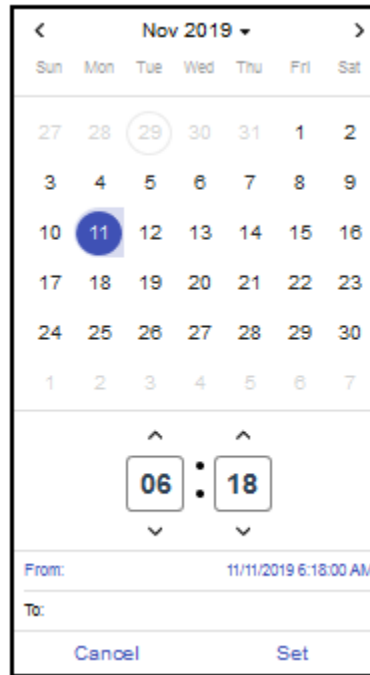
Headway Average Query

This query returns the average of headways over a statistical interval. Headway is the difference between the time when the front of a vehicle arrives at a point on the highway and the time the front of the next vehicle arrives at the same point (in seconds).

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Headway, average**.

The screenshot shows a web interface for a 'Query'. At the top, there's a dropdown menu currently set to 'Headway, average' with a question mark icon to its right. Below this, a descriptive text reads 'Average time between front of one vehicle to front of next'. A dark 'Download' button is positioned below the text. Underneath is a section titled 'Optional parameters'. It contains four input fields: 'Save as file name', 'Start and end date/time' (which has a calendar icon to its right), 'Zones', and 'Time interval'. The 'Time interval' field is followed by a unit selector dropdown currently set to 'Minutes'.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is average-headway.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the **From** field.

6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.

8. Enter the zone(s) for which data is to be included in the download.

To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).

To specify all zones, leave the field blank.

9. Select the time frame and enter the interval for which data is to be included in the download.

If omitted, the default is 15 minutes.

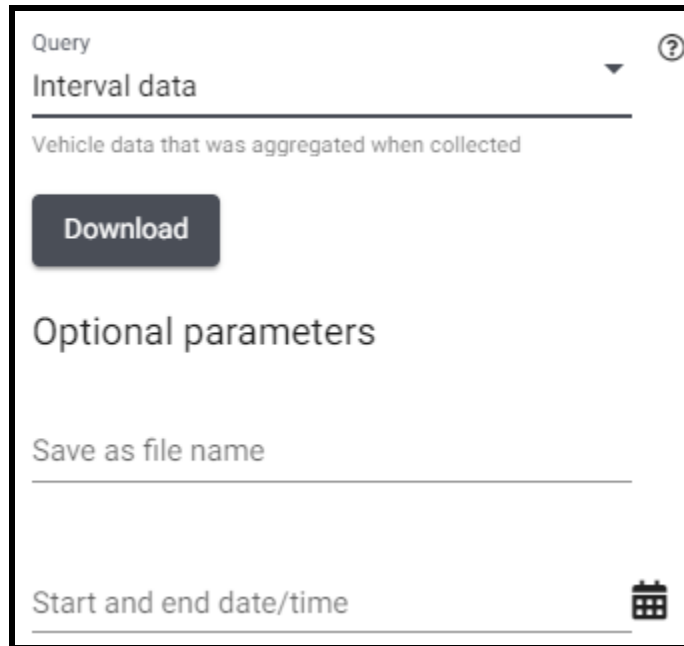
10. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

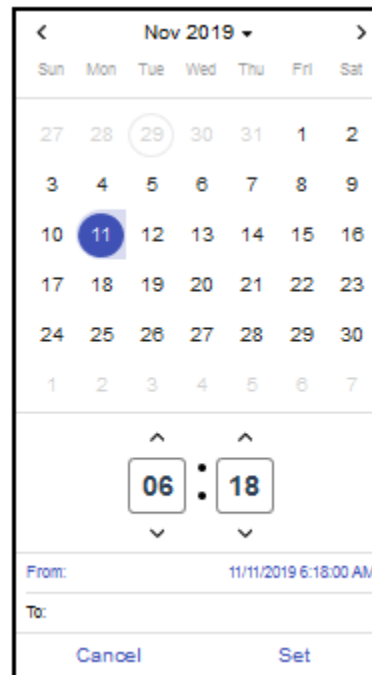
Interval Data Query

This query returns vehicle data that was aggregated when collected over a statistical interval.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Interval Data**.

The screenshot shows a web interface for querying interval data. At the top, there is a 'Query' label and a dropdown menu currently set to 'Interval data'. To the right of the dropdown is a help icon (a question mark in a circle). Below the dropdown, a descriptive text reads 'Vehicle data that was aggregated when collected'. A dark grey 'Download' button is positioned below the text. Further down, the section is titled 'Optional parameters'. Under this title, there is a text input field labeled 'Save as file name'. At the bottom of the form, there is another text input field labeled 'Start and end date/time', followed by a calendar icon on the right.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is aggregate-detection.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the From field.
6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

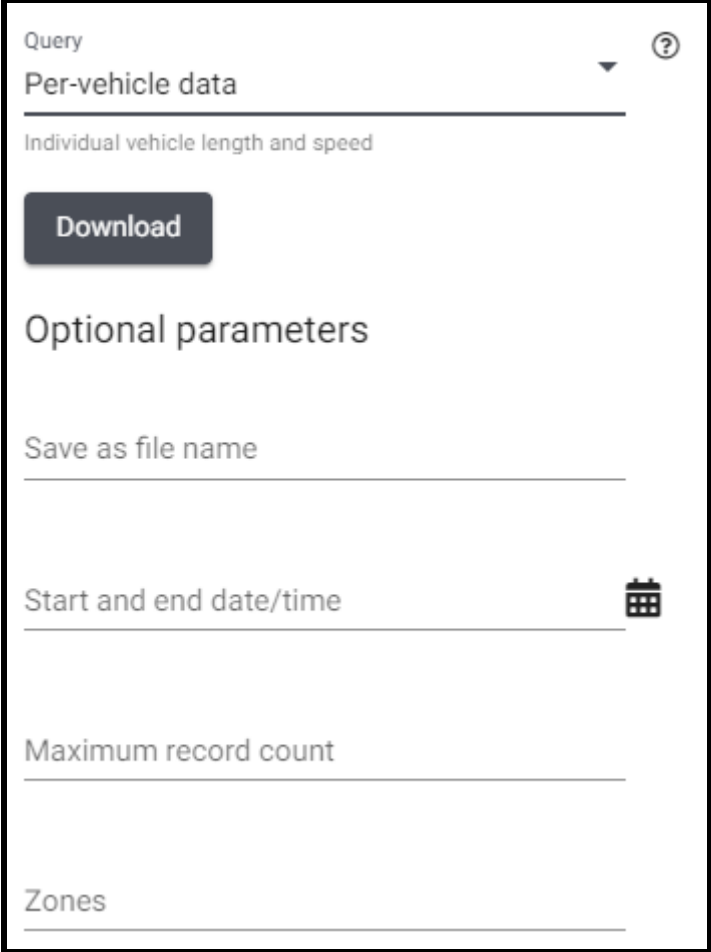
7. Click **Set**.
8. Select the maximum number of records to be returned in the response.
9. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

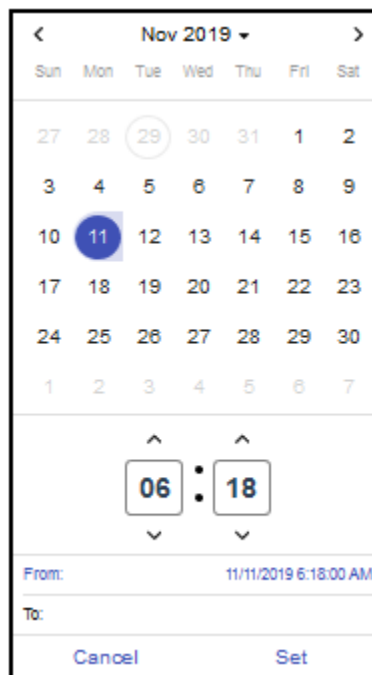
Per-Vehicle Data Query

This query returns the length and speed for each vehicle detected in a zone over a statistical interval.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Per-vehicle Data**.

A screenshot of a web interface for a 'Per-vehicle data' query. At the top, there's a 'Query' label and a dropdown menu currently showing 'Per-vehicle data' with a question mark icon to its right. Below this is a horizontal line, followed by the text 'Individual vehicle length and speed'. A dark grey 'Download' button is positioned below the text. Further down, the section 'Optional parameters' is titled. It contains three input fields: 'Save as file name', 'Start and end date/time' (which has a calendar icon to its right), and 'Maximum record count'. At the bottom, there is a 'Zones' label and an input field.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is per-vehicle.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the From field.
6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

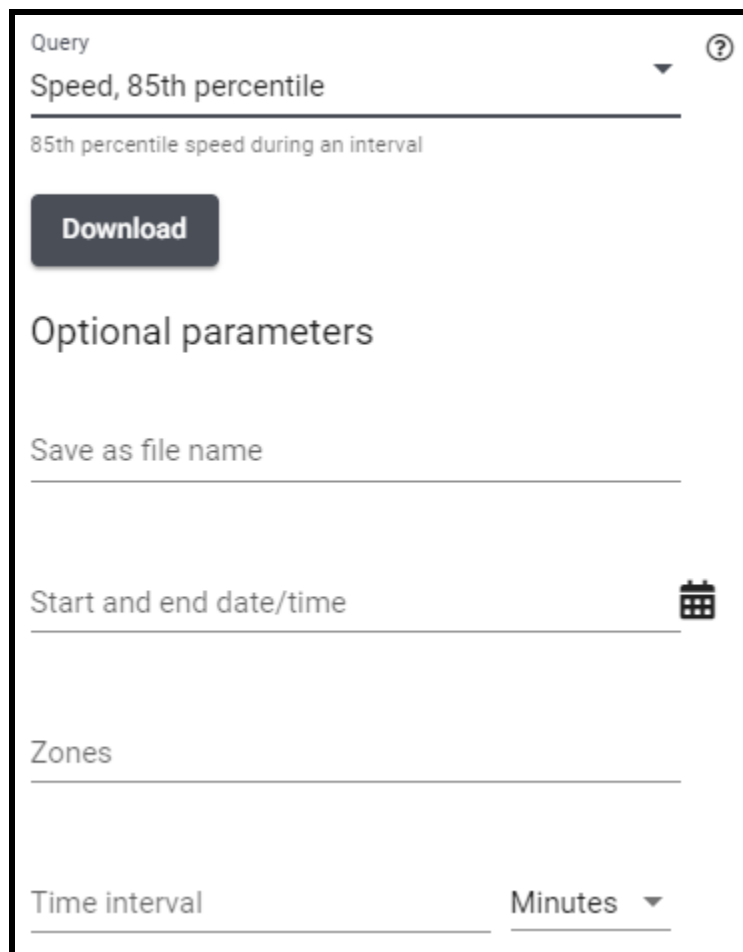
7. Click **Set**.
8. Select the maximum number of records to be returned in the response.
9. Enter the zone(s) for which data is to be included in the download.
To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range of zones (e.g., 2-5).
To specify all zones, leave the field blank.
10. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

Speed 85th Percentile Query

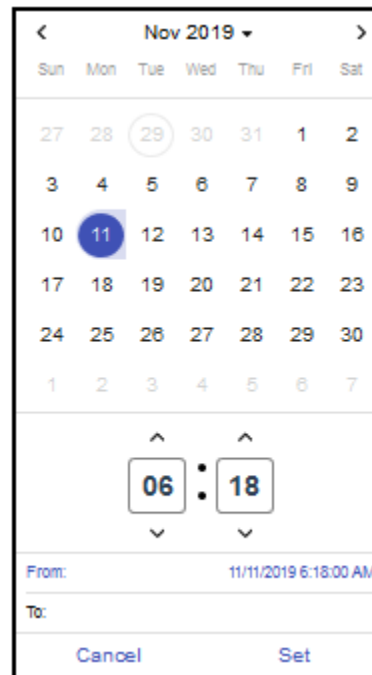
This query returns the speed at which 85 percent of all vehicles detected in a zone are at or below.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Speed, 85%**.



The screenshot shows a web interface for a query. At the top, there is a 'Query' label and a dropdown menu currently set to 'Speed, 85th percentile'. Below this is a description: '85th percentile speed during an interval'. A dark blue 'Download' button is visible. Underneath is a section titled 'Optional parameters'. It contains four input fields: 'Save as file name', 'Start and end date/time' (with a calendar icon), 'Zones', and 'Time interval' (with a unit dropdown set to 'Minutes').

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is speed85.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the **From** field.

6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.

8. Enter the zone(s) for which data is to be included in the download.

To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).

To specify all zones, leave the field blank.

9. Select the time frame and enter the interval for which data is to be included in the download.

If omitted, the default is 15 minutes.

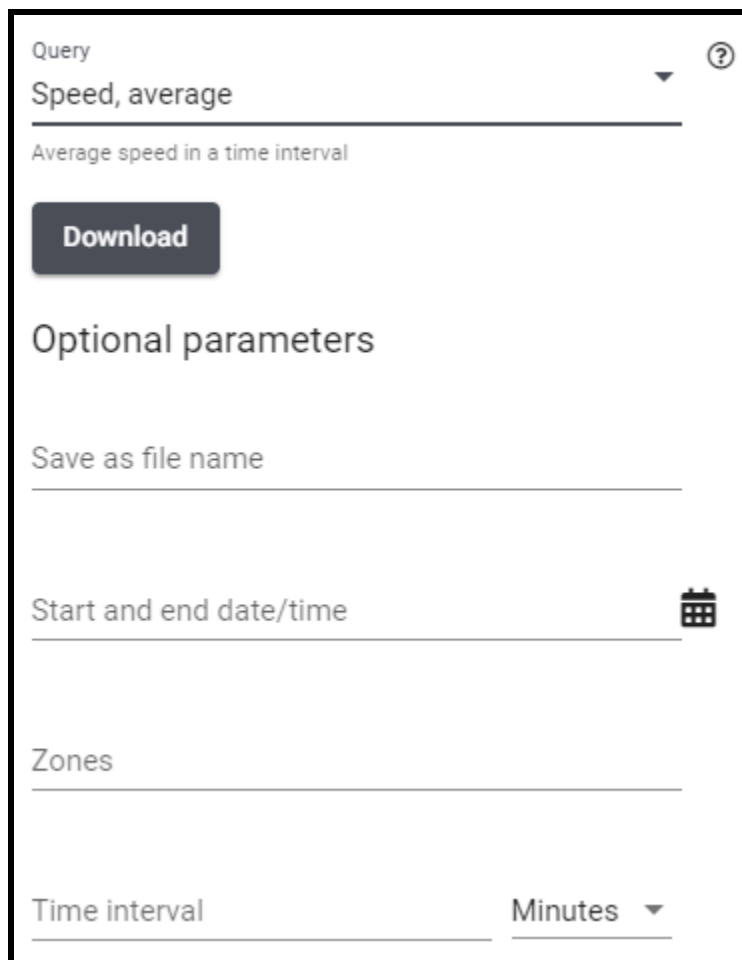
10. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

Speed Average Query

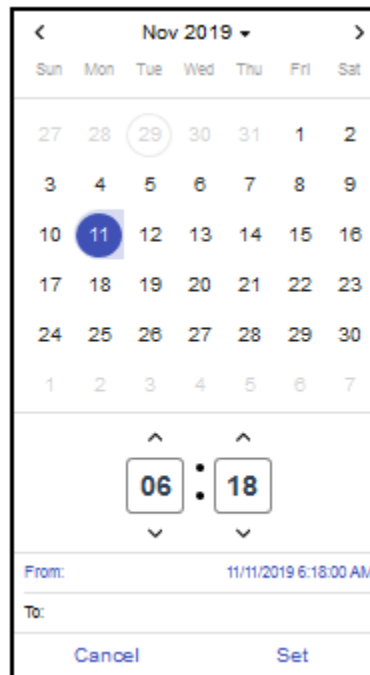
This query returns the average speed of all vehicles detected in a zone over a statistical interval.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Speed, average**.



The screenshot shows a web interface for a 'Speed, average' query. At the top, there's a 'Query' label and a dropdown menu currently set to 'Speed, average'. Below this is a description: 'Average speed in a time interval'. A dark 'Download' button is visible. Under the heading 'Optional parameters', there are several input fields: 'Save as file name', 'Start and end date/time' (with a calendar icon), 'Zones', and 'Time interval' (with a unit dropdown set to 'Minutes').

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is average-speed.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the **From** field.

6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.

8. Enter the zone(s) for which data is to be included in the download.

To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).

To specify all zones, leave the field blank.

9. Select the time frame and enter the interval for which data is to be included in the download.

If omitted, the default is 15 minutes.

10. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

Speed By Bin Query

This query returns speed data spread over several user-customizable bins. The results can be reported for individual zones or aggregated over all zones.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Speed, binned**.

Query

Speed, binned

Vehicle counts binned by speed

Download

Optional parameters

Save as file name

Start and end date/time

Zones

Time interval

Minutes

Max speed for 1st speed bin

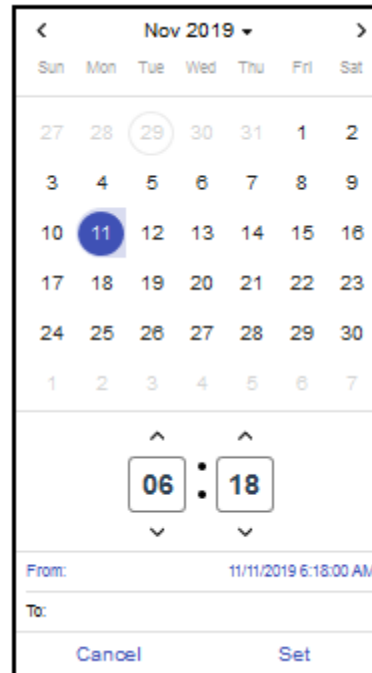
Number of additional speed bins

Speed increment for additional speed bins

3. Click **Save as file name** and enter a name for the file.

The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is speed-bin.

4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the From field.
6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.
8. Enter the zone(s) for which data is to be included in the download.
To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).
To specify all zones, leave the field blank (default).
9. Select the time frame and enter the interval for which data is to be binned.
The value must be less than or equal the difference between the start and end times. If omitted, the default is 15 minutes.
10. Enter the speed of the initial bin.
If omitted, the default value is 20.

11. Enter the number of speed bins to be included in the result.

If omitted, the default is 15. The query will always include one additional bin, the $N_{th} + 1$ bin, where N is the speed-bin-count, to indicate the number of vehicles with speeds greater than the N_{th} bin.

12. Enter the speed increment of each bin after the initial setting.

If omitted, the default is 5.

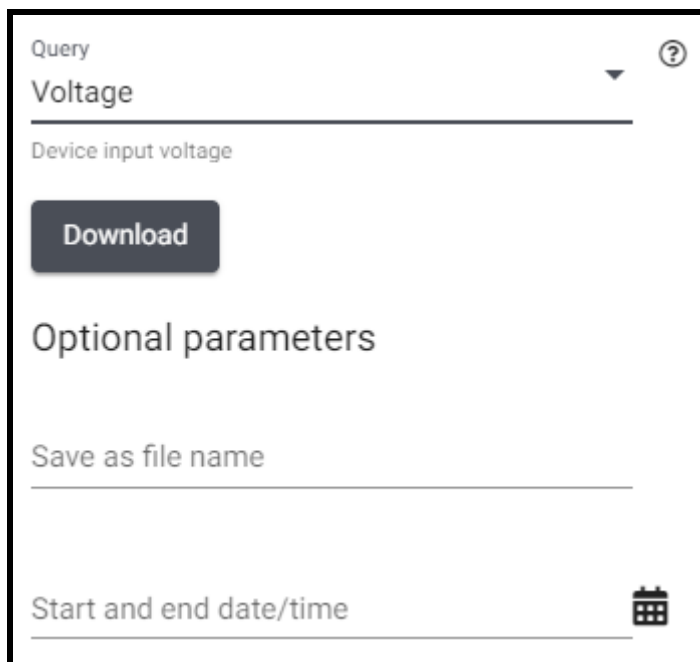
13. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

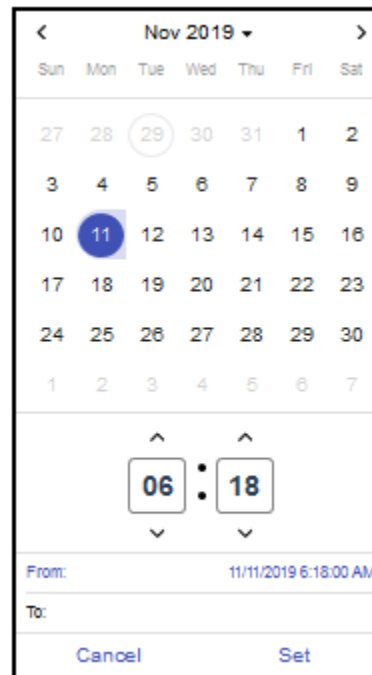
Voltage Query

This query returns the input voltage at the sensor detected over a statistical interval.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Volume**.

The screenshot shows a web interface for a 'Voltage' query. At the top, there is a 'Query' label and a dropdown menu currently set to 'Voltage', with a help icon (?) to its right. Below this is a horizontal line, followed by the text 'Device input voltage'. A dark grey 'Download' button is positioned below the text. Further down, the section is titled 'Optional parameters'. Under this title, there is a text input field labeled 'Save as file name'. At the bottom of the form, there is another text input field labeled 'Start and end date/time', with a calendar icon to its right.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is input-voltage.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the From field.
6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

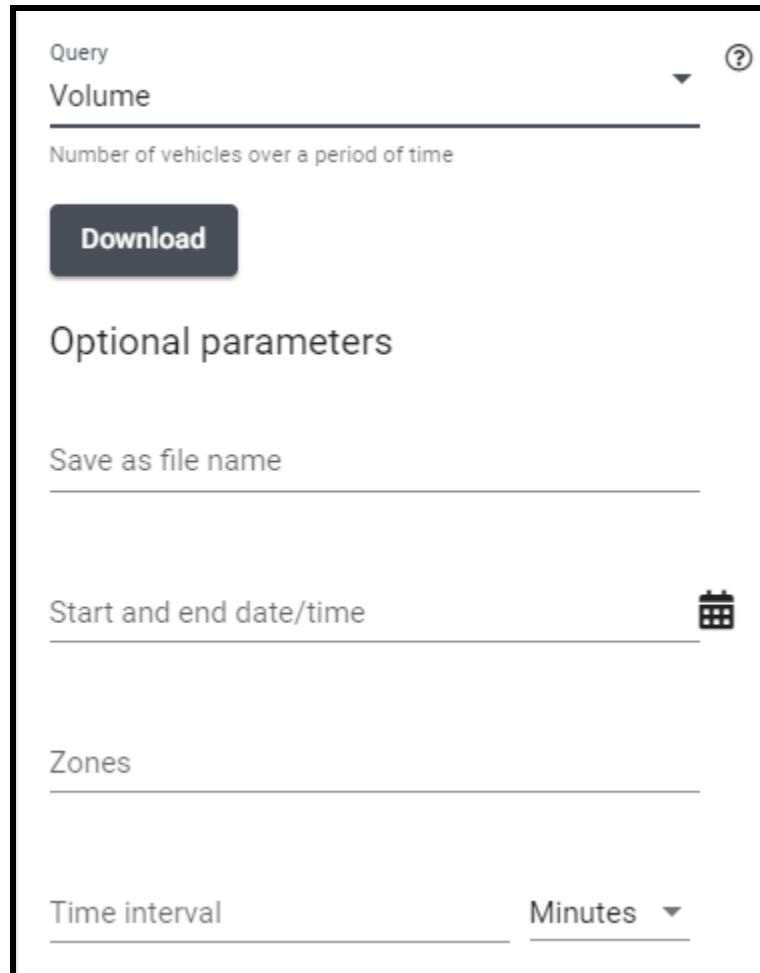
7. Click **Set**.
8. To run the query, click **Download**.

The requested data is saved as a CSV file in the Downloads folder.

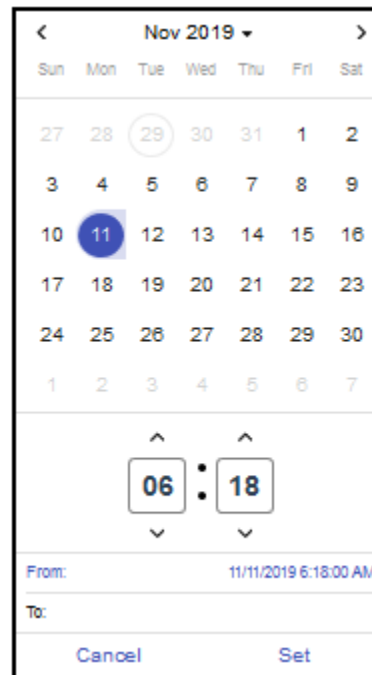
Volume Query

This query returns the number of vehicles detected in a zone over a statistical interval.

1. Click the **Reporting** tab.
2. From the drop-down to the right of Query, select **Volume**.

A screenshot of a web interface for a 'Volume Query'. At the top, there's a 'Query' label and a dropdown menu currently showing 'Volume'. To the right of the dropdown is a help icon (a circle with a question mark). Below the dropdown, the text 'Number of vehicles over a period of time' is displayed. A dark grey 'Download' button is positioned below this text. Underneath the button is a section titled 'Optional parameters'. This section contains three input fields: 'Save as file name', 'Start and end date/time' (which has a calendar icon to its right), and 'Zones'. At the bottom of the form, there is a 'Time interval' input field followed by a dropdown menu set to 'Minutes'.

3. Click **Save as file name** and enter a name for the file.
The name can be any number of alphanumeric, dash (-), underscore (_) or space characters. The default is volume.
4. Click the icon to the right of the date/time field.



5. Select the starting date and time of the query. It will appear in the From field.
6. Click in the **To** field and select the ending date and time of the query.

NOTE: The defaults for date/time are the earliest record to the current date and time.

7. Click **Set**.
8. Enter the zone(s) for which data is to be included in the download.
To enter multiple zones, separate each entry with a space (e.g., 1 2 4 etc.), or with a dash for a range a of zones (e.g., 2-5).
To specify all zones, leave the field blank.
9. Select the time frame and enter the interval for which data is to be included in the download.
If omitted, the default is 15 minutes.
10. To run the query, click **Download**.
The requested data is saved as a CSV file in the Downloads folder.

Log Tab

Each RTMS Echo sensor maintains a log which contains messages about operational errors and warning and other helpful information about sensor operations.

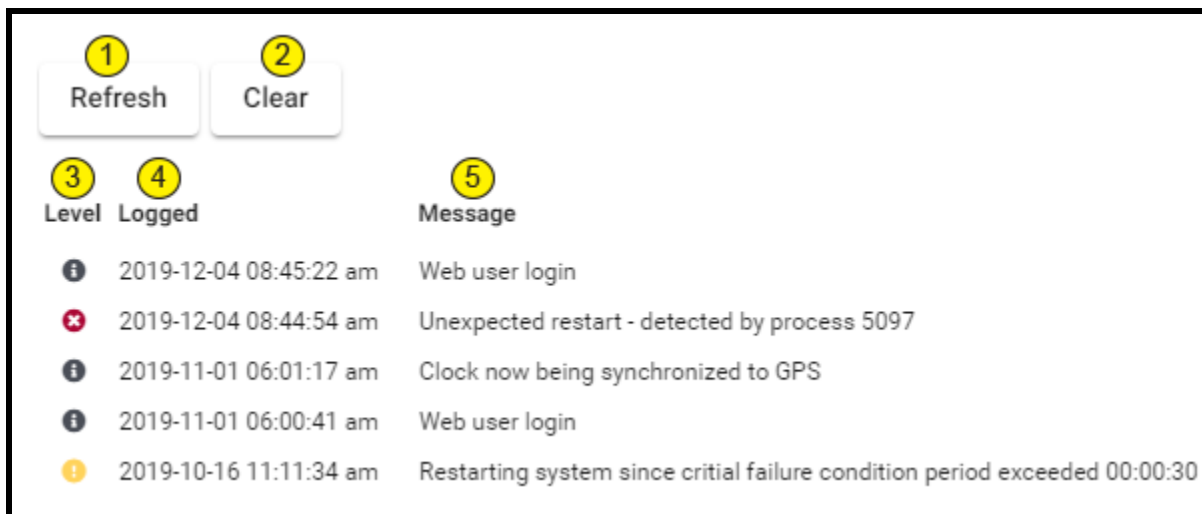


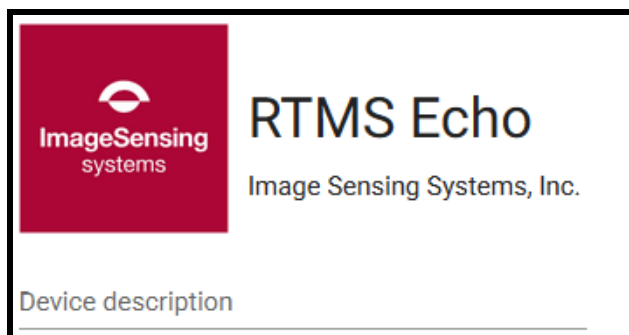
Figure 4-10: Log Page

Table 4-2: Log Page Descriptions

Item	Description
1	Click to refresh the displayed messages.
2	Click to clear all of the messages from the log.
3	Icons that indicate the severity level of the entry. - Blue icon indicates informational message. - Yellow icon indicates warning message. - Red icon indicates error message.
4	Date and time when the message was issued.
5	The message that was issued.

Settings Tab

This tab is used to enter a name for the Echo sensor and to set operational parameters for the sensor.

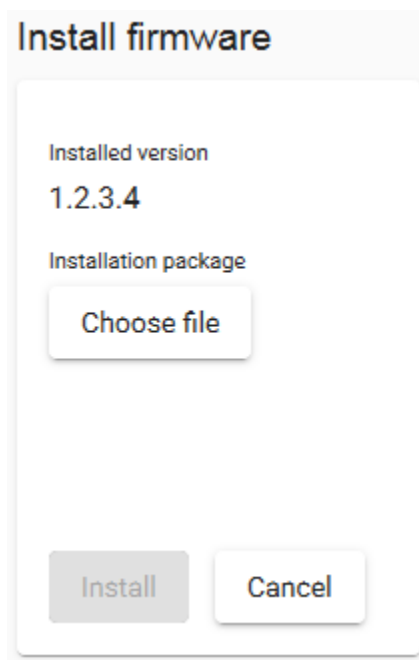


For **Device description** enter a name for the sensor.

Install Firmware

This function is used to upgrade the firmware in the RTMS Echo sensor.

1. Click the **Settings** tab.
2. Click **Install firmware**.

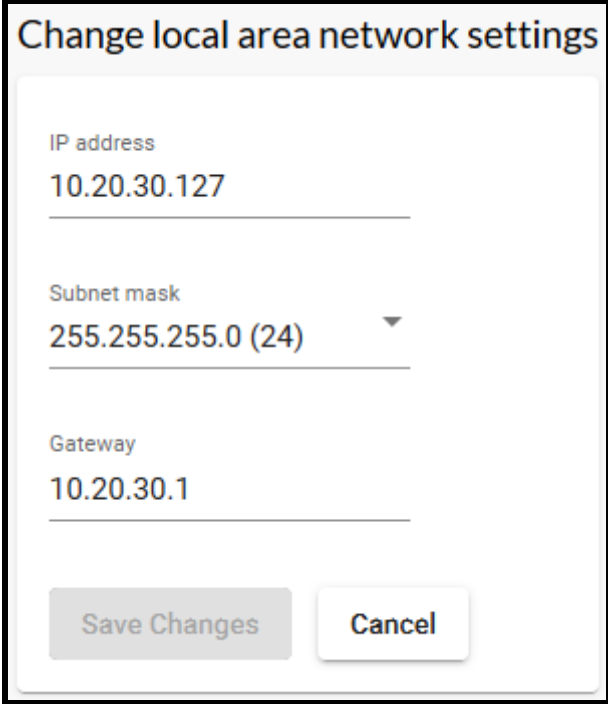


3. Click **Choose file**.
4. Locate and select the **x.x.x.x.issf** file (where x.x.x.x is the version number).
5. Click **Open**.
6. Click **Install**.

Local Area Network Setting

This function is used to set the IP address of the RTMS Echo sensor.

1. Click the **Settings** tab.
2. In the Local area network section, click **change**.

A screenshot of a web-based dialog box titled "Change local area network settings". The dialog box has a white background and a thin black border. It contains three input fields: "IP address" with the value "10.20.30.127", "Subnet mask" with the value "255.255.255.0 (24)" and a dropdown arrow, and "Gateway" with the value "10.20.30.1". At the bottom of the dialog box, there are two buttons: "Save Changes" and "Cancel".

Change local area network settings

IP address
10.20.30.127

Subnet mask
255.255.255.0 (24)

Gateway
10.20.30.1

Save Changes Cancel

3. Enter the IP address, Subnet mask and Gateway.

NOTE: The default IP address is 192.168.0.10.

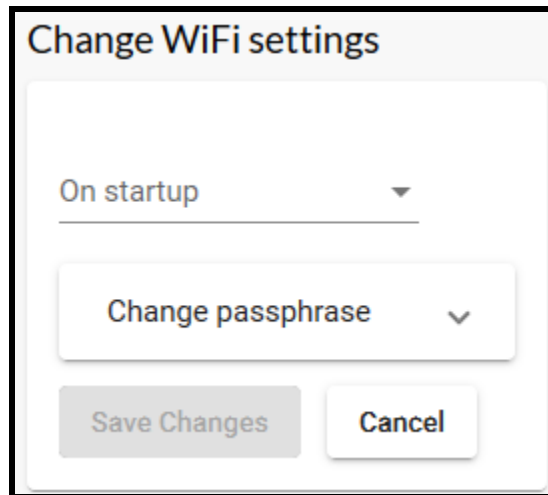
4. If a change was made, click **Save changes**.

Wi-Fi Setting

This function is used to enable or disable the Wi-Fi feature and/or change the password to allow Wi-Fi access.

The wireless network for the Echo sensor is iss-echoxxxx (where xxxx is the Echo device serial number) and the default password is echo123456. The default Wi-Fi IP is 10.99.50.1

1. Click the **Settings** tab.
2. In the Wi-Fi section, click **change**.

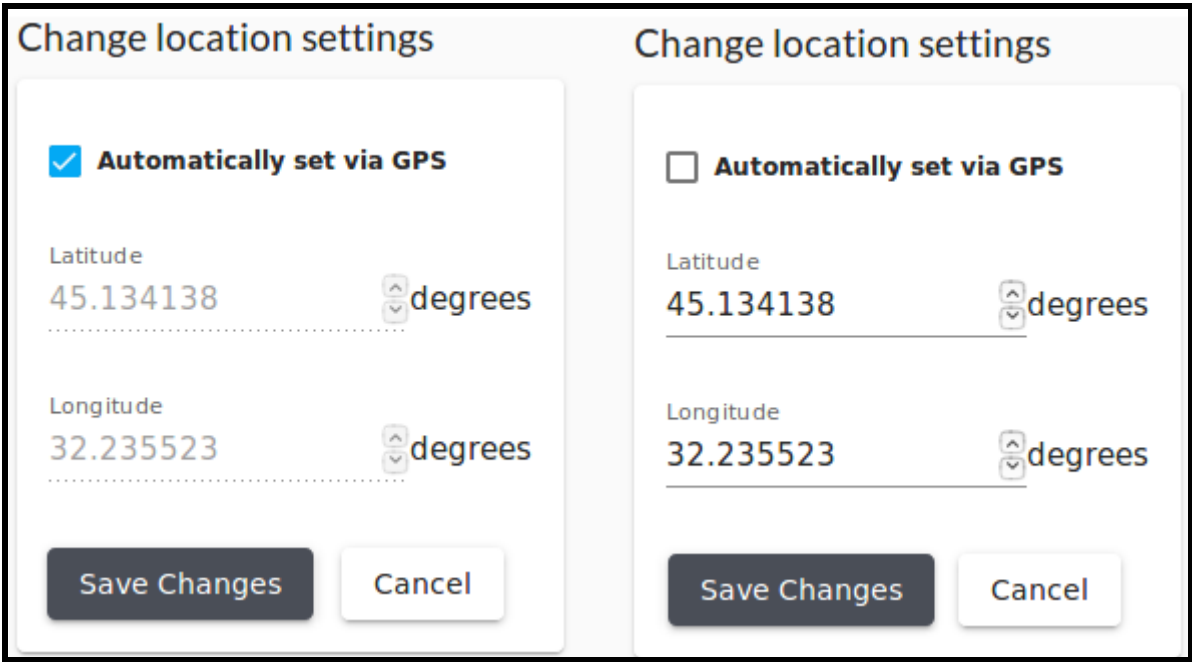


3. Use the drop-down to select whether Wi-Fi is enabled or disabled.
Wi-Fi can be enabled permanently, for just 15 minutes or for just one hour.
4. To change the password used to access the Wi-Fi, click in the field, enter then re-enter the new password.
A minimum of 8 and a maximum of 63 characters can be entered.
5. If a change was made, click **Save changes**.

Location Setting

This function is used to set the latitude and longitude of where the RTMS Echo sensor is installed. The location can either be set automatically by GPS or manually.

- 1. Click the **Settings** tab.
- 2. In the **Location** section, click **change**.



- 3. Is the location to be set automatically or manually.

Automatically	Manually
Select the Automatically set via GPS check box.	a) De-select the Automatically set via GPS check box. b) Enter the latitude and longitude.

- 4. If a change was made, click **Save changes**.

Date and Time Setting

This function is used to set the date and time in the RTMS Echo sensor.

1. Click the **Settings** tab.
2. In the **Date and time** section, click **change**.

3. Is the date and time to be set automatically or manually.

Automatically	Manually
Select the Automatically set via GPS check box.	a) De-select the Automatically set via GPS check box. b) Continue with the next step.

4. Is the date and time to be set according to the connected computer?.

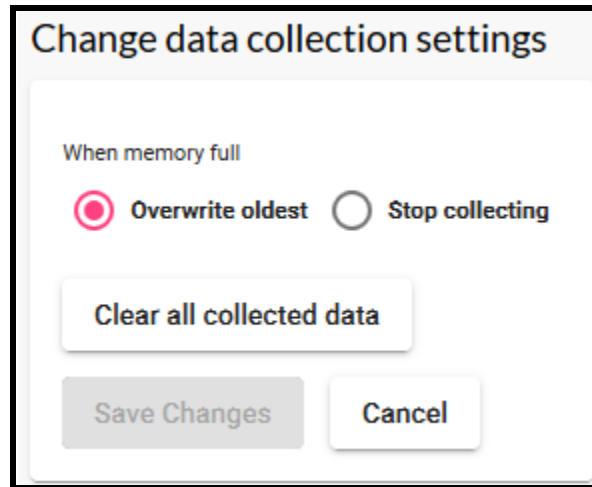
Yes	No
a) Click the Use computer date and time icon.  b) Continue with the next step.	a) Click the calendar icon.  b) Select the date and time. c) Click Set . d) Continue with the next step.

5. Select the time zone where the RTMS Echo sensor is installed.
6. If a change was made, click **Save changes**.

Traffic Data Storage Setting

This function is used to determine what action is to be taken when the memory in the RTMS Echo sensor is full.

1. Click the **Settings** tab.
2. In the **Data collection** section, click **change**.

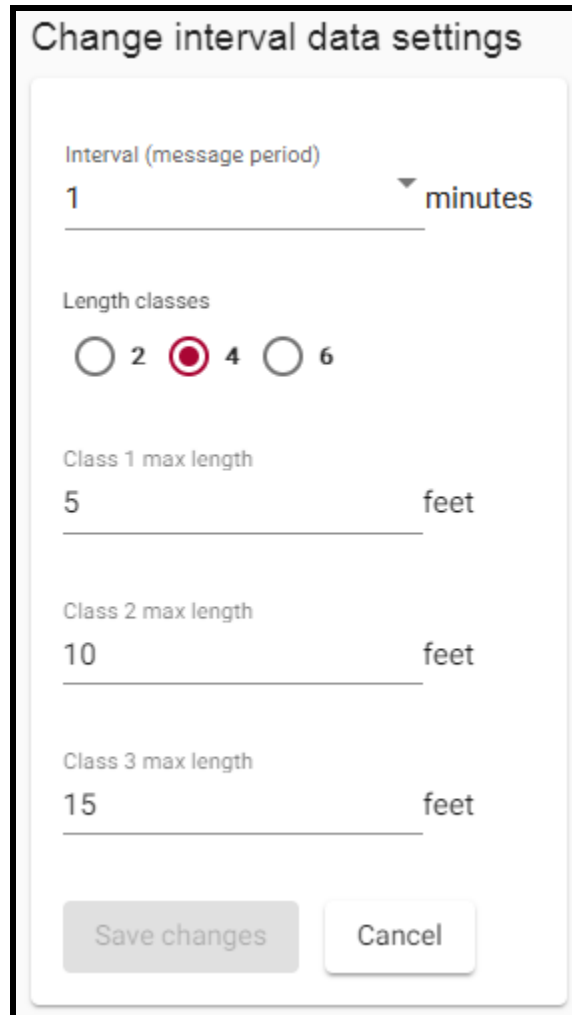


3. Select one of the following.
 - **Overwrite oldest** – when memory is full continue storing messages by overwriting the oldest messages
 - **Stop collecting** – when memory is full no new messages will be stored in internal memory. In this case, the only way to start saving messages again is to either to select **Overwrite oldest** or to click **Clear all collected data**.
4. To clear (delete) all of the messages stored in internal memory, click **Clear all collected data**.
5. If a change was made, click **Save changes**.

Interval Data

This function is used to set the message period interval and the number and length of vehicle classes.

1. Click the **Settings** tab.
2. In the Data aggregation section, click **change**.



The dialog box titled "Change interval data settings" contains the following fields and controls:

- Interval (message period):** A text input field with the value "1" and a dropdown menu set to "minutes".
- Length classes:** Three radio buttons labeled "2", "4", and "6". The "4" button is selected.
- Class 1 max length:** A text input field with the value "5" and a unit label "feet".
- Class 2 max length:** A text input field with the value "10" and a unit label "feet".
- Class 3 max length:** A text input field with the value "15" and a unit label "feet".
- Buttons:** "Save changes" and "Cancel" buttons at the bottom.

3. Select how often a statistical message is created. One record is created for each zone during each period.
4. Select the number of vehicle classifications to be detected.
5. Enter the length of each vehicle classification.

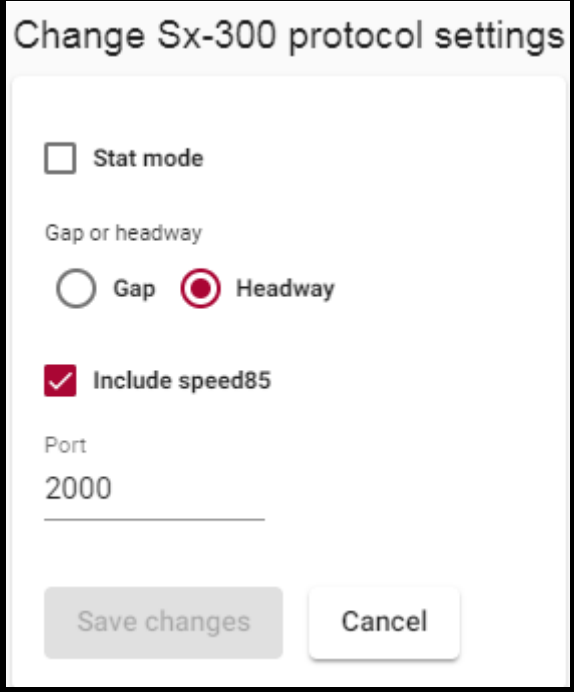
NOTE: The number of length classifications is one less than the number of classes selected because the last classification is everything greater than the last classification specified.

6. If a change was made, click **Save changes**.

Sx-300 Protocol Settings

This function is used to set operating parameters allowing the RTMS Echo to simulate an RTMS Sx-300.

1. Click the Settings tab.
2. In the Sx-300 protocol section, click change.



The image shows a dialog box titled "Change Sx-300 protocol settings". It contains the following controls:

- A checkbox labeled "Stat mode" which is currently unchecked.
- A section labeled "Gap or headway" with two radio buttons: "Gap" (unchecked) and "Headway" (checked).
- A checkbox labeled "Include speed85" which is checked.
- A text input field labeled "Port" with the value "2000" entered.
- At the bottom, there are two buttons: "Save changes" and "Cancel".

3. To put the sensor in Stat mode, select the check box. If unchecked, the sensor is in polled mode.

In Stat mode, statistical messages are only transmitted at the end of every message period.

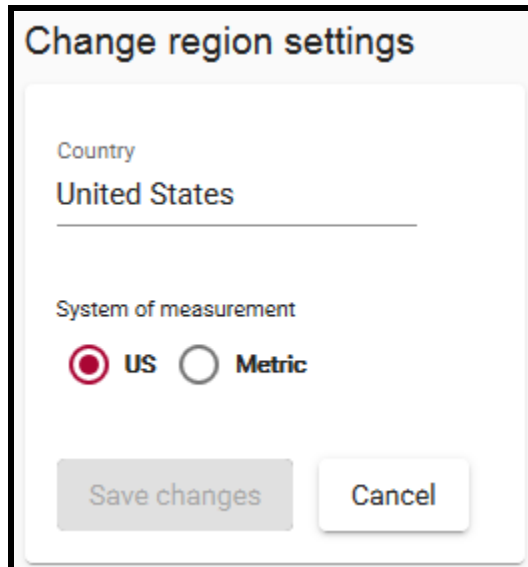
In Polled mode, only statistical data that is currently stored in the Echo buffer is transmitted and only when a matching sensor ID request is received by the Echo sensor.

4. Select whether Gap or Headway data is to be included in the statistical message.
5. If Speed 85th percentile data is to be included select the check box.
6. For **Port**, enter the port number to be used for communicating with the Echo sensor. The default is 2000.
7. If a change was made, click **Save changes**.

Region Setting

This function is used to set the units in which speed and length are displayed and to indicate the country in which the RTMS Echo is configured for.

1. Click the **Settings** tab.
2. In the **Measurement** section, click **change**.

A dialog box titled "Change region settings" with a light gray header. Inside, there are two sections. The first section is labeled "Country" and shows "United States" in a blue font, with a horizontal line underneath. The second section is labeled "System of measurement" and contains two radio button options: "US" with a red radio button and "Metric" with a gray radio button. At the bottom of the dialog box are two buttons: "Save changes" (gray) and "Cancel" (white with a gray border).

3. Select one of the following.
 - **US** – speed and lengths are shown in MPH and feet.
 - **Metric** – speed and lengths are shown in kp/h and meters.
4. If a change was made, click **Save changes**.

Licensing

This function is reserved for future use.

Backup/Restore Device Configuration

These functions are used to backup the current device configuration or to restore a previously saved backup file.

The information that is included in the backup file is as follows.

- Setup File Version
- Sensor ID
- Sensor Model
- Firmware Version
- Timestamp when saved
- User Descriptions
- Location
 - Location Source
 - Latitude
 - Longitude
- Data Aggregation Config
 - Interval
 - Classification lengths
- Data Collection Config
 - Drop Inserts When Full (true/false)
- SX300 Protocol
 - ID (1)
 - Port (2000)
 - Push Statistics (true/false)
 - Gap or Headway
 - Include Speed85 (true/false)
- Detection Config
 - Device ID (0)
 - Last Modified Date
 - Software Version
 - Config Version
 - Actions
- Sensors
 - Sensor Type (Radar)
 - Annotations
- Zones
 - Zone Type (vertical line zone)
 - ID
 - Name
 - Start
 - End

- Traffic Direction
- Lane Index
- Speed Calibration (offset, multiplier)
- Length Calibration (offset, multiplier)
- Rules
- Radar Environment Config
 - Range Bin Energy Thresholds

Download Diagnostics

This function creates a file that can be sent to ISS for diagnostic purposes if the sensor is experiencing problems. The file is saved to the default folder for your browser (usually the Downloads folder) on the computer and includes the following information:

- Interval and per-vehicle databases
- Operation logs
- Device configuration settings

NOTE: Depending on the amount of data in the databases this file can be extremely large, 100MB or more.

Reboot Device

This function is used to send a reboot command that will cause the sensor to restart.