SOFAR

Spotter

User Guide

Spotter

User Guide


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Table of Contents

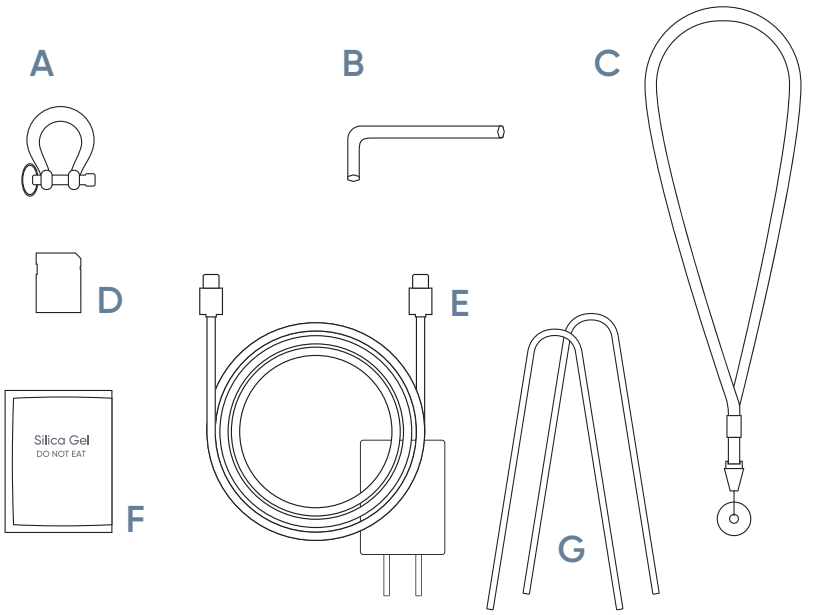
Scan the QR code to access
online Support page

What's Included

Spotter device

Spotter toolkit, including:

A	Bow shackle for attaching a mooring line
B	5mm hex key to open and close the lid of Spotter
C	Lanyard and magnet to switch between **IDLE** and **RUN** mode(s)
D	SD card for data storage during deployment (shipped with unit)
E	USB-C power charger to charge the battery prior to deployment
F	Marine-safe desiccant to reduce moisture inside Spotter
G	Mousing wire to secure shackles



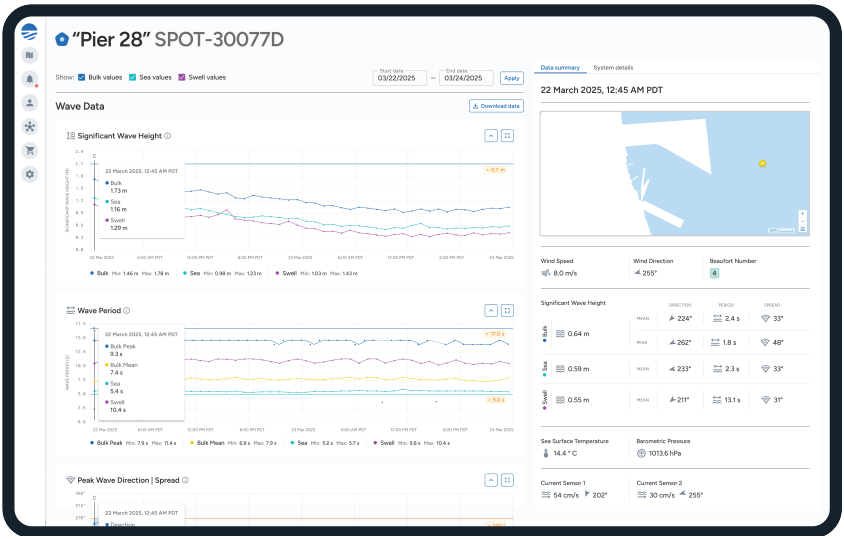
Sofar Spotter

Spotter is an integrated solution for collecting ocean data. The Spotter platform consists of a globally-connected buoy (“Spotter”), the online Spotter Dashboard, and the Spotter Data API.

The Dashboard allows you to configure your Spotter remotely and provides access to real-time Spotter ocean and tracking data, system status, alerts, and data visualization.

CORE SYSTEM FEATURES

2-Way Communication	Remotely change settings on Spotter through the online Dashboard.
Alerts + Notifications	Set a system or measurement alert and receive notifications when thresholds are reached.
Spotter API	Access Spotter data via our API for seamless application integration.
Track Mode	Fast positional updates for tracking Spotter through the Dashboard.



Core Features

Spotter is a compact and lightweight instrument consisting of a waterproof hull, solar panel array, and electronics package.

Spotter is completely solar-powered, so you don't have to replace or recharge the battery during deployment. The solar-battery power system is designed to support Spotter at higher latitudes in limited light conditions.

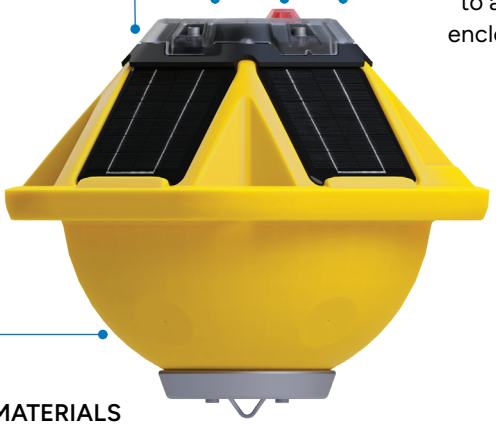
Spotter stores the data it collects on its onboard SD card and transmits condensed forms of that data over cellular and satellite connections.

MAGNET SWITCH
Use a magnet to switch modes without opening the unit and risking water intrusion

CAPTIVE LID SCREWS
Screws will not get lost when lid is removed

STROBE LIGHT
Flashes amber for nighttime visibility

TRANSPARENT LID
LEDs provide clear visual indication of system status, and lid can be removed to access electronics enclosure and SD card

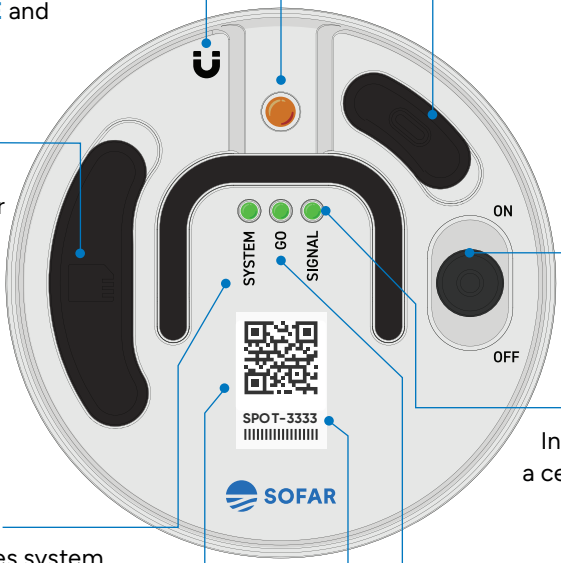


MARINE GRADE MATERIALS

HARDWARE INTERFACE
Integrated bottom attachment point

For mooring applications see p. 16

User Interface



STROBE LIGHT

MAGNET
Hold here for 3 seconds to switch between **IDLE** and **RUN** modes

USB-C
Charger and data transfer

SD CARD
Onboard storage, cover provides retention and splash protection

ON/OFF
switch

SIGNAL LED
Indicates whether a cellular network is present

SYSTEM LED
Communicates system health status

GO LED
Displays status of GPS connectivity and solar charging system

QR CODE
Scan for quick access to Spotter Dashboard

SPOTTER ID #

Getting Started

STEP 01

Set up account and register Spotter

Set up user account

Visit **spotter.sofarocean.com** to set up your user account. Click “Create an account,” enter personal details, and click “Register.” This will take you to the overview page.

Register your Spotter

To register your Spotter, click ☰ and then “Register Spotter.”

Enter your Spotter ID number and your activation code, which you should have received by email from the Sofar team. If you have not received this, or do not have this available anymore, please contact Sofar at: **support@sofarocean.com**

Your Spotter ID number is also listed on the device, and looks like SPOT-######. After entering this information, click “Register.”

You will now see your Spotter listed on the overview page. The map will update as soon as the first data message is received, which typically takes 1-1.5 hrs from device power on. Please note that message and data transmission require a clear view of the sky with minimal obstruction in order to establish a GPS signal and communicate effectively.

Spotter requires a clear view of the sky with minimal obstruction.

STEP 02

Set up Spotter device

Ready to go

Spotter device is completely self-powered and can be operated right out of the box.

Check the SD card

When inserting or checking the SD card, please make sure the card is properly seated. The SYSTEM LED will turn red if the card is not seated correctly.

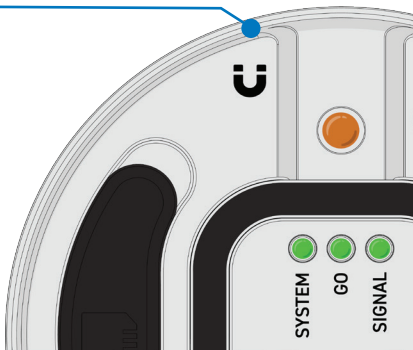
Turn Spotter on

Switch the on/off switch to the “on” position to turn Spotter on. During boot-up, the SYSTEM and GO LEDs will be orange, and after startup they will switch to green. Spotter has two possible operating modes: **IDLE** mode and **RUN** mode. You can switch between modes using the provided magnet by holding it at the designated area for 3 seconds. Spotter will always boot into the last mode it was in before it was switched off.

Check cellular network

Spotter comes equipped with cellular connectivity. For more information about cellular data transmission, data plans, firmware updates, and how you can use Spotter’s SIGNAL LED to determine whether the cellular signal is strong enough at your desired deployment location, please visit **www.sofarocean.com/support-docs/cellular**

MAGNET
Hold here for 3 seconds to switch between **IDLE** and **RUN** modes



IDLE	RUN
In **IDLE** mode, the SYSTEM and GO LEDs alternate flashing green. The strobe light will be OFF.	In **RUN** mode, the SYSTEM and GO LEDs are solid green and the amber strobe light flashes periodically.
IDLE mode is to save power and suspend data acquisition and transmission. Using the magnet, you can switch to **RUN** mode without having to open the lid.	**RUN** mode is for full system functionality, including: data acquisition, processing, data transmission, and onboard logging to SD card.
Use **IDLE** mode for short-term inactivity, in preparation for deployment (e.g. transport to deployment site).	Use **RUN** mode during deployment.

Note: Spotter DOES NOT collect data when in ***IDLE*** *mode.*

Important

- Spotter needs to be switched into **RUN** mode for deployment.
- If Spotter is in **IDLE** mode, you can switch to **RUN** mode by holding a magnet onto the recessed area directly on top of the electronics box until the lights turn off. Or, if the transparent lid is screwed on, hold the magnet onto the recessed round area in the lid for 3 seconds.
- The flashing pattern of the the SYSTEM and GO LEDs and the strobe light will reveal which mode Spotter is in. (See next pages.)
- In **IDLE** mode, the SYSTEM and GO LEDs will shut off after 3 minutes to save power.
- When switched to **RUN** mode, the SYSTEM and GO LEDs communicate system status and signal when Spotter is ready to deploy.

Explanation of user LEDs

SYSTEM LED

Communicates system health status

GO LED

Displays status of GPS connectivity and solar charging system

SIGNAL LED

Indicates whether messages are transmitting over cellular

Explanation of user LEDs *(continued)*

IDLE mode

SYSTEM GO SIGNAL

AT STARTUP

Both solid orange. System is booting up and running self-check.

AFTER STARTUP

Blinking green. The system is in **IDLE** mode. Flashes in alternating pattern between SYSTEM and GO LEDs for 3 minutes and then turns off.

CHARGING mode

Note: While OFF and connected to a DC charger, Spotter's lights will indicate its charge status. Please note that charging Spotter can take as long as 8 hours.

SYSTEM GO SIGNAL

Both solid green. System is fully charged.

Blinking green in sync. System is charging.

Both solid red. Battery error, battery is not connected.

Both blinking red. Charging error, device is connected to DC power but not charging properly.

RUN mode

SYSTEM GO SIGNAL

AT STARTUP

Both solid orange. System is booting up and running self-check.

AFTER STARTUP

Both solid green. All systems are checked and OK. Ready to deploy. Both LEDs will time out after 60 minutes to save power.

RUN mode (continued)

SYSTEM GO SIGNAL — AFTER STARTUP (CONTINUED)

Blinking green GO LED. System is not solar charging but is trying to acquire GPS signal. If this is a night deployment or the panels are covered, ignore and deploy. If this is a day deployment, something is wrong with the charging system. Do not deploy.

Solid red SYSTEM LED. Check if SD card is present. If not, turn off system, insert a freshly formatted SD card, and switch back on. If the red light persists, there may be a serious system error. Do not deploy until this is resolved and please contact the Sofar team.

Solid red GO LED. Limited GPS connectivity. Ensure system is outside with a clear view of the sky. Wait a few minutes for system to connect with the GPS satellite. If the system has a clear view of the sky and the GO LED remains red for longer than 30 minutes, something may be wrong. Please contact the Sofar team.

Both solid red. Do not deploy. Follow instructions for red SYSTEM or GO LED detailed above.

Connectivity

Note: the SIGNAL LED on satellite-only systems is always unlit.

SYSTEM GO SIGNAL

All Solid Green. Cellular data is available; ready to deploy.

Solid red SIGNAL LED. Cellular data is not available; if deployed, unit will still be able to use Iridium.

Blinking orange SIGNAL LED. Cellular data is syncing, please be patient

STEP 03

Deploy Spotter in the water

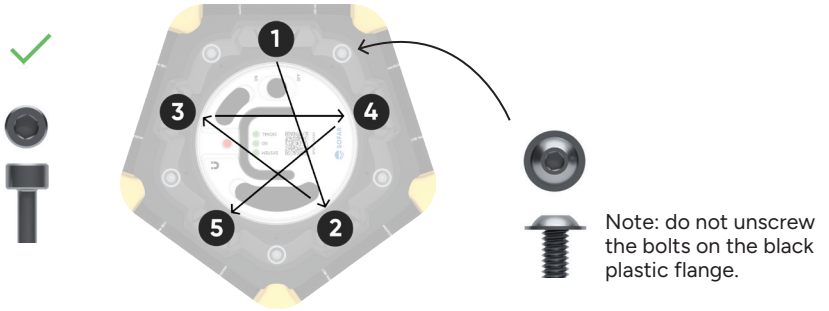
Activate Spotter in **RUN** mode

Switch Spotter ON and ensure Spotter is in **RUN** mode. Ensure both SYSTEM and GO LEDs are green after ~10 minutes with a clear view of the sky. In warm environments, don't leave systems out of the water in direct sun for more than 3 hours when dry testing. This will cause the battery to overheat and the system will disable charging to protect it.

Please note that the SYSTEM and GO LEDs time out after 60 minutes to save power. After 60 minutes you can see that the system is in **RUN** mode from the flashing of the strobe light.

Carefully secure lid

Secure the lid using a 5 mm hex key and hand-tighten (~10 in-lbs of torque) the 5 captive screws (with washers) using a star pattern. The captive screws will bottom out to prevent over-tightening.



Note on Mooring Design: Spotter can be deployed either as a free- floating drifter or in a moored configuration. For free-floating deployments, Spotter comes with everything required to deploy. For moored applications, you will need to design a mooring to anchor Spotter to the seafloor.

Visit **www.sofarocean.com/support** for more information on mooring guidelines.

STEP 04

Check your Spotter Dashboard

Log in to your account

Visit **spotter.sofarocean.com** to log in to your user account. Once you are logged in you are on the overview page. If your Spotter has been deployed, it will display as a pulsing dot on the map. In that case, Spotter is set up properly and you can access your data.

Currently the Dashboard allows you to:

- View real-time surface wave data from your Spotter.
- Search and download historical data for a custom date range.
- Track your Spotter on the map so you can plot and estimate surface currents or anticipate a retrieval strategy.
- Set a geofence so that you are notified if Spotter detaches from its mooring or otherwise moves outside the set boundaries.
- Add measurement alert so that you are notified if Spotter observes something of interest.
- Remotely switch Spotter between Waves and Track mode. See the "Spotter Measurements" section on page 20 to determine which mode you need for your application.
- Access our API to integrate ocean data into your own applications.
- Review health status of your Spotter (battery, system status) and get notified when something is off.
- Check and renew your data subscription.
- Change your personal profile.

Besides the features described above, we are constantly developing new functionality for Spotter, so keep an eye on the Spotter Dashboard for the latest news and updates.

Note: Instructions for the Dashboard were included in the email that you received with your activation code.

STEP 05

Retrieve and store Spotter

Retrieve Spotter

After retrieval, disconnect the mooring and rinse off Spotter and mooring with fresh water before storage. If any fouling has built up on Spotter, this can generally be removed with a soft brush and soapy water.

Turn the device off for storage

After rinsing, dry the area around the lid and unscrew the lid using the 5mm hex key. Remove the lid carefully to prevent water from dropping onto the electronics box. After the lid is removed, turn the device off using the on/off switch. At this point you can also remove the SD card and download the data stored on the card to your personal computer.

If you plan to store Spotter for a longer period of time, please see the notes on “Lithium-ion battery use and storage” below.

If you plan to deploy after a prolonged storage period, we recommend that you use the wall charger provided to fully charge Spotter before deployment. This ensures that the system can start up and operate without delay.

Before redeployment, we recommend that you replace the desiccant inside the Ebox. Spare desiccant can be found inside the included Spotter accessory kit. In most models of Spotter, the desiccant will change color from its natural orange to a dark green as it becomes more saturated.

Lithium-ion battery use and storage

Spotter units are equipped with a lithium-ion battery pack, which is located inside the electronics box. It is important to handle Spotter with care to prevent any possible damage to the electronics and battery pack. For prolonged storage (longer than a week), Spotter should ideally be stored in a cool (< 25°C) and dry area with the battery at a medium charge. Never store Spotter in < -20°C.

Lithium-ion battery packs stored at or near full charge for extended periods of time can experience a reduction in battery capacity. Therefore, if planning to store for longer than 1 week, we advise that the battery not be fully charged. One way to ensure proper state of battery charge is to run the system for two days without solar power (in a box or dark room) before turning it off and putting it in storage.

Avoid submersion of Spotter

Spotter is not rated for continuous submersion. Continuous submersion can lead to damage or failure of critical components, such as the barometer or sea surface temperature sensor. Possible causes of continuous submersion include:

- Excessive biofouling accumulation on Spotter or mooring lines.
- A Spotter moored directly in the surf zone or in a way where it is pulled through the face of a breaking wave.
- Moorings with too much drag or that are missing the required surface float(s) recommended in the mooring guidelines.
- Moorings that are incompatible with site-specific ocean conditions, such as waves and currents.

Please see the Support section of our website for the latest guidelines on mooring and maintaining your Spotter:
www.sofarocean.com/support

Data Access & Spotter Measurements

Data Access

Spotter collects displacement (3D movement) data continuously at 2.5Hz. This data is stored as a time series on the onboard SD card and sent to Sofar's online Dashboard and APIs. Depending on which mode Spotter is in, different data is available in different places. To learn more about data access visit **www.sofarocean.com/support**

Spotter Measurements

Spotter has several modes that can be set remotely through the online Dashboard. Spotter modes can be changed and further customized to fit various applications. To learn more about the different modes and how to enable them, visit:
www.sofarocean.com/posts/spotter-data-modes

Waves:Standard mode

Waves:Standard is the default mode and is recommended for most marine monitoring applications. Displacement data is collected continuously at 2.5Hz. Every 30 minutes, Spotter computes wave and wind statistics. To save transmission bandwidth, two time-stamped 30 minute bulk statistics are transmitted every hour.

The standard bulk statistics includes these parameters:

- Position (latitude and longitude)
- Significant Wave Height
- Peak/Mean Period
- Peak/Mean Direction
- Peak/Mean Directional Spread

All bulk statistics are computed over frequency range 0.03 – 0.8Hz.
For definitions of various bulk wave statistics see e.g. Holthuijsen (2007).

Waves:Partition

Waves:Partition mode is a balance between Standard and Spectrum modes. In this mode, Spotter also provides the same bulk parameters for two “sea” (short period) and “swell” (long period) wave partitions. Waves:Partition uses a 60 minute sample window.

Waves:Spectrum

Waves:Spectrum is recommended for deeper analysis, modeling, and science applications. In this mode, Spotter transmits the variance density spectrum and directional moments as a function of frequency. Waves:Spectrum uses a 60 minute sample period to improve the statistical estimate of spectrum and directional moments. Waves:Spectrum has an adjustable update rate of between 1 and 6 hours.

Note: Spectrum data is only available via the API, bulk statistics will still be displayed on the Dashboard.

Note: Update rates faster than 6 hours will incur higher data usage costs than Waves:Standard mode due to the increased amount of data transmitted.

High Data Rate (HDR) — Cellular Only

Spotters with cellular connectivity can take advantage of low cost and high bandwidth LTE networks to transmit richer data. Spotter data sent over HDR can be used to generate the data from all the modes described above - and more - at a fraction of the cost. Sample and update rates can be configured to as short as 15 minutes.

Track Mode

Track mode is intended for retrieval of free-drifting Spotters or for other tracking needs. In Track mode, positional updates are transmitted every 15 minutes. Spotter does not transmit wave data when in Track mode, but data is stored locally to the SD card.

Data Subscription Guide

The Spotter Platform transmits data messages over cellular or satellite “lines”. There are two components of your Spotter Platform subscription:

Line “rental”

This gives you access to the "line" along which the data from your Spotter travels for one month. Satellite line rental costs $20 per month. Cellular line rental costs $30 per month.

Satellite credits

For satellite telemetry, there is an additional $0.14 cost is for each message sent by your Spotter. We refer to these as “satellite credits.”

How many satellite credits do I need?

Use this chart as a guide to purchasing. During deployment, the Telemetry Overview page will display a usage summary.

Spotter Data Mode	Monthly Credit Usage
Waves:Standard (1hr) - default	744
Waves:Standard (30m)	1488
Waves:Partition	744
Waves:Spectrum (1hr)	4,464
Waves:Spectrum (3hrs)	496
Waves:Spectrum (6hrs)	124
Track	2,976
Each subsurface sensor	744

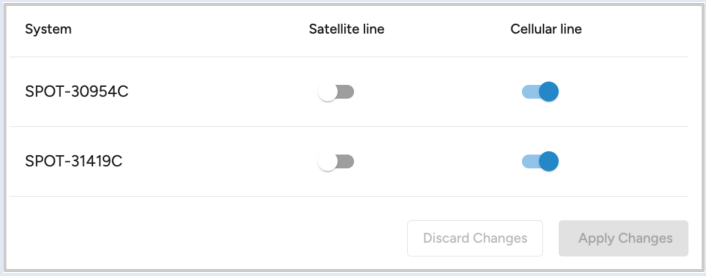
Start Billing

When your Spotter is activated and ready to deploy, go to the Spotter dashboard to add subscription items.

1. In the ***Subscription Overview*** menu, click Edit and update the Quantity fields for the number of satellite and/or cellular line(s) needed and click Purchase. If you have no prepaid account balance, this step will require payment via credit card.

2. When using satellite lines, purchase satellite credits. Spotter, by default, uses Waves:Standard (1hr) data reporting, and this uses approximately 744 satellite credits per Spotter per month. See the chart below for more data usage options.

3. In the ***Telemetry Overview*** menu, toggle ON the cellular and/or satellite lines(s) for each Spotter being deployed.



Stop Billing

When your deployment is complete, take these actions in the Spotter dashboard to stop billing.

1. In the ***Telemetry Overview*** menu, toggle OFF the satellite and/or cellular line(s) for each Spotter.

2. In the ***Subscription Overview*** menu, reduce the satellite and cellular line Quantity field(s) by the number of Spotters no longer using data.

IMPORTANT: Physically turning your Spotter off using the ON/OFF switch will stop data consumption, however it will NOT stop billing for the line rental. You MUST also deactivate your line rental in the dashboard to stop billing.

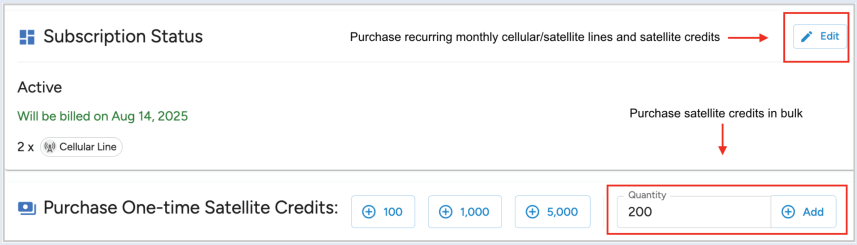
Do I need cellular AND satellite lines for each Spotter?

If you are planning to deploy your Spotter within cellular range, Sofar recommends purchasing both cellular and satellite lines for each Spotter. This ensures seamless data transmission in instances where there is poor or intermittent cellular coverage. If a Spotter unexpectedly drifts out of cellular range, it will fall back to satellite service. It then resumes cellular service when back in cellular range. A Spotter deployed far offshore may not need a cellular line.

Also, be sure to check your purchase documents. Some Spotters have satellite modems only. If your Spotter does not have a cellular modem installed, then it can only transmit over satellite.

How do I purchase data lines and satellite credits?

Data lines can be purchased using a credit card via the Subscription Overview page in the Spotter Dashboard. Your card will be billed monthly for the number of lines purchased. Satellite credit amounts can be purchased as-needed, or on a recurring monthly basis. If you are unable to pay with a credit card, your salesperson can provide a quote.



Product Specifications

Data and Connectivity

Connectivity	Iridium SBD (satellite) and Cellular
Data storage and access [01]	1. Full-size 16GB SD card (onboard) - saves displacement time series, spectra and statistics, surface currents, and positions for 1 year 2. Online Dashboard - unlimited real-time wave statistics and tracking data 3. Spotter Data API - access both the latest and historical data
Applications	**Free-drifting:** Spotter measures waves, position and surface currents, designed to operate in any current speed **Moored:** Spotter measures waves and position, plus whichever sensors are attached

Spotter is equipped to transmit data globally via a cellular modem or by Iridium satellite connection. For more information about connectivity and data plans, please visit www.sofarocean.com/support

Onboard Data Analysis

Spectral output	Function of frequency: variance density spectrum, directional moments, mean direction, directional spreading.
Frequency range	0.033 - 1 Hz (30s - 1s)
Frequency resolution	0.0098 Hz
Bulk statistics	Significant wave height, mean period, peak period, mean direction, mean directional spread, peak direction, peak directional spread

[01] For more information, please visit:
www.sofarocean.com/posts/spotter-data-access

Power, System Upgrade, and Monitoring

Primary power source	Solar-powered, 5× 2 Watt, 6 Volt solar panels
Battery	Rechargeable Lithium-ion 13,400 mAh capacity, 3.7 Volts
Firmware upgrade	Standard USB-C connector (cable included), Over-the-Air upgrades for cellular Spotters
System monitoring	Internal temperature, humidity, and solar charging monitored for system health

Motion Sensing

Motion data format	Easting, northing, elevation, latitude, longitude
Wave frequency range	0.03 - 1 Hz (30s - 1s)
Wave direction range	0 - 360 degrees (full circle)
Sampling rate	2.5 Hz (Nyquist at 1.25 Hz)
Wave displacement accuracy	Approximately ±2 cm , practical accuracy depends on field of view, conditions, and GPS system status

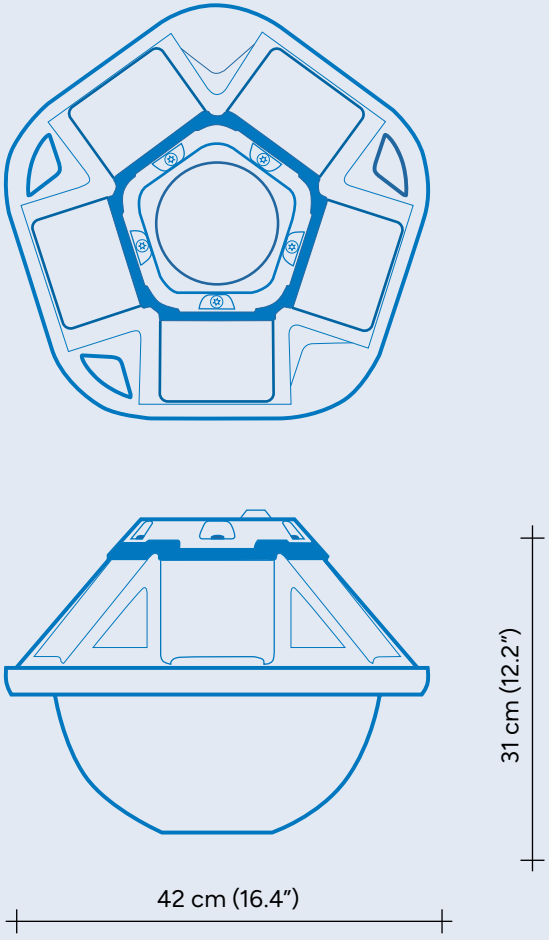
Additional Onboard Sensors

Sea surface temperature (Not included with Spotters with Smart Mooring)	Range Accuracy Resolution	-5°C - 50°C 0.1 °C absolute ±0.02°C
Barometer (Station Pressure)	Range Accuracy	700 - 1100mbar ±0.5 mbar at 25°C

Product Specifications

Dimensions and Weight

Weight	7.45 kg (16 lbs, 7 oz)
Height	31 cm (12.2 in)
Width	42 cm (16.5 in)



Legal

Trademarks and Patenting

Sofar Spotter and other Sofar products are covered by U.S. and international patents. For a full list of Sofar's patents, please refer to: www.sofarocean.com/legal/patents

The Sofar logo and the terms "Sofar Ocean" and "Spotter" are trademarks belonging to Sofar Ocean Technologies, Inc ("Sofar Ocean"). All other related designs, text, graphics, pictures, videos, or any other proprietary intellectual property included with this purchase are the property of Sofar Ocean or its vendors or licensors.

Terms and Policies

Your purchase and use of Spotter, including any associated software, is subject to the following Sofar policies:

Sofar Terms of Sale
Sofar Terms of Use
Privacy Policy
Warranty Policy
Return Policy
www.sofarocean.com/legal

Should you have any questions about these policies or your rights and responsibilities relating thereto, please contact Sofar at:
support@sofarocean.com

Scan the QR code to visit
our online Support Page

Safety & Compliance

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC (Federal Communications Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by Sofar could void your warranty and your authority to operate this equipment.

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 operations.

This device contains a certified transmitter module which is located in the electronics package, FCC number Q639603N.

⚠ CAUTION

If the device is damaged due to water ingression or otherwise, do not use or charge your Spotter, and disconnect the solar panels.

Lithium batteries and products that contain them must be disposed of properly. Contact your local waste management company or municipality for safe disposal instructions.

Safety and Handling Considerations

As with any marine activity, take caution when deploying your Spotter. Ensure that you are familiar with the operation of your watercraft and have the necessary safety gear and safety precautions in place prior to your deployment. Secure your Spotter while it is in transit so that it is not lost or damaged. When deploying your Spotter from a boat, stay clear of all lines, especially when deploying a mooring weight.

Your Spotter contains a lithium-ion battery. Do not attempt to replace the battery yourself—you may damage the battery, which could cause overheating, fire, and injury. Do not drop Spotter onto hard surfaces or subject Spotter to extreme temperatures (below -20°C or above 45°C) or fire as doing so may damage Spotter or its battery. Dispose of batteries according to your local environmental laws and guidelines.

Any damage caused to your Spotter by incorrect use or unauthorized modification or disassembly may void your warranty. You are responsible for following all laws and securing all necessary permits required for your application.

Disposal Guidelines

Spotter's electronic components and the lithium-ion battery are not generally suitable for disposal in standard municipal waste systems. Please contact your local provider to determine proper disposal and recycling options.

If in doubt, please contact us anytime at support@sofarocean.com to discuss recycling options for your Spotter.

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