Getting Started Guide

Internet of Things

Aspen™ 10

With CampbellCloud Connectivity

RELIABLE MONITORING SINCE 1974

Campbell SCIENTIFIC®

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1. Getting started

Getting started provides an overview of how to get data from your Aspen 10™ to *CampbellCloud*. You may not find it necessary to progress beyond this guide. However, should you want to dig deeper into the Aspen 10 functions or quickly look for details, extensive information is available in the full Aspen 10 manual.

This exercise guides you through the following steps:

- In the office:
    - Setting up a *CampbellCloud* organization account
    - Downloading the *CampbellGo* app to your smartphone

- In the field:
    - Installing the Aspen 10 with your sensor
    - Setting up *CampbellGo*
    - Adding the Aspen 10 as an asset
    - Creating a station
    - Using *Go* to view real time data

2. *CampbellCloud*

The Aspen 10 is set up to automatically send data to *CampbellCloud*.

To ensure your data is accessible and organized, you will need to join or create an organization account in *CampbellCloud* before installing the Aspen 10 in the field.

> **NOTE:** In this context, an organization is an individual, business, or organization that uses *CampbellCloud* services to manage a network of stations.

Every CampbellCloud user must be associated with an organization, either as the account owner or as a user.

If you're **not** the account owner but need to join the account as a user, you should receive an invitation email from **hello@campbell-cloud.com** with instructions to join as a user. For directions on joining an existing organization account, proceed to Join a CampbellCloud organization account (p. 3)

> **NOTE:**
> The organization account owner will be responsible for providing the subscription-management billing information.

> **CAUTION:**
> If you or your organization already has a *CampbellCloud* organization account do not create another one.
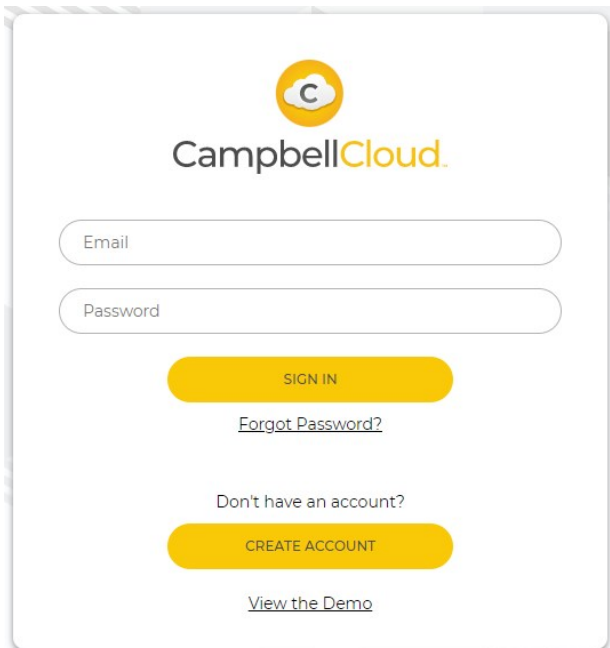
2.1 Create a *CampbellCloud* organization account

> **CAUTION:**
> If you or your organization already has a *CampbellCloud* organization account do not create another one.

If you are the account administrator, follow these steps to create an organization account and your user account:

1. Using a web browser go to https://iot.campbell-cloud.com ⬈.
2. Click **REGISTER**.
3. Click **CREATE ACCOUNT**.

4. If you are the person who will be responsible for the organization account click **CONTINUE TO SIGN UP**.

5. Fill out the form.

6. Read and select the check box for each agreement.

7. Click **CREATE ACCOUNT**.

8. You should receive an email confirmation from `hello@campbell-cloud.com`.

9. Click **Verify your email**. A new browser tab will open.

10. Click **SIGN IN** and proceed to *CampbellCloud*.

2.2 Join a *CampbellCloud* organization account

Every user must be associated with an organization. Your organization administrator will invite you to be a member. Shortly thereafter you will receive an email from `hello@campbell-cloud.com`.

> **NOTE:** Organization administrators are automatically set up as users. If you are the administrator proceed to Install Aspen 10 (p. 5).

The email you receive should look similar to the following:
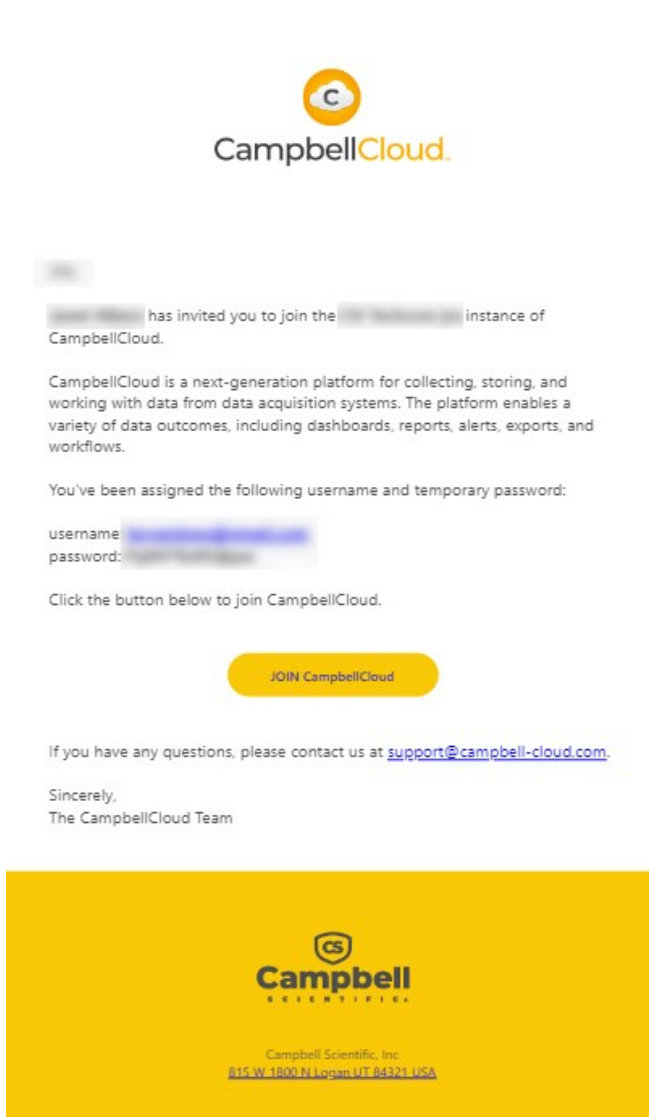
Click the button to **JOIN CampbellCloud**.

Your organization administrator assigned you to one or more security groups. Each security group has a defined set of permissions. Contact your organization administrator for more information.

3. Install Aspen 10

The Aspen 10 is weather proof and does not need an additional enclosure. The integrated solar panel should be installed so it receives a minimum of four hours of sunlight per day. See Figure 3-1 (p. 5) for recommended orientation based on latitude. A snap-on 10° tilt spacer is included with the Aspen 10 to optimize the solar panel angle in certain areas. Elsewhere, it should be mounted in a near-vertical orientation.
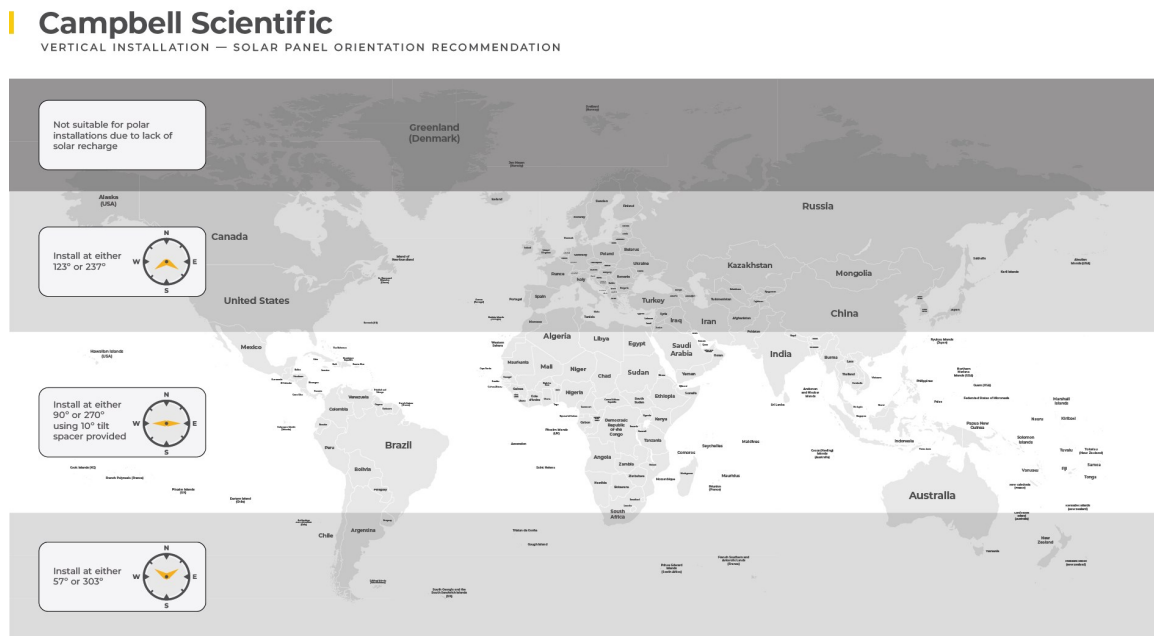
Figure 3-1. Recommended solar panel orientation

The following image shows a typical installation of an Aspen 10 with a RainVUE sensor.

3.1 Mounting

1. If needed, install the snap-on 10° tilt spacer, see .

2. Use simple cable ties (included) to mount the Aspen 10 to a vertical post.

3. Fit the extension cable connector to the sensor cable connector. Hand tighten the connectors.

> **CAUTION:**
> Hand tighten only! Using tools to tighten the connectors can permanently weld the stainless steel connectors together.
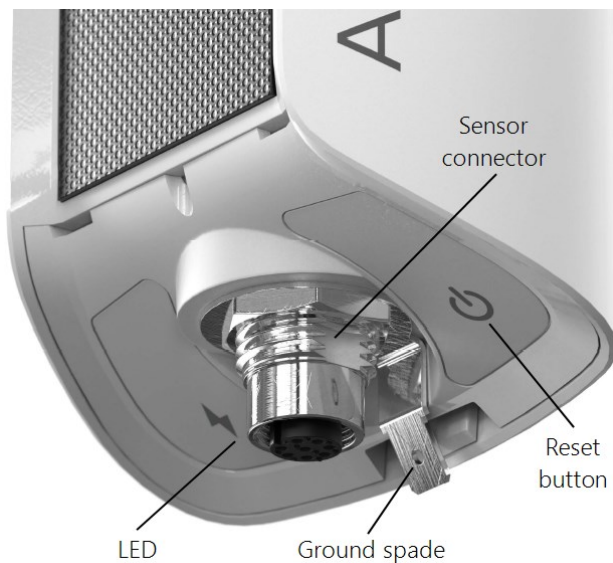
4. The LED will flash red and blue indicating the Aspen 10 is turning on, reading the sensor identification and obtaining a recipe (program and settings). See LED indicator (p. 16) and

> **WARNING:**
> The Aspen 10 sensor connector is for Campbell Scientific approved sensors and cable only. The connector is rated for 12 VDC@ 210 mA max. Cable is rated for 30 VDC. Connections to an unsuitable sensor, cable, or device may result in damaged equipment or loss of data. Go to www.campbellsci.com ⬀ for a list of compatible sensors and cables.

3.2 Grounding

Earth grounding is recommended when sensors are installed at distances greater than 10 meters (33 feet) from the Aspen 10. A good earth connection is recommended to secure the ground potential of the Aspen 10 and shunt transients away from electronics. Campbell Scientific recommends 14 AWG wire.

Drive a ground rod close to the Aspen 10. Drive the rod at an angle if an impenetrable hard-pan layer exists. Crimp one end of the ground wire to the insulated push-on ground terminal and slide it onto the ground spade. Fasten the other end of the ground wire to the ground rod.
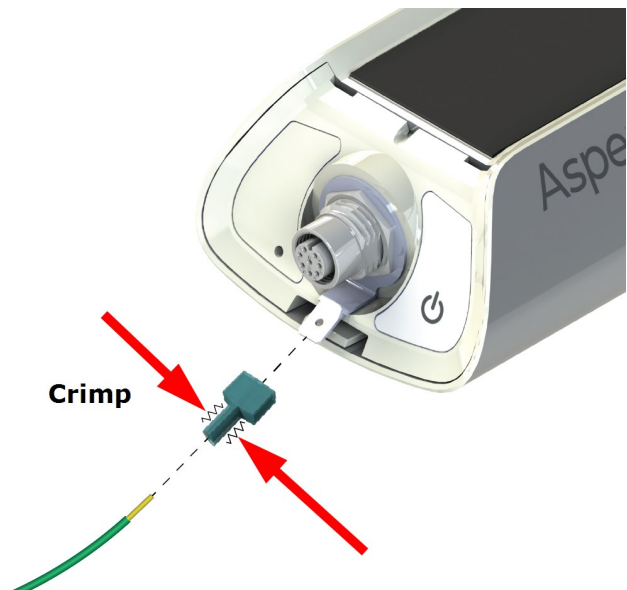
> **DANGER:**
> Contact local utilities for the location of buried utility lines before digging or driving ground rods.

Ensure all local electrical codes are followed by having electrical equipment and grounding installed by a licensed electrician.

3.3 Sensor connector

The Aspen 10 has an 8-pin M12 connector for approved cables and sensors. Individual pins and sockets are non-accessible. See product specifications⬀ for pinout details.
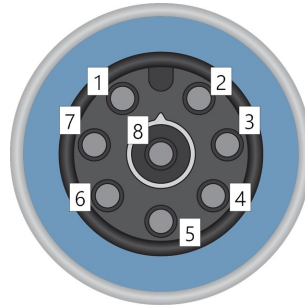
Figure 3-2. M12 connector pinout

4. *CampbellGo*

CampbellGo ⊙ enables secure NFC/Bluetooth pairing between a smartphone and the Aspen 10. This simplifies the installation process with real-time sensor readings, diagnostic tools, and data-to-cloud delivery information while you are on-site.

4.1 Install app

Install the **Go** app on the smartphone you will use for field work. The app is free and available through the Apple App Store or Google Play Store ⬈.

4.2 Create an asset

An asset is a device, data source, or other equipment associated with a station in *CampbellCloud*. The Aspen 10 is an asset. A station may contain one or many assets.

1. Open *CampbellGo* ⊙ on your phone.

2. Enter your *CampbellCloud* user name and password.

3. Tap **SIGN IN**.
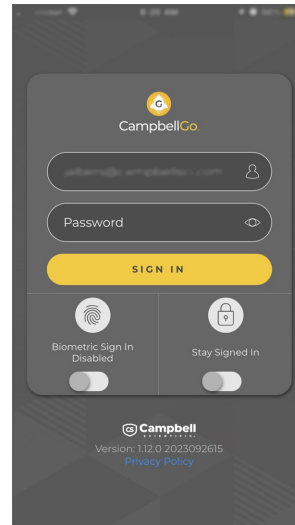
4. Because we have not yet added an asset, **Go** prompts us to add one. Tap **Add** Aspen 10.
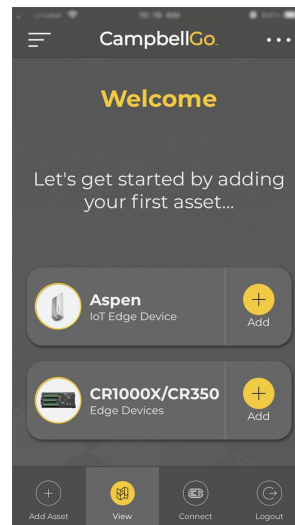
5. There are three ways to onboard the Aspen 10 asset: NFC, QR Scan, and UID Entry. **NFC** and **QR Scan** require use of a smartphone with those capabilities. For **UID Entry**, you will need the device UID that is printed below the QR code on the back of the Aspen 10.

6. If it is not already selected, tap **NFC** then **START**. The procedures for **QR Scan** and **UID Entry** are similar.
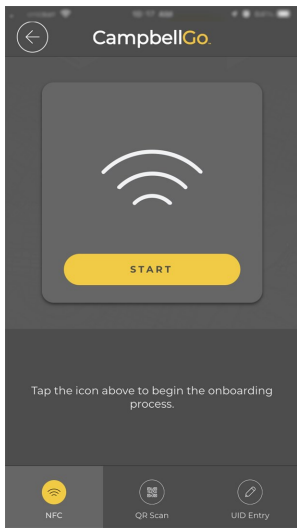
7. Hold phone close to the NFC tap icon))) on the side of the Aspen 10 until it vibrates and connects.

8. Go will identify the asset. Then enter a **Name**, (optional) **Description**, and (optional) labels.
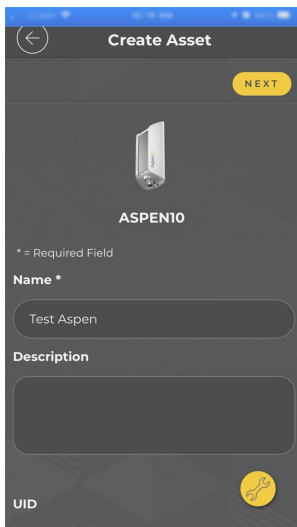
9. Tap **NEXT**.

10. This is a good time to check the orientation and angle of your installed Aspen 10. Tap the Installation Tool icon at the bottom right corner of the screen.
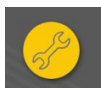
11. Hold your smartphone to the Aspen 10 solar panel.

12. Adjust the installation direction and angle. See Recommended solar panel orientation (p. 5).
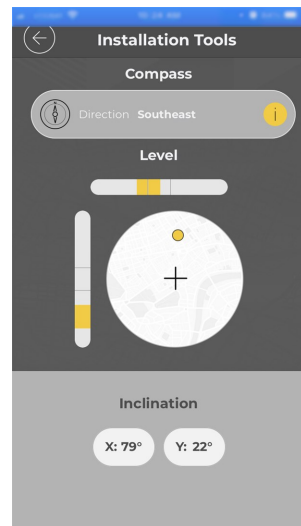
4.3 Create a station

A station is a location configured to manage assets and record measurements. A network may contain one or many stations.

1. After creating an asset you are prompted to create a station. Enter a **Name**, (optional) **Description**, and other (optional) information.
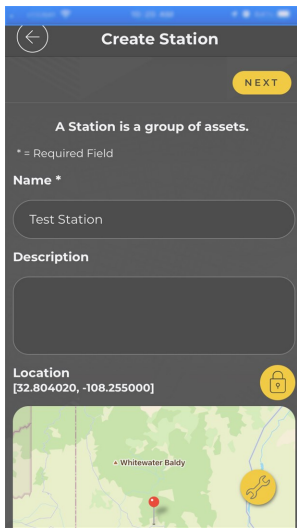
2. (Optional) Enter the station location. Tap the lock/unlock button. In the unlocked position you can tap the location on the map. Tap the lock/unlock button again to save the station location. Enter its elevation in meters.
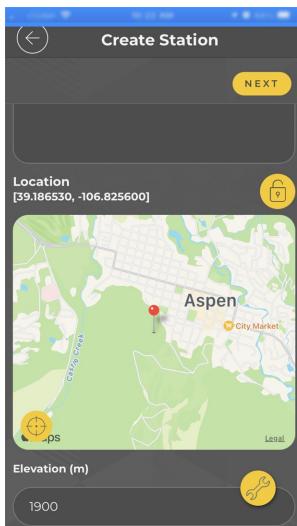
3. Tap **NEXT**.

4. Review the summary screen. Click **CONFIRM**.
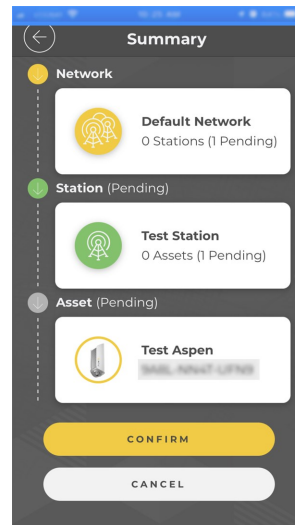
5. You will see the progress of your device communicating with Cloud. This could take several minutes to complete.
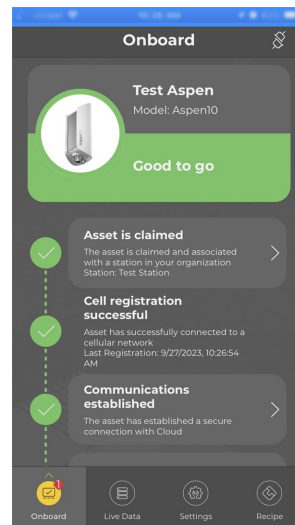
6. Once the process is complete you can view **Live Data** and other features through Go.

5. Field use

1. Open *CampbellGo* on your phone.

2. Enter your *CampbellCloud* user name and password.

3. Tap **SIGN IN**.
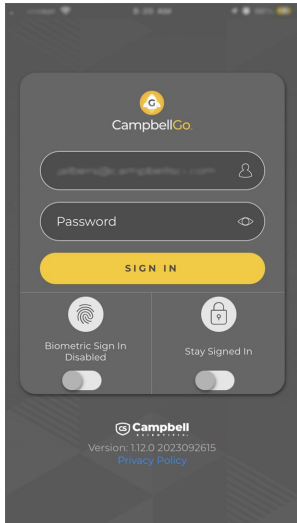
4. Tap **Connect**.

> **NOTE:**
> Your home screen may be different.
> This is a User setting in *CampbellCloud*.
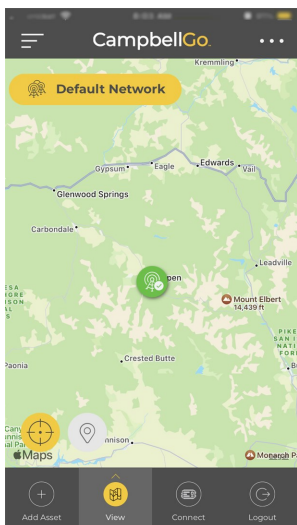
5. Tap **NFC Tap.**
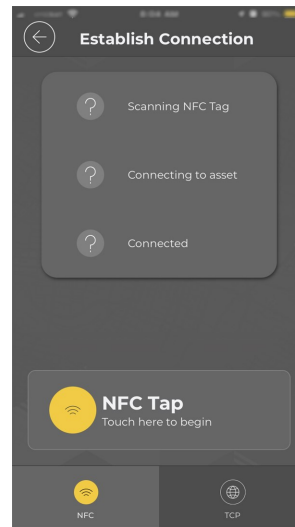
6. Hold phone close to the NFC tap icon))) on the side of the Aspen 10 until it vibrates and connects.
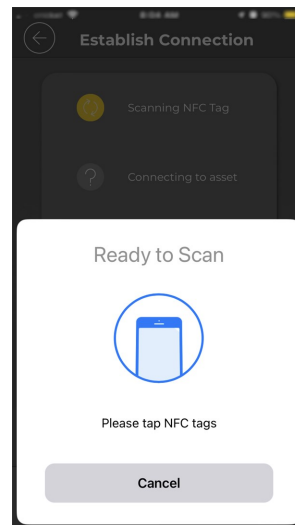
7. Important information on the health of your Aspen 10 is shown on the Status ⌇ screen. Swipe up to see all fields
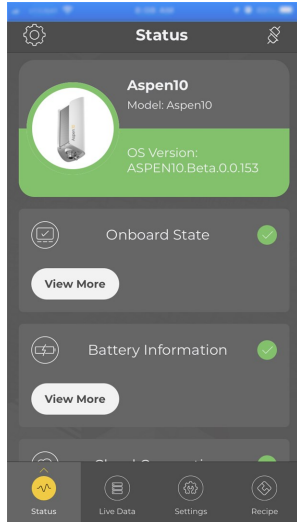
8. Select **Live Data**.

9. Swipe up to see all fields.
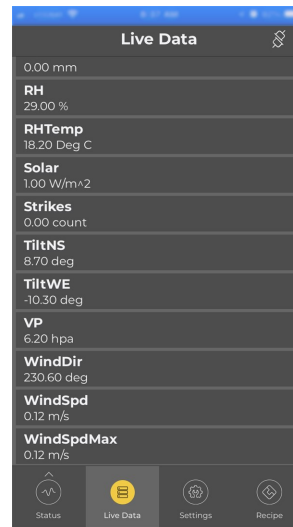
10. Tap the connection icon ⌇ to disconnect from the Aspen 10 and return to your home screen.

11. Check the LED. It should periodically flash red and blue for the next ten minutes then turn off. See LED indicator (p. 16) for more information.

6. Observation mode

To make field work more efficient, observation mode allows an on-site technician to see measurements and publish data to *Cloud* at faster intervals than normal. Enter observation mode by direct connecting to an Aspen 10 using **NFC Connect** in *CampbellGo* or pressing the **Power** button. Entering observation mode causes the following things to happen:

- The Aspen 10 wakes from its low-power mode.

- The internal cellular modem turns on and makes a connection to a cellular network.

- If a recipe is needed it is retrieved from *Cloud*.

- Measurements are taken at a faster rate. See Recipes (p. 18) for sensor specific information.

- Data is stored to the **Observations** table and published to *Cloud*.

Observation mode is automatically exited by closing the *Go* direct connection or after about ten minutes of inactivity.

7. LED indicator

The LED indicator is activated for approximately 10 minutes after the **Power** button is pressed or a direct connection has ended.

The red LED will turn on according to power and recipe states.

Table 7-1: Red LED activity	
State	Description
Off	Aspen 10 running in low-power mode
Off (immediately after **Power** button is pressed or a direct connection attempted)	No power, no recipe running.
One flash every 10 seconds	Powered from internal battery, recipe running
Two flashes every 10 seconds	Powered from internal battery with solar recharge active, recipe running

Table 7-1: Red LED activity

State	Description
Rapid flashing	Sensor detected, followed by always on while retrieving recipe
Always on	Powered, no recipe running. See Recipes (p. 18).

The **blue LED** will turn on according to cellular modem communications states.

Table 7-2: Blue LED activity

State	Description
Off	Aspen 10 running in low-power mode
Off (immediately after **Power** button is pressed or a direct connection attempted)	Cellular modem off, insufficient power, or failure to establish a connection with the provider (periodic retries will occur)
One flash every 10 seconds	Modem actively connection to *CampbellCloud*
Two flashes every 10 seconds	Modem attempting to establish connection with cellular provider
Three flashes every 10 seconds	Modem determining its location using a global navigation satellite system (GNSS)
Rapid flashing	Modem communications interrupted and modem turning off. Typically caused by pressing the Power button for 3 seconds.
Always on	Cellular modem turning on or off

Typical LED sequence when first installing an Aspen 10 and sensor is shown in the following table.

Table 7-3: Installation LED activity

Color and state[1]	Description
Red rapid flashing	Sensor first connected
Red always on	No recipe
Red always on, two blue flashes every 10 seconds	Modem connecting with cellular provider

Table 7-3: Installation LED activity	
Color and state[1]	Description
Red always on, one blue flash every 10 seconds	Modem connected to *Cloud*
Red always on. LEDs may go off completely for one to two seconds.	Retrieving recipe, loading program and restarting
One blue flash every two seconds. This will continue for about 10 additional minutes after the **Power** button is pressed or a direct connection has ended. Then the LED will turn off.	Recipe obtained successfully and program running

[1]LED may appear purple when red an blue LEDs are on at the same time.

8. Recipes

The Aspen 10 must have a recipe in order to make measurements, store data, and publish data to *CampbellCloud*. Aspen 10 recipes contain programs that are executed on a precise schedule, based on the Aspen 10 internal clock. On a time interval, specified in the recipe, the Aspen 10 stores data in tables and copies it to *Cloud*. The **Observations** table is only written to when in observation mode. See Observation mode (p. 16) for more information.

When the Aspen 10 does not have a recipe it automatically retrieves one from *Cloud* when the sensor is first connected. The following sections describe the data intervals and measurements associated with different sensor recipes.

8.1 ClimaVUE™50

Table 8-1: ClimaVUE™50 recipe data intervals			
Name	Description	Measurement interval	Publish to *CampbellCloud* interval
ClimaVUE50	Sample of all measurements	Five minutes	Ten minutes (two measurement intervals)
Observations	Sample of all measurements	20 seconds when in observation mode	20 seconds when in observation mode

Table 8-2: ClimaVUE™50 recipe measurements		
Measurement	**Description**	**Units**
Solar	Solar flux density	W/m^2
Rain	Precipitation	mm
Strikes	Lightning strike count	count
Dist	Strike distance	km
WindSpd	Wind speed	m/s
WindDir	Wind direction	°
MaxWindSpd	Wind speed max.– 10 second gust	m/s
AirTemp	Air temperature	°C
VP	Vapor pressure	hPa
BP	Barometric pressure (absolute)	hPa
RH	Relative humidity	%
RHTemp	Temperature (temperature/humidity sensor)	°C
TiltNS	Tilt North(+)/South(–) orientation	°
TiltWE	Tilt West(+)/East(–) orientation	°

8.2 HygroVUE™5

Table 8-3: HygroVUE™5 recipe data intervals			
Name	**Description**	**Measurement interval**	**Publish to *CampbellCloud* interval**
HygroVUE5	Sample of all measurements	Five minutes	Ten minutes (two measurement intervals)
Observations	Sample of all measurements	20 seconds when in observation mode	20 seconds when in observation mode

Table 8-4: HygroVUE™5 recipe measurements

Measurement	Description	Units
Temp	Temperature	°C
RH	Relative humidity	%

8.3 RainVUE™10

Table 8-5: RainVUE™10 recipe data intervals

Name	Description	Measurement interval	Publish to *CampbellCloud* interval
RainVUE10	Sample of all measurements	Five minutes	Ten minutes (two measurement intervals)
Observations	Sample of all measurements	10 seconds when in observation mode	10 seconds when in observation mode

Table 8-6: RainVUE™10 recipe measurements

Measurement	Description	Units
Rain	Intensity correctedrain accumulation since last measurement, typically five minutes.	mm
Tips	Number of raw bucket tipssince last measurement, typically five minutes.	count
TotalAccumulation	Total intensity correctedaccumulation over last five minutes. **NOTE:** Not reset when in observation mode.	mm
AverageIntensity	Average precipitation intensitysince last measurement, typically five minutes.	mm/hr
PeakIntensity	Maximum (peak) intensitysince last measurement, typically five minutes.	mm/hr

8.4 SnowVUE™10

Table 8-7: SnowVUE™10 recipe data intervals

Name	Description	Measurement interval	Publish to *CampbellCloud* interval
SnowVUE10	Sample of all measurements	One hour	One hour
Observations	Sample of all measurements	20 seconds when in observation mode	20 seconds when in observation mode

Table 8-8: SnowVUE™10 recipe measurements

Measurement	Description	Units
Distance	Distance to snow	m
QualityNum	Quality number	N/A
ExtTemp	External temperature	°C
IntTemp	Internal temperature	°C
IntRH	Internal RH	%
Pitch	Pitch	°
Roll	Roll	°
SupplyVolt	Supply voltage	V
Freq	Resonant frequency(should be 50 kHz)	kHz
AlertFlag	Alert flag0 = good1 = transducer outside ofnormal operating range	N/A

8.5 SoilVUE™10

Table 8-9: SoilVUE™10 recipe data intervals

Name	Description	Measurement interval	Publish to *CampbellCloud* interval
SoilVUE	Sample of all measurements	One hour	One hour
Observations	Sample of all measurements	60 seconds when in observation mode	60 seconds when in observation mode

Table 8-10: SoilVUE™10 recipe measurements

Measurement	Description	Units
VWC_5	Volumetric Water Content, 5 cm	m^3/m^3
Ka_5	Relative Permittivity, ε, 5 cm	
T_5	Temperature, 5 cm	°C
EC_5	Bulk Electrical Conductivity, 5 cm	dS/m
VWC_10	Volumetric Water Content, 10 cm	m^3/m^3
Ka_10	Relative Permittivity, ε, 10 cm	N/A
T_10	Temperature, 10 cm	°C
EC_10	Bulk Electrical Conductivity, 10 cm	dS/m
VWC_20	Volumetric Water Content, 20 cm	m^3/m^3
Ka_20	Relative Permittivity, ε, 20 cm	N/A
T_20	Temperature, 20 cm	°C
EC_20	Bulk Electrical Conductivity, 20 cm	dS/m
VWC_30	Volumetric Water Content, 30 cm	m^3/m^3
Ka_30	Relative Permittivity, ε, 30 cm	N/A
T_30	Temperature, 30 cm	°C
EC_30	Bulk Electrical Conductivity, 30 cm	dS/m
VWC_40	Volumetric Water Content, 40 cm	m^3/m^3
Ka_40	Relative Permittivity, ε, 40 cm	N/A

Table 8-10: SoilVUE™10 recipe measurements		
Measurement	**Description**	**Units**
T_40	Temperature, 40 cm	°C
EC_40	Bulk Electrical Conductivity, 40 cm	dS/m
VWC_50	Volumetric Water Content, 50 cm	m^3/m^3
Ka_50	Relative Permittivity, ε, 50 cm	N/A
T_50	Temperature, 50 cm	°C
EC_50	Bulk Electrical Conductivity, 50 cm	dS/m

8.6 Wintersense™SDI-12

Table 8-11: Wintersense SDI-12 recipe data intervals			
Name	**Description**	**Measurement interval**	**Publish to *CampbellCloud* interval**
Wintersense	Sample of all measurements	Five minutes	Ten minutes (two measurement intervals)
Observations	Sample of all measurements	20 seconds when in observation mode	20 seconds when in observation mode

Table 8-12: Wintersense SDI-12 recipe measurements		
Measurement	**Description**	**Units**
SurfaceTemp	Surface temperature	°C
AirTemp	Air temperature	°C
RH	Air relative humidity	%
DewPointTemp	Dew point temperature	°C
Angle	Tilt	°
SupplyVoltage	Supply voltage	V
SensorTemp	Sensor body temperature	°C

Appendix A. Glossary

A

asset

Primarily this is a data source such as a data logger or Aspen 10. It can also be another piece of hardware.

N

network

A group of stations

NFC

Near field communications

O

onboard

A collective term for the tasks that have to complete successfully in order for a data source asset to be correctly configured and send data to CampbellCloud. These tasks may be automated or require manual user input depending on the data source type. For Aspen 10 data sources, these tasks include asset claiming, automated sensor identification, cellular communications registration, secure Cloud communications, program retrieval, successful sensor measurement, and confirmation that Cloud received data.

organization

An entity that uses CampbellCloud services to manage a network of stations owned by the entity. Every user must be associated with an organization.

Q

QR code

Quick response barcode

R

recipe

A set of files that include the Aspen 10 program, settings and configuration for a specific sensor and application.

S

station

A group of assets

U

UID

Unique identifier

user

Individuals who have been added to an organization account. Users are assigned permissions via the Security Groups application.

Global Sales and Support Network
A worldwide network to help meet your needs

○ Corporate Headquarters
● Regional Office

Campbell Scientific Regional Offices

Australia
Location:	Garbutt, QLD Australia
Phone:	61.7.4401.7700
Email:	info@campbellsci.com.au
Website:	www.campbellsci.com.au

Brazil
Location:	São Paulo, SP Brazil
Phone:	11.3732.3399
Email:	vendas@campbellsci.com.br
Website:	www.campbellsci.com.br

Canada
Location:	Edmonton, AB Canada
Phone:	780.454.2505
Email:	dataloggers@campbellsci.ca
Website:	www.campbellsci.ca

China
Location:	Beijing, P. R. China
Phone:	86.10.6561.0080
Email:	info@campbellsci.com.cn
Website:	www.campbellsci.com.cn

Costa Rica
Location:	San Pedro, Costa Rica
Phone:	506.2280.1564
Email:	info@campbellsci.cc
Website:	www.campbellsci.cc

France
Location:	Montrouge, France
Phone:	0033.0.1.56.45.15.20
Email:	info@campbellsci.fr
Website:	www.campbellsci.fr

Germany
Location:	Bremen, Germany
Phone:	49.0.421.460974.0
Email:	info@campbellsci.de
Website:	www.campbellsci.de

India
Location:	New Delhi, DL India
Phone:	91.11.46500481.482
Email:	info@campbellsci.in
Website:	www.campbellsci.in

South Africa
Location:	Stellenbosch, South Africa
Phone:	27.21.8809960
Email:	sales@campbellsci.co.za
Website:	www.campbellsci.co.za

Spain
Location:	Barcelona, Spain
Phone:	34.93.2323938
Email:	info@campbellsci.es
Website:	www.campbellsci.es

Thailand
Location:	Bangkok, Thailand
Phone:	66.2.719.3399
Email:	info@campbellsci.asia
Website:	www.campbellsci.asia

UK
Location:	Shepshed, Loughborough, UK
Phone:	44.0.1509.601141
Email:	sales@campbellsci.co.uk
Website:	www.campbellsci.co.uk

USA
Location:	Logan, UT USA
Phone:	435.227.9120
Email:	info@campbellsci.com
Website:	www.campbellsci.com