ZS300 Sensor

User Guide

ZEBRA

P1128661-01EN Rev A

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2023/02/03

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Getting Started

The ZS300 Sensor is a Bluetooth-enabled wireless device designed to monitor temperature-sensitive products during shipping and storage. With its small footprint, the ZS300 fits conveniently inside many types of product packaging, containers, and equipment where it tracks temperature according to parameters that you can define for your specific needs.

The ZS300 Sensor records ambient temperature at regular intervals and stores the information in its memory. The ZS300 is designed to be a reusable device over the duration of its 12-month battery operated life, but can also apply to single-use applications as well. The battery in the sensor is not replaceable. By using the sensor with specially designed companion products, users can benefit from a flexible temperature monitoring solution that adapts to many usage scenarios, from low volume to very high volume needs. With this solution, you can keep track of critical temperature information wirelessly without having to open any containers.

The sensor works in conjunction with the ZB200 Bridge, which is typically placed at a central location in a storage or shipping facility. The bridge automatically collects data via Bluetooth when it detects sensors within wireless range. Data is then pushed to the Zebra Savanna Cloud where it can be accessed and analyzed online; for example temperature, location, and other key events.

Additionally, by implementing the Sensor Discovery Service for Android (ZSFinder), a mobile device can act as a mobile bridge to upload the data to the Zebra Savanna Cloud. In either case of upload via bridge or mobile device, the solution will be able to provide near real-time alerts for any temperature excursion.

The core behind the ZS300 solution is the software ecosystem. Software vendors working with Zebra have developed software platforms to maximize the visibility to conditions and alarms within shipping and storage processes. Through the use of the Zebra Developer Tools which utilize a set of APIs, and the Android Sensor Discovery Service, their software solutions allow the ZS300 to seamlessly integrate into your workflow, processes and systems of record. This is all supported by the Zebra Savanna Cloud which provides the data storage for all the data generated by the sensors.

Unpacking the Device

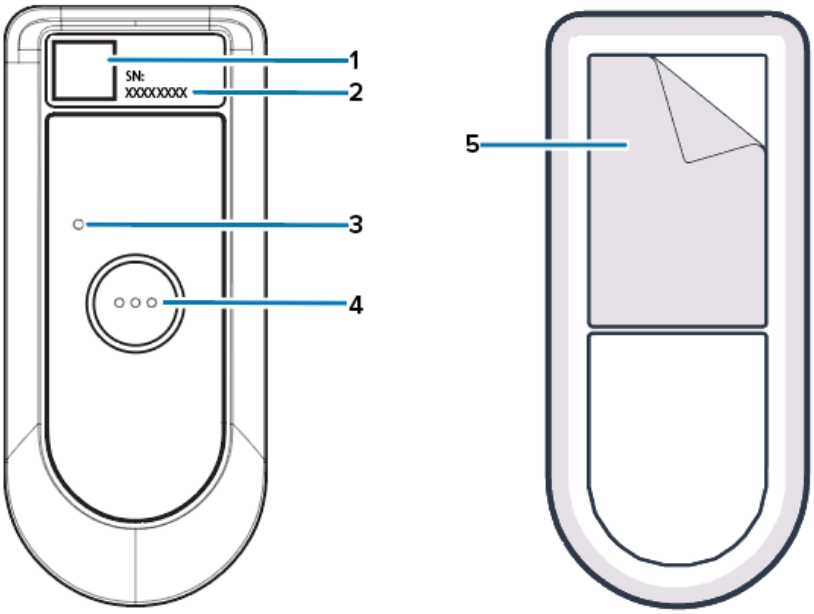
The ZS300 Sensor package contains:

- ZS300 Sensor
- Adhesive tape for mounting
- Quick Start Guide

Features

This section lists the features of the ZS300 Sensor.

Figure 1 ZS300 Sensor Features



1	QR Code
2	Serial Number
3	LED Indicator
4	Push Button
5	Adhesive Strip

The ZS300 Sensor features the following:

- Physical Characteristics
  - QR Code for identifying serial number and connecting to product support page
  - LED indicator with red, green, and yellow status indicators
  - Push button to activate sensor, check alarm status, and start recording period
  - Adhesive strip on the back of sensor for mounting
- Wireless Technology
  - Bluetooth Low Energy (BLE) 5.2 compliant radio interface for reading and transmitting data
- Monitoring
  - Temperature Monitoring Range: -40°C to +85°C (-40°F to 185°F)
  - Reading Accuracy: +/- 0.3°C (32.54°F) across entire monitoring range
  - Sensor Resolution: 0.01°C (32°F)
  - Internal Memory: 16,000 data points

Operating Modes

The ZS300 Sensor has three operating modes that optimize battery life and ensure uninterrupted data collection and transmission in various environmental conditions. These modes operate automatically and don't require manual intervention.

- Standard Mode: This mode is used in ambient to colder temperatures. In this mode, the sensor takes temperature measurements as configured, sends advertisement packets (including alerts) via Bluetooth Low Energy, and transfers data logs through the Bridge or Sensor Discovery Service to their destination.
- Cold Mode 1: This mode is used in a lower range of temperatures. In this mode, the sensor takes temperature measurements as configured, sends advertisement packets (including alerts) via Bluetooth Low Energy, and transfers data logs through the Bridge or Sensor Discovery Service to their destination at a slower rate to conserve battery life. After warming for 30 minutes, the sensor returns to Standard Mode.
- Cold Mode 2: This mode is used in an even lower range of temperatures. In this mode, the sensor takes temperature measurements as configured and sends advertisement packets (including alerts) via Bluetooth Low Energy. After warming for 30 minutes, the sensor returns to Cold Mode 1.

NOTE: Additional details regarding Operating Modes are available upon request.

Using the Device

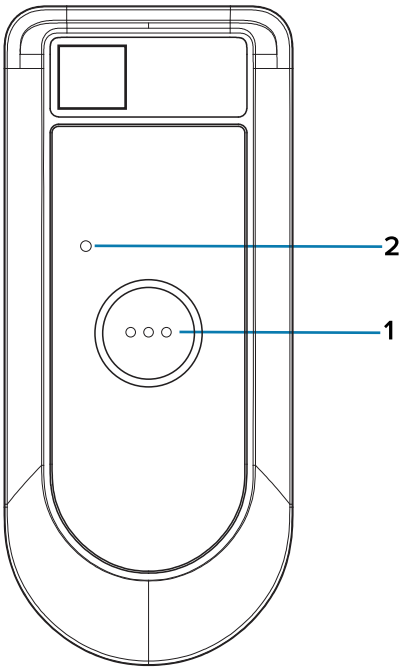
This section describes how to use the Sensor, including waking up the device, the LED blink patterns, and scanning the QR code.

Waking the Sensor

The ZS300 Sensor ships in deep sleep mode in order to maintain battery life and must be woken up prior to use.

- Press and hold the button (1) on the front of the sensor for three seconds in order to wake up the device.
- The LED (2), located above the button, will light up and blink yellow.
- The sensor will remain in an awake state for three minutes.
- If the button is pressed again at any point during the three minute period, the sensor will remain awake for another three minutes.
- Once awake, the sensor is able to be added to an account or to a task.

Figure 2 ZS300 Sensor



LED Blink Patterns

The ZS300 Sensor features an LED indicator in red, green, and yellow colors, the patterns of which are detailed below.

Table 1 LED Blink Patterns

LED to Check Status (Short Press)	Flash Type	No Task Programmed	Delayed Task	Task Started
OK	Slow			
Issue with Sensor (Alarm, Reached Reading Limit)	Slow	N/A	N/A	

Sensor Programmed with a Task (via Bluetooth)	Flash Type	No Task Programmed	Delayed Task	Task Started
OK	Fast	N/A		
Change State (Long Press)	Flash Type	Wake Up	Delayed Task	Start Delayed Task
OK	Fast		N/A	

- Green, fast blinking LED: Task started; sensor recording.
- Green, slow blinking LED: Sensor is awake; task started.
- Yellow, fast blinking LED: Sensor is awake; not running a task.
- Yellow, slow blinking LED: No task programmed.
- Green and Yellow slow/fast blinking: Delayed task; sensor has received the task, but the start of recording is delayed.
- Red slow blinking: Sensor has alarm state.

NOTE: The sensor enters Cold Mode 2 when the temperature falls below -25°C (-13°F). The user will be unable to change the sensor state (for example, start task, stop task, etc.) when the sensor is below -25°C (-13°F).

Scanning the QR Code

The ZS300 Sensor has a unique serial number identifier located on the front of the device. The QR Code allows the sensor to be identified using the camera on a mobile device. This enables the user to add a sensor to an account or add it to a task. Additionally, scanning the QR Code brings the user to the ZS300 support page on zebra.com.

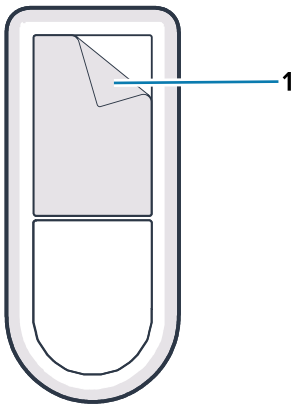
Mounting the Device

The ZS300 Sensor can be mounted to a desired surface either by use of an adhesive strip on the back of the sensor, or by adhering a magnet to the back of the sensor.

Adhesive Strip

To secure a sensor to a desired surface during transport, peel back the adhesive strip (1) on the underside of the sensor. Use the adhesive side of the sensor to secure the sensor to the surface.

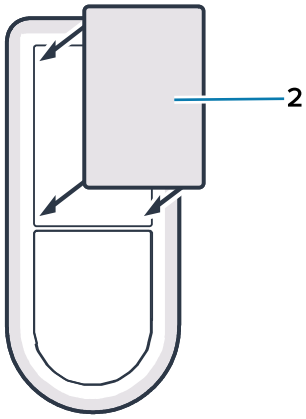
Figure 3 Adhesive Strip



Magnet

A magnet is also available as an optional accessory to secure the sensor to a metal surface. Peel back the adhesive on the underside of the sensor as previously stated, and attach the magnet (2) to the adhesive side of the sensor. Adhere the magnet to a desired surface during transport.

Figure 4 Magnet Install



Maintenance and Troubleshooting

The ZS300 Sensor does not require much maintenance, however, there are specific cleaning requirements that are detailed in this section. Also detailed in this section are troubleshooting scenarios and frequently asked questions (FAQs).

Cleaning the Sensor

As the ZS300 is used in locations subjected to different environmental conditions, there will likely be a need to clean the device occasionally. Here are some recommendations and guidelines for cleaning your device.

- Only use the approved cleaning and disinfecting agents listed below to avoid damage to the device.
- Follow the manufacturer's directions on the approved cleaning and disinfecting agent for the proper and safe use of their product.
- Use pre-moistened wipes or a damp, soft sterile cloth with the approved agent. Never spray or pour chemical agents directly onto the device.
- Use a moistened cotton-tipped applicator to reach tight areas. Be sure to remove any lint left over by the applicator.
- Although the sensor has an IP67 rating, it is still best not to allow liquid to pool on the device.
- Clean and fully dry at room temperature before use. Exposing products to elevated temperatures before drying may cause product damage.
- The combining of chemical agents may be hazardous to both the user as well as the device. Always follow the safety instructions provided by the manufacturer, as well as the Zebra cleaning and disinfecting guidelines.
- The use of non-approved cleaners or disinfecting agents, or not following the recommended cleaning guidelines, may result in damage to the product and void the warranty.

Approved Cleaning Agents

The following are approved cleaning agents for use with the ZS300 Sensor.

- Sani-Cloth HB Wipes
- Super-Sani Cloth Wipes
- Sani-Cloth Plus Wipes
- Sani-Cloth Bleach Wipes
- Clorox Healthcare Hydrogen Peroxide Wipes
- Diversey Oxivir TB Wipes
- MadaCide-FDW-Plus Wipes
- CaviWipes Disinfectant Towelettes
- CaviWipes Bleach 1:10 Bleach Dilution Disinfecting Towelettes
- Windex Blue
- 409 General Purpose Cleaner

Recycling Program

When the ZS300 Sensor has reached end-of-life, refer to the following link for product and battery recycling information: zebra.com/recycle

Shipping Information

The Zebra ZS300 Sensor is a data logger that contains a lithium battery and emits RF signals when in operation. For additional details, see the product specifications.

The ZS300 Sensor is manufactured and shipped by Zebra in compliance with applicable standards including the following:

RF Signal Emissions Standards Of:

1. FAA Advisory Circular 91-21.1D.

Mode of Transportation for Lithium Batteries Requirements Of:

1. USDOT 49 CFR Part 171-180.
2. IMDG Regulations International Maritime Dangerous Goods (IMDG) Code.
3. IATA (International Air Transport Association) code/ICAO Technical Instructions.
4. ADR European Road Regulations.

For additional guidance on air shipment of data loggers see: (IATA) Guidance Document – Battery Powered Cargo Tracking Devices/ Data Loggers.

The ZS300 with BTLE radio meets the requirements of RTCA-DO-160G Section 21.

Any subsequent use, shipment, or application of these data loggers may be subject to additional or different standards or compliance requirements, such as packaging, labeling, marking, and handling requirements associated with particular goods.

Troubleshooting

This section provides some basic troubleshooting information for the ZS300 Sensor. For API-related questions and issues, refer to the API documentation on the Developer Portal (developer.zebra.com/apis).

Table 2 Troubleshooting the Sensor

Issue	Possible Cause	Possible Resolution
The LED does not light when the sensor button is pressed.	The sensor button is not being held down for three seconds.	• Press and hold the sensor button for three seconds until the LED flashes. • If the LED still does not light up, the battery might be dead and the sensor should be replaced.
Sensor will not connect with the Bridge despite being within range.	• Press the sensor button to determine if it is on a task. (LED will slowly blink green or red to show a task has started.) • There is too much distance between sensor and bridge. • The bridge is not connected to the Cloud.	• If the sensor is not on a task, the sensor may be asleep. Press and hold the sensor button for three seconds until the LED flashes. • If the sensor is on a task, it should automatically connect to a Bridge. • Ensure the Sensor and Bridge are not too far apart and out of Bluetooth range. • Ensure the Bridge is connected to the Cloud. If not, check bridge network connection. • Reboot the Bridge by unplugging and re-plugging power.

Table 2 Troubleshooting the Sensor (Continued)

Issue	Possible Cause	Possible Resolution
Sensor will not connect with an Android device running the Electronic Temperature Sensor Android Service despite being within range.	• The Android device's Bluetooth is not turned on. • Press the sensor button to determine if it is on a task. (LED will slowly blink green or red to show a task has started.) • There is too much distance between the sensor and Android device. • The Android device is not connected to the Cloud. • Proper permissions have not been given to the Android mobile application to enable Bluetooth.	• Ensure Bluetooth is turned on in mobile device. • Ensure the Electronic Temperature Sensor Android Service is running on the device and has been granted the necessary permissions. • If Sensor is not on a task, the sensor may be asleep. Press and hold the sensor button for three seconds until the LED flashes. • If the sensor is on a task, it should automatically connect to the Android device. • Ensure the Sensor and Android device are not too far apart and out of Bluetooth range. • Ensure Android device is connected to the Cloud. If not, check Android device network connection. The ZSFinder App requires access to scv.zpc.zebra.com, port 443 and api.zebra.com, port 443. • Ensure proper permissions have been given to the Android mobile application to enable Bluetooth.

Table 2 Troubleshooting the Sensor (Continued)

Issue	Possible Cause	Possible Resolution
Sensor does not appear in a Scan Nearby search.	• The sensor button is not being held down for three seconds. • There is too much distance between the Android device and sensor. • Bluetooth is not enabled on your Android device. • Proper permissions have not been given to the Android mobile application to enable Bluetooth.	• Press and hold the sensor button for three seconds until the LED flashes. • Ensure there is proper distance between sensor and bridge so they are within Bluetooth range of each other. • Ensure Bluetooth is enabled on your Android device (if no sensors appear). • Ensure proper permissions have been given to the Android mobile application to enable Bluetooth. • Run another scan.
Sensor stopped collecting data before the task was finished.	• Sensor has already collected the maximum number of data samples (for example, 16,000 samples), if not programmed to overwrite. • Temperature fell below operating temperature range.	• Ensure the user understands rate of sampling and how that affects how long it takes to collect the max number of samples. (Understand enabling and disabling loop overwrite and letting the user go back to overwrite older samples. Understand also that alarms are never overwritten.) • Return sensor to operating temperature range. Keep in mind that temperature sampling will not resume after the sensor returns to operating temperature range. Additionally, if the sensor falls below the operating temperature range while on a task, a brownout condition (loss of power while on a task) occurs and the sensor cannot be re-used.

Table 2 Troubleshooting the Sensor (Continued)

Issue	Possible Cause	Possible Resolution
Unable to stop a task for a sensor.	• Sensor is not in range of a bridge. • There is too much distance between the Android device and sensor. • The network is blocking communications to the Cloud.	• Move sensor within range of a bridge or Android mobile device. • Work with your network administrator to ensure that you can properly access the required Zebra Savanna Cloud servers.
Sensor is not starting a task.	• Sensor is not within range of a bridge. • Sensor is not on. • Sensor is set up for delayed start (for example, time, temperature, sensor button-press). • Sensor is below -25°C (-13°F).	• Move sensor within range of a bridge. • Press and hold the sensor button for three seconds until LED flashes. • Verify start time. • Ensure sensor is above -25°C (-13°F).

Frequently Asked Questions

This section provides a simple reference for the most commonly asked questions related to the ZS300 Sensor and the answers to those questions.

Table 3 FAQs

Question	Answer
What is included in the box with the sensor?	The sensor ships with a Quick Start Guide and adhesive tape included in the box.
How do I find out the state of my sensor?	Press the sensor button. If the LED flashes red it's in an alarm state. If it flashes green, it is on a task with no alarm. And if it flashes yellow, it is not on a task.
What is the warranty period for the sensor?	One year from the date of shipment from Zebra.
When does the warranty period officially start?	The customer ship date will be the start of the warranty, or the customer's purchase date (with proof of purchase provided), whichever is the latest date.
How do I turn on the sensor?	Press and hold the sensor button for three seconds until the LED flashes yellow.
How do I put my sensor back to sleep?	The sensor will go back to sleep when it is no longer on a task and all data from the sensor has been uploaded to the Zebra Savanna Cloud.

Table 3 FAQs (Continued)

Question	Answer
How long should I expect my sensor to last?	The battery shall provide a minimum 12-month operating life depending on actual use and operating temperature.
Can my sensor be exposed to water?	Yes, the sensor has an IP67 waterproof rating.
What is the purpose of the QR code on the front of the sensor?	The sensor has a unique serial number identifier. The QR code allows the sensor to be identified using the camera on a mobile device or via a barcode scanner. This allows the user to add a sensor to an account or add it to a task. Additionally, scanning the QR Code brings the user to the ZS300 support page on zebra.com.
How do I mount my sensor?	The sensor can be mounted via an adhesive strip on the back of the sensor, or by adhering a magnet to the back of the sensor. (The magnet is an accessory and sold separately.)
How do I differentiate between the sensors?	Each sensor has a unique serial number located on the front of the sensor next to the QR code.
How do I properly dispose of the sensor?	Refer to the following link for product and battery recycling information: zebra.com/recycle
How do I know the remaining battery life of my sensor?	Refer to the application that your organization or vendor developed to communicate with the sensors.
How do I create a task?	Refer to the application that your organization or vendor developed to collect data.
How do I stop a task on a sensor?	Refer to the application that your organization or vendor developed to collect data.
How do I stop a task?	Refer to the application that your organization or vendor developed to collect data.
How do I view the data that the sensor collects?	Refer to the application that your organization or vendor developed to collect data.
How do I download a report for the entire task?	Refer to the application that your organization or vendor developed to collect data.
How do I download a report of the data the sensor collects?	Refer to the application that your organization or vendor developed to collect data.

Technical Specifications

The following section details basic specifications for the ZS300 Sensor.

Sensor Specifications	
Monitoring Temperature Range	-40°C to +85°C (-40°F to 185°F)
Accuracy	+/- 0.3°C (32.54°F) across the entire range
Resolution	0.01°C (32°)

Physical Characteristics	
Dimensions	87.2 mm L x 38.1 mm W x 10.55 mm H (3.43 in L x 1.5 in W x 0.42 in H)
Weight	0.8 oz (22.7 g)
Case Material	Polycarbonate
IP Rating	IP67
Mounting	Adhesive strip, magnet (optional)
Traceability	Unique Serial Number (2D barcode, human readable)
Battery Type	3V Lithium, non-replaceable (C2450N)
Battery Life	12 month operating life, assuming 1 min interval at -20°C (-4°F) and 12 month shelf life

Datalogging Specifications	
LED Indicator	Alarm status and communication
Alarms	Programmable high and low limits, with delay
Datalogging Start-up	Immediate, delayed with programmable threshold/ time, and start on button press
Datalogging Intervals	Programmable, 15 sec to 240 min
Datalogging Stop	Programmable, memory full, or overwrite oldest values
Internal Memory	Up to 16,000 data points
Bluetooth	BLE 5.2
Mobile OS Compatibility	Android OS 8.1 or higher

Operating and Storage Conditions	
Operating Temperature Range	-40°C to +85°C (-40°F to 185°F)
Operating Humidity Range	10-90% (non-condensing)
Storage Temperature Range	-25°C to 65°C (-13°F to 149°F)