



Lunar Outpost™



Project Canary®

Canary – S

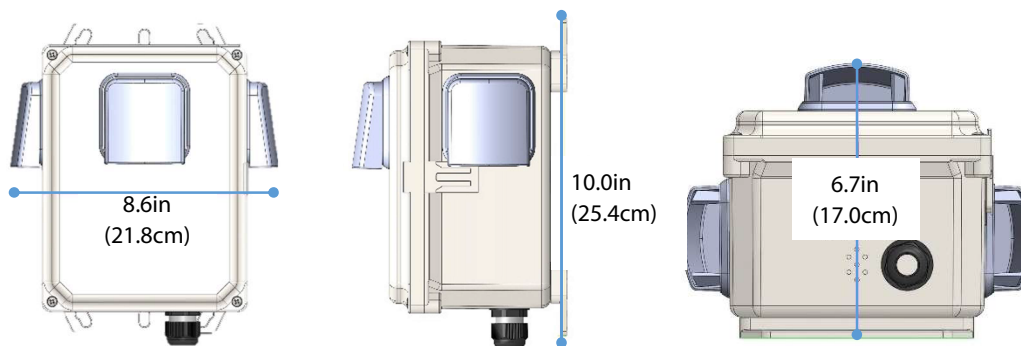
Air Quality Monitoring System

Gen 4 Revised: 12/17/19

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. With cellular communication these systems can be placed nearly anywhere to provide measurements on particulate matter, targeted gases, and meteorological data. Multiple units can be deployed to create a network of real-time data integrated into existing customer databases or into Lunar Outpost’s platform.

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 and submersion testing. The original enclosure before modification had an IP68 rating. The rating after modification is reduced due to the designed addition of vents for airflow, but the unit maintains protections against inclement weather when mounted correctly. The enclosure is UV-Stabilized Polycarbonate and the 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 air quality monitor

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 air quality monitor

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: 2G/3G Cellular Data Connection Specifications

Network	2G/3G HSPA/GSM	Cellular Modem	Ublox SARA-U260
HSPA Bands	850/1900 MHz	GSM Bands	850/1900 MHz

Table 4: 4G Cellular Data Connection Specifications

Network	4G LTE Cat M1	Cellular Modem	Ublox SARA-R410M
LTE Bands	3, 4, 5, 8, 12, 13, 20, 28	2G/3G Bands	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.

V. Sensors

Table 5: Base Unit Sensor Specs

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

Table 6: Optional Sensor Specs

Property	Range	Max Resolution Limit
Total VOC (tVOC)	0 to 50 ppm	1 ppb
Ozone (O₃)	0 to 20 ppm	15 ppb
NO₂	0 to 20 ppm	15 ppb
CO	0 to 1000 ppm	4 ppb
CO₂	0 to 5% volume	1 ppm
H₂S	0 to 100 ppm	5 ppb
SO₂	0 to 100 ppm	5 ppb
CH₄	0 to 50000 ppm	100 ppm
External Temperature	-40 to 80°C (-40 to 176°F)	+/-0.3 °C (0.54 °F)
External Humidity	0-100% RH	+/-2%
Wind Speed	0-75 m/s (0-168mph)	0.01 m/s
Wind Direction	0-360 deg	+/- 2 deg

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