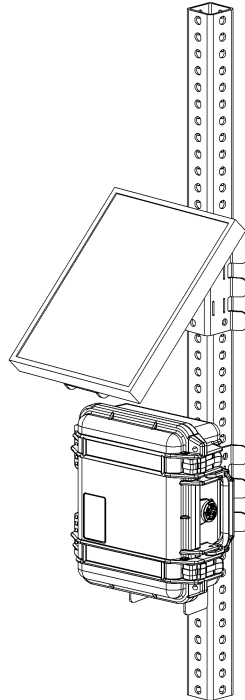


Silent Sensor

Solar Powered Pole Mounted
Autonomous Radar Sensor

Procurement Specifications



As Reliable as the Sun

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This document presents a detailed specification for a portable solar powered tower. This specification typically requires additions and/or modifications to meet a user's specific requirements.

This specification is subject to periodic revisions as required without notice.

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1. General

1.1 Product Description

The **Silent Sensor** is a versatile solar powered data acquisition device capable of being deployed to support the Intelligent Transportation Systems (ITS). The Silent Sensor is capable of gathering key traffic metrics such as average speed, traffic volume and traffic composition to autonomously relay information to the traffic safety equipment within Smart Work Zones through SolarTech's WebSuite software.

The **Silent Sensor** consists of a robust watertight polypropylene case and an adjustable tilt photovoltaic array, capable of being mounted on most poles facing any direction, designed for maximum portability and easy deployment.

1.2 Design Objectives

- 1.2.1 Maximize reliability by using generally accepted design techniques for outdoor-use electrical and electronic equipment.
- 1.2.2 Maximize reliability by using highly robust outer casing materials designed for resistance to any weather conditions.
- 1.2.3 Minimize operating cost by using a renewable energy source, requiring minimal maintenance.
- 1.2.4 Maximize portability, simplicity, ease and rapidity of deployment, stability, and safety.

1.3 Performance Objectives

- 1.3.1 Continuous, uninterrupted operation on solar power.
- 1.3.2 Maximum stability of mount for proper operation.
- 1.3.3 Three (3) month typical maintenance interval.

1.4 Quality Assurance Objectives

- 1.4.1 All manufacturing shall be carried out in a facility with a completely implemented and properly maintained ISO 9001:2015 certified quality management system.
- 1.4.2 All units shall be tested to ensure that they are neither susceptible to nor produce any electromagnetic interference.

2. Physical

2.1 Dimensions

2.1.1 Height

2.1.1.1 Equipment Box – 11.5 in. (29 cm)

2.1.1.2 Solar array – 7 in. to 12.5 in. (18 cm to 32 cm)

2.1.2 Width

2.1.2.1 Equipment Box – 10 in. (25 cm)

2.1.2.2 Solar Array – 10 in. (25 cm)

2.1.3 Depth

2.1.3.1 Box without the mounting bracket – 5 in. (13 cm)

2.1.3.2 Box with the mounting bracket – 8.5 in. (22 cm)

2.1.3.3 Solar array – 5 in. to 16 in. (13 cm to 41 cm)

2.1.4 Weight – 8 lbs. (3.5 kg)

2.2 Environmental

2.2.1 Temperature, operating and storage – -40 to +185 °F (-40 to +85 °C)

2.2.2 Relative Humidity – 20% to 98%, non-condensing

3. Construction and Operation

3.1 General Mount Bracket Construction

- 3.1.1 All mounting brackets shall be designed to facilitate quick, easy installation and removal of the brackets on any common road pole.
- 3.1.2 All brackets shall be completely assembled with removable fasteners to accommodate quick, easy maintenance and repair.
- 3.1.3 All fasteners shall be rust resistant and equipped with nylon-stop lock nuts to prevent loosening of fasteners during normal operation.
- 3.1.4 All metal surfaces shall be completely cleaned and deburred.
- 3.1.5 All brackets shall be made from 1/8" 5052 marine grade corrosion resistant aluminum.
- 3.1.6 All mounting brackets shall contain four 3/8" mounting holes to allow attachment to standard 2" perforated square steel sign posts (PSST) using 3/8" hardware, with hole spacing compatible with the 1" on-center perforation pattern.
- 3.1.7 All mounting brackets shall additionally provide slots sized to accept stainless steel band/hose clamps, enabling mounting to round or non-perforated poles of varying diameters. Slot dimensions shall accommodate clamp band widths of up to 7/8" (22 mm). Brackets shall accommodate pole diameters from 2" (51 mm) using worm-gear or band-style stainless steel clamps. A minimum of four slots shall be provided per bracket to ensure secure two-point clamping.

3.2 Equipment Box Mount Bracket

- 3.2.1 The mounting bracket shall have the ability to angle 70 degrees in each direction from the center position to facilitate installation on all types of poles facing any direction and still being able to face the traffic.

3.3 Solar Array Mount Bracket

- 3.3.1 The mounting bracket shall have the ability to tilt down up to 60 degrees to allow the panel to face the sun. The tilt mechanism shall lock securely at any needed angle with four 1/4" bolts to resist movement under wind loading and panel weight.
- 3.3.2 The mounting bracket shall have the built-in indicator to display the solar array angle to allow precise adjustment without external measurement tools. The indicator shall be legible in field conditions and marked in increments of no greater than 5 degrees.

3.4 Equipment Case Construction

- 3.4.1 The equipment case shall be equipped with 5 rubber sealed watertight self-regulating pressure release valves to allow air circulation in any weather conditions.
- 3.4.2 The equipment case shall be equipped with sealed on/off toggle switch.
- 3.4.3 The equipment case shall be connected to the solar array using sealed automotive style watertight plug.
- 3.4.4 The equipment case shall house a protective aluminum guard on the bottom to prevent

accidental switch operation or contact with the plug or pressure valves.

- 3.4.5 The equipment case lid shall incorporate a continuous rubber O-ring gasket that seals the lid when closed, achieving a minimum ingress protection rating of IP67. The O-ring shall be seated in a dedicated groove to ensure proper compression and alignment and shall be made of a UV and weather-resistant material suitable for continuous outdoor exposure.
- 3.4.6 The equipment case shall be capable of being locked in the closed position with a standard padlock to deter equipment theft.

4. Control Module

4.1 Physical

- 4.1.1 Control module shall include internal cell and GPS antennas to allow for remote communication and geolocation of the sensors in the equipment box
- 4.1.2 The equipment box shall house a metal bracket to internally secure the control module components. The bracket shall restrain the equipment against movement and vibration during transport.
- 4.1.3 All control module wiring and cables shall be equipped with modular power and signal connectors to permit repairs without the need for any tools

4.2 Programming

- 4.2.1 Control module shall provide a method for switching radar gun output from MPH to KPH remotely via remote control software.

4.3 Cellular Transceiver & GPS Receiver Module

- 4.3.1 LTE Cat M1 transceiver integrated into equipment box – proprietary

4.4 Flux-Gate Digital Compass

- 4.4.1 Input Current – 5.7 mA @ 12 Vdc maximum
- 4.4.2 Operating Temperature Range – -40°C to +65°C (-40°F to +150°F)
- 4.4.3 Accuracy – ± 0.5 degrees
- 4.4.4 Repeatability – ± 0.2 degrees
- 4.4.5 Resolution – 0.1 degrees
- 4.4.6 Dip Angle – ± 80 degrees
- 4.4.7 Tilt Angle – ± 16 degrees
- 4.4.8 Response Time – 1 second

4.5 Radar Speed Monitor

4.5.1 General

- 4.5.1.1 Operating Frequency - 24.15 GHz $\pm$ 10Mhz (K-Band)
- 4.5.1.2 Antenna Beam Angle – 9° (vertical) x 18° (horizontal)
- 4.5.1.3 Target Speed Range – 1 to 206 mph (2 to 331 km/h)
- 4.5.1.4 Target Speed Accuracy – $\pm 0.5\%$ of reading + 0.1 mph
- 4.5.1.5 Detection Distance – based on radar mounted 5 feet above level road, pointed into oncoming traffic. Detection Distances vary with vehicle characteristics, installation and road conditions.
 - Non-range boost mode – 1500 ft (450 meters)

Range boost mode – 2600 ft (760 meters)

4.5.1.6 Radar unit shall install in the field with minimum effort.

4.5.1.7 Message sign shall be pre-wired and pre-programmed for radar speed monitor option.

4.5.2 Radar Statistical Data Collection

4.5.2.1 Control Module shall automatically log and record (to a standard USB memory stick) all raw data provided by the radar gun along with basic statistical information about the collected data in 15 minute intervals. The data shall be stored in two CSV (Comma Separated Value) files which may be opened in Microsoft Excel or any other similar spreadsheet type application for viewing, manipulation and analysis. Additionally, the most recent 30 days worth of Radar Statistics (statistical radar data logged every 15 minutes) shall be maintained in the control module's nonvolatile memory and shall be retrieved remotely via Command Center.

4.5.2.2 Data Provided

- 4.5.2.2.1 Raw Data File: (radar_data file) - (Year, Month, Day, Time, Reading) - every reading - readings recorded every 250ms while tracking a target
- 4.5.2.2.2 Statistical Data File: (radar_statistics file) - (Year, Month, Day, Time, # of Readings, Mean, Median, Mode, Standard Deviation, Lowest Reading, Highest Reading) - based on all readings - readings are taken every 250ms while tracking a target

5. Power System**5.1 General**

- 5.1.1 Operating Voltage - 6 Volts DC nominal
- 5.1.2 Main Power Switch - Main power switch shall provide complete electrical system protection without the inconvenience of conventional fuses. Main power switch shall be splash proof and weather resistant.

5.2 Battery Bank

- 5.2.1 Number of batteries: One (1)
- 5.2.2 Battery type: 6-Volt, heavy duty, deep cycle, sealed lead acid AGM
- 5.2.3 Energy capacity – 12 Amp Hours nominal

5.3 Solar Array

- 5.3.1 Photovoltaic module type - Single crystal (monocrystalline) silicon
- 5.3.2 Number of solar cells per module – 30
- 5.3.3 Solar array power output: 10 Watts.

5.4 Wiring and Cabling

- 5.4.1 All wiring shall be marine grade, multi-strand, tin-plated copper with PVC insulation rated for outdoor use.
- 5.4.2 All conduit fittings shall be sealed at bulkheads or enclosure entry points.
- 5.4.3 All power system wire terminals shall be silver or tin-plated copper to minimize the effects of galvanic corrosion.
- 5.4.4 Main power wiring shall be 16 AWG minimum.
- 5.4.5 Solar panel terminations shall consist of stainless steel screws with #8 tin-plated copper snap spade terminal.

6. Documentation**6.1 Operation and Maintenance Manual – available online at www.solartechnology.com**

6.1.1 Setup and Operation

6.1.2 Maintenance

6.1.3 Troubleshooting and Repair

6.1.4 Assembly Diagrams and Parts Lists

6.1.5 Specifications

6.1.6 Appendix

6.2 Integration Support Documentation – Per request from customer support (1-800-475-5442)

7. Maintenance

Solar Array - Clean with water and mild detergent as needed.

8. Warranty

Solar Panels – Ten (10) years