



# Canary – S



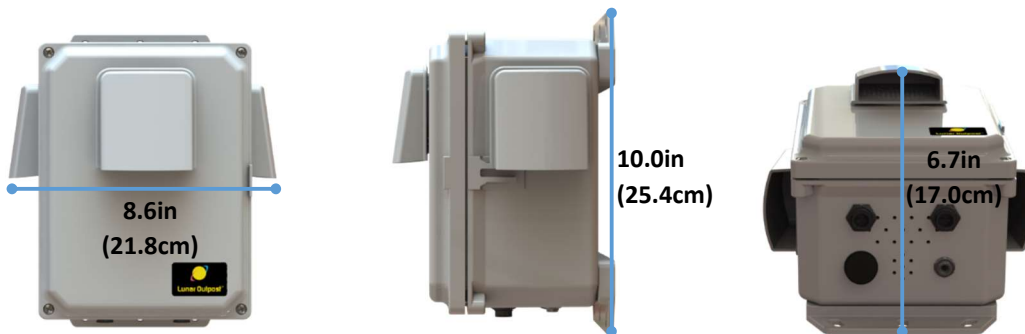
## Environmental Monitoring System

Gen 4V3 Revised: 2/22/21

### I. Introduction

The Canary-S is a continuous, solar-powered air quality and meteorological monitoring system designed to be class-leading in size, reliability, and flexibility. Cellular connectivity enables these systems can be placed nearly anywhere to monitor particulate matter, targeted gases, and meteorological data. Multiple units can be deployed to create a comprehensive network of real-time data sources, providing an accurate picture of environmental conditions in the area being monitored. The data produced by these networks can be integrated into existing customer databases or into Lunar Outpost’s end-to-end database system, LunarAtmo. Additionally, the Canary-S can be paired with Lunar Outpost’s automatic Summa canister triggering package, the Canary ACE.

### II. Mechanical



#### A. Physical Properties

See Table 1.

#### B. Mounting Options

The Canary enclosure allows mounting to either tripods, large diameter poles, or DIN rails.

#### C. Certifications and Environmental

The Canary enclosure meets the following certifications: UL508A, UL 50, CSA-C22.2 No. 14, NEMA 1,2,3,3R,4,4X,5,6,6P,12,13, UL94V-0 Flame rating, and UL746C-F1 UV. The original enclosure before modification has an IP68 rating. The rating after modification is reduced due to the designed addition of vents for airflow, but maintains protections against inclement weather when mounted correctly. The enclosure is UV-Stabilized Polycarbonate and units have undergone extensive testing in a variety of outdoor environments to ensure robust functionality. Canary units have an operational temperature range of -20F to 140F (-28.89C to 60C).

Table 1: Physical Properties of Device

Dimension	Value
Width	8.6 in
Height	10.0 in
Depth	6.7 in
Weight	~4.3 lbs

### III. Power

Table 2: Power Characteristics of Device

Battery		Charging	
Chemistry	Lithium-Ion	Solar Panel	12V DC (20W)
Capacity	8000 mAh	Solar Charge Controller	12V DC
Run-time without power input	120 hours* *under proper conditions	Wall Charger	120V AC (US std) input to 12V DC output (24W)

## IV. Communication and Data

Canary-S units communicate over commercial cellular bands and data is transmitted to a secure cloud. From the cloud, the data can be routed to the customer's database or Lunar Outpost's custom database. The connection to the cloud is database agnostic, allowing integration with a variety of commercial or custom databases. Table 3 and 4 outline the cellular data connection specifications of two of the cellular modems used in the Canary units.

### A. Cellular Communication

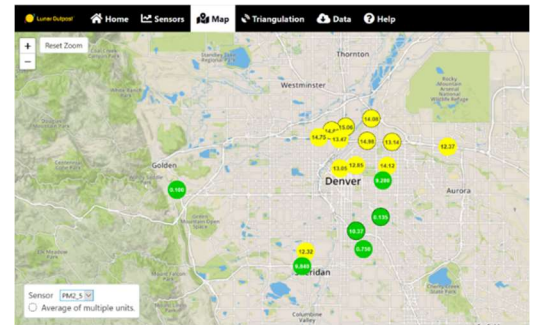
Table 3: 4G Cellular Data Connection Specifications

<b>Network</b>	4G LTE Cat M1	<b>Cellular Modem</b>	Ublox SARA-R410M
<b>LTE Bands</b>	3, 4, 5, 8, 12, 13, 20, 28	<b>2G/3G Bands</b>	None

### B. Data

The Canary-S allows for data integration into the platform of choice and puts data ownership and control in the customer's hands. JSON formatting is used for the data unless otherwise requested by the customer. Micro-SD capability allows for data-backups and redundancy storing up to 7 years of data locally.

- **Integrate to client database:** Canary-S data can be routed to a customer's existing database or routed to multiple databases simultaneously.
- **Lunar Outpost's custom database:** Lunar Outpost's custom database is an effective, user friendly platform that allows customers to view, interact with, analyze, and download data (Map page shown to the right).



## V. Sensors

Table 4: Standard Unit Sensor Specs

Property	Range	Resolution
<b>PM2.5</b>	0~1000 $\mu\text{g}/\text{m}^3$	1 $\mu\text{g}/\text{m}^3$
<b>PM10</b>	0~1000 $\mu\text{g}/\text{m}^3$	1 $\mu\text{g}/\text{m}^3$
<b>Internal Temperature</b>	-40 to 85 °C (-40 to 185°F)	+/-1.5 °C (2.7 °F)
<b>Internal Humidity</b>	0-100% RH	+/-3%
<b>Atmospheric Pressure</b>	300-1250 hPa (mbar)	+/-1.7 hPa (mbar)

Table 5: Optional Sensor Specs (contact Lunar Outpost for more customization options)

Property	Range	Max Resolution Limit
<b>Total VOC (tVOC)</b>	0 to 50 ppm	1 ppb
<b>Ozone (O<sub>3</sub>)</b>	0 to 20 ppm	15 ppb
<b>NO<sub>2</sub></b>	0 to 20 ppm	15 ppb
<b>CO</b>	0 to 1000 ppm	4 ppb (at 0-15ppm range)
<b>CO<sub>2</sub></b>	0 to 5% volume	10 ppm
<b>H<sub>2</sub>S</b>	0 to 100 ppm	5 ppb
<b>SO<sub>2</sub></b>	0 to 100 ppm	5 ppb
<b>CH<sub>4</sub></b>	0 to 40000 ppm	1 ppm
<b>Wind Speed</b>	0-75 m/s (0-168mph)	0.01 m/s
<b>Wind Direction</b>	0-360 deg	+/- 2 deg

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