



CS1040 Long Range Tilt & Vibration Sensor

User Guide

Long-range, low-power tilt and vibration sensor supporting LoRaWAN or Coralink wireless protocols. Ideal for applications in smart-building, home automation, and security.



Version: 1.3
July 2022



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Getting Started

The CS1040 is a long-range, low-power tilt and vibration sensor supporting LoRaWAN or Coralink wireless protocols. The sensor provides configurable, real-time notifications or regular reported statistics.

The sensor can be readily attached to doors, windows, firearms, jewelry boxes, or machinery. The sensor detects linear or rotational motion in all three dimensions. Small and low profile, the sensor can be used for a wide variety of applications where detection of tilt, vibration, or motion activity is required.

The CS1040 is powered by two AAA batteries providing 2+ years of operation in typical conditions. Batteries can be easily replaced.

The sensor can be configured to notify when vibrations exceed thresholds: supporting impulse, direction, and duration configurations. Powerful statistics monitoring can record duration of events, maximum, and minimum values as well as direction. The CS1040 has temperature monitoring, triggers, and battery level notifications.

What's In the Box

The CS1040 package includes the following:

- ◆ One (1) Tilt & Vibration Sensor

The sensor is self-contained unit, which can be mounted using the provided double-sided tape or permanently mounted using the screw holes found in the battery compartment. See *Installation* for details and to learn more about proper placement.

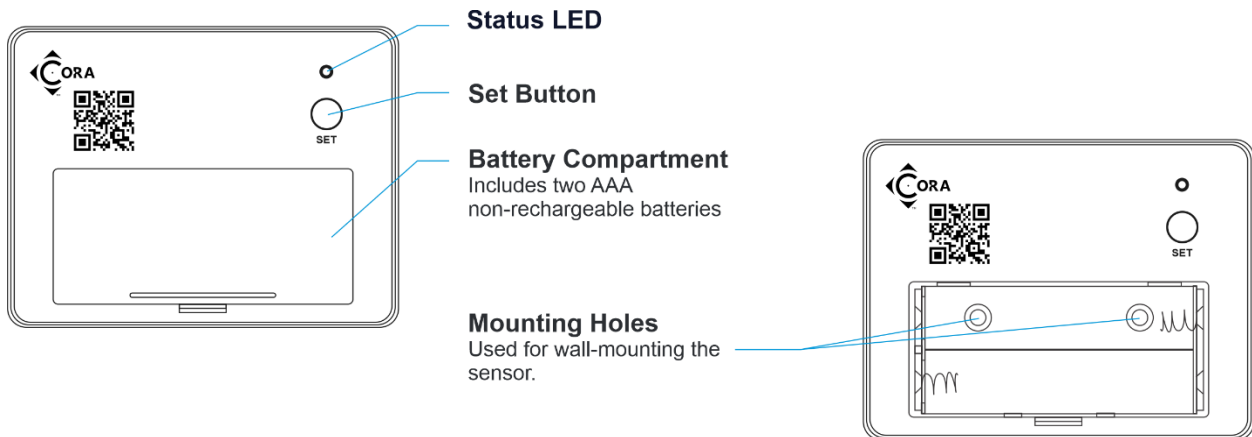


Figure 1 –CS1040 Tilt & Vibration Sensor

Registering the Device

This step requires a third-party mobile application, which can register new devices. Please follow the application instructions for registration and activation. Cora devices are typically registered by scanning the QR code printed on the device housing or attached label.

Attaching to the Network

Once the device is removed from the packaging, it can be activated by pressing the set button.

The device will activate, blinking orange four times and begin issuing join requests. The LED status indicators is shown in the figure below.

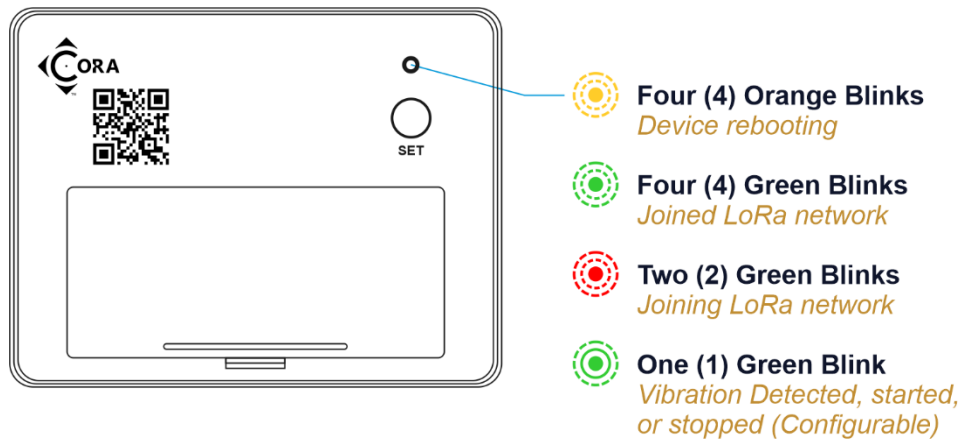


Figure 2 – CS1040 LED Status Indicators

Periodically, the CS1040 will blink red twice when joining the network. Assuming the device is properly registered on an available network and in range, it should connect. It will blink green four times indicating it has joined.

Once joined, the sensor can be tested by placing the device in a wet dish or touching the top sensors with a wet finger. By default, the unit will generate vibration detected events to notify the application. Reminders and other configurations options are available.

Note: If the CS1040 has not joined within a few minutes, the LED will stop blinking, though it will continue try to join: ten times in the first hour, then longer intervals over the first week until finally attempting once every 12 hours. This is done to conserve battery power when the network is not available for long periods of time. You may reset the join schedule by performing a Network Reset on the device, see *User Interface*.

To learn more about the capabilities of the CS1040, see *Configuration and Integration*.

User Interface

Set Button

The CS1040 user interface consists of the LED status indicators (Figure 2) and the set button located on the underside of the device. Pressing the button quickly will send a battery health message and indicate the current network status discussed previously.

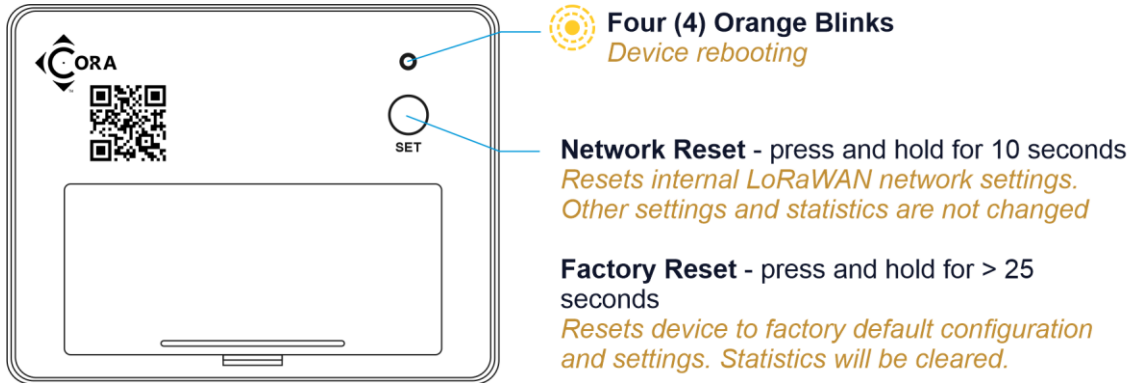


Figure 3 – Performing Network or Factory Reset on the Tilt & Vibration Sensor

Holding the button will perform a network or factory reset:

- ◆ **Network Reset** – Press and hold the SET button for 10 seconds, but less than 25, then release. The device will reset all LoRaWAN Settings, which does not affect device operation or configuration. Following reboot, a reset event uplink (confirmed) will be sent upon rejoining the LoRaWAN network.
- ◆ **Factory Reset** – Press and hold the SET button for > 25 seconds, then release. The device will reset all parameters to factory defaults. Following reboot, a Factory Reset event uplink (confirmed) will be sent upon rejoining the LoRaWAN network.

Status Indicators

A single button press will indicate the network status. The following table summarizes all the LED indicators.

LED	Status
Fast Red Blink Two (2) Times	Not Joined
Fast Green Blink Four (4) Times	Joined
Slow Red Blink Two (2) Times	Joining Network
Slow Green Blink Four (4) Times	Joined Network
Green Blink (1) Time	Motion Event

Network status blink occurs up to 50 times. Single button press will resume status blink for another 50 cycles.

Selecting Operating Configuration

The CS1040 can be configured through a series of button presses to operate in one of the available default settings. Select one of the following settings based on the application requirements.

Default Configuration	Description	Button Presses
Vibration Impulse Detector	<p>Sends notification whenever a vibration or rotation is detected. Waits three minutes to clear between additional notifications. Battery health check sent every three (3) hours. This configuration is good to monitor any movement such as breaking glass, package tampering, opening a drawer, or safe.</p> <p>Battery life is typically 2+ years.</p>	1
Continuous Motion Sensor	<p>Monitors continuous motion. Sends notification when motion begins and ends. Battery health check sent every three (3) hours.</p> <p>This configuration is useful for monitoring the use of mechanical equipment. Battery life is typically 2+ years.</p>	2
Garage Door Tilt Detector (Factory Default)	<p>Monitors vibration and vertical rotation when attached to a garage door. Sends notifications when in-motion, opened, and closed. Battery health check sent every three (3) hours.</p> <p>The device ships with this configuration as the default. Battery life is typically 2+ years.</p>	3
Garage Door Tilt Detector, 15 Minute Reminder	<p>Monitors vibration and vertical rotation when attached to a garage door. Sends notifications when in-motion, opened, and closed. Sends reminder notification every 15 minutes. Battery health check sent every three (3) hours.</p> <p>Battery life is typically 2+ years.</p>	4
Garage Door Tilt Detector, 1 Hour Reminder	<p>Monitors vibration and vertical rotation when attached to a garage door. Sends notifications when in-motion, opened, and closed. Sends reminder notification every 1 hour. Battery health check sent every three (3) hours.</p> <p>Battery life is typically 2+ years.</p>	5
Garage Door Tilt Detector, 3 Hour Reminder	<p>Monitors vibration and vertical rotation when attached to a garage door. Sends notifications when in-motion, opened,</p>	6

	and closed. Sends reminder notification every 3 hours. Battery health check sent every three (3) hours. Battery life is typically 2+ years.	
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To change the Sensor configuration:

1. Press the button slowly three (3) times (about 2 – 3 presses per second max) to enter the configuration selection mode. The device will alternate green/red blink pattern continuously once entered.
2. Then press the button slowly the corresponding number of times (e.g., 1,2, or 3) to select the desired configuration.
3. If pressed more than four (4) times, the selection will be cleared and a new selection specified. If no selection is made in 30 seconds, the device will exit configuration mode without changes.
4. Once the choice of configuration is made, the device will stop the blink pattern, wait 5 seconds for no further input, apply the configuration change, and perform a network reset.
5. After reset, the Sensor will be in the new operating configuration.

The device configuration can also be changed using one or more of the configuration downlink messages. Custom configurations are possible as well. Consult your application provider for support.

About LoRaWAN

LoRaWAN is a low-power, secure, wide area (LPWAN) networking protocol designed to wirelessly connect devices to the internet in regional, national, or global networks. To use the CS1040 Tilt & Vibration Sensor, wireless connectivity to an internet connected LoRaWAN gateway is required.

For more information about LoRa and LoRaWAN visit the LoRa Alliance webpage:

<https://lora-alliance.org/>

Terminology

- ◆ Message sent from the Tilt & Vibration Sensor to the network are referred to as “uplink messages” or “uplinks”.
- ◆ Messages sent to the Tilt & Vibration Sensor from the network are referred to as “downlink messages” or “downlinks”.
- ◆ Both uplink and downlink messages may be of either “confirmed” or “unconfirmed” type. Confirmed messages are guaranteed to be delivered but will consume extra wireless bandwidth and battery life. These mechanisms are analogous to TCP (confirmed) vs UDP (unconfirmed) protocols used for IP networks.
- ◆ Before a device, such as the CS1040 can transmit messages using Lora WAN, it must go through a “join” process. The Join process involves key-exchange with the cloud-hosted network provider (The Things Network, Helium, etc.) and is defined in the LoRaWAN protocol standard. If connectivity is lost due to RF interference, power loss or other temporary internet outages, the device will need to rejoin the network prior to being able to transmit messages. This process happens automatically but is managed in a battery-efficient manner and may take significant time.

Installation

Testing the Sensor Location Before Installation



Test the CS1040 sensor location before affixing it to the surface. Use masking or painter's tape to secure the sensor to the surface. Once you have the sensor temporarily mounted, test it out. Vibrate or tilt the detection area while observing the status of the sensor, the device should report the vibration or tilt event to the application.

The sensor can be installed in several ways. It can be affixed to the object via 3M mounting tape (included), it can be mounted to the object via screws (not included), or it can be placed in or on an object. Other methods may void the warranty (e.g. glue, epoxy).

You can adjust the device sensitivity to reduce false alerts. Determine if the sensitivity is too low or too high during your functional test. If the sensor triggers false alerts, you can reduce the sensitivity. If the sensor does not respond to a condition that should trigger an alert, increase the sensitivity. After adjusting the sensitivity, always perform a functional test.

The CS1040 sensor is not waterproof and is designed and intended only for indoor use.

Applications

Place the sensor in or on the object to be monitored.

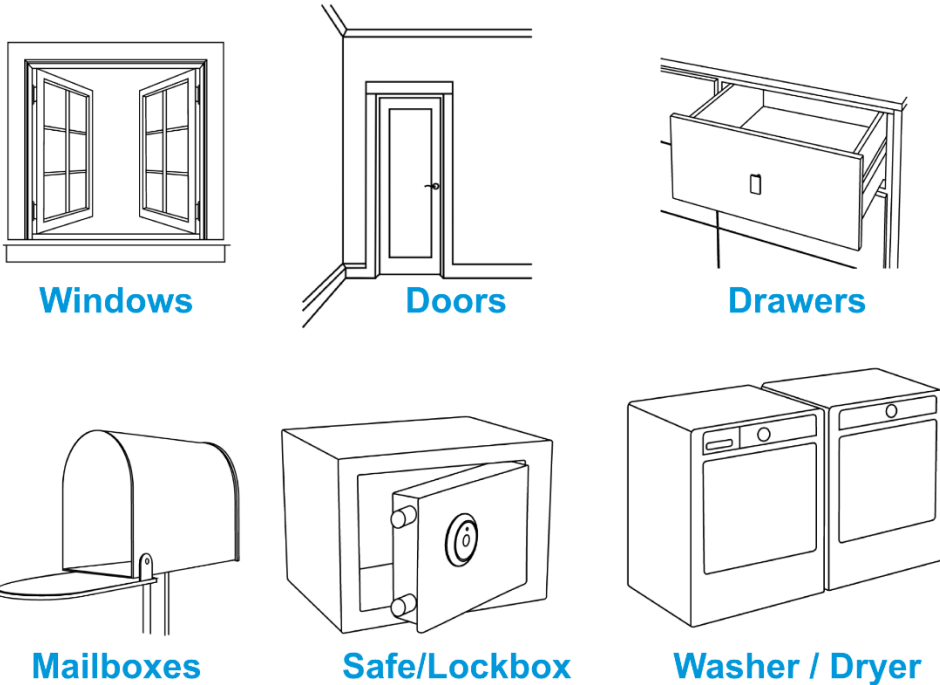


Figure 4 – Potential CS1040 Sensor Applications

Factors such as temperature can adversely impact the operation of the sensor. Using the sensor outdoors and/or in environmental conditions outside those listed in the Environmental section of the manual (page 26) is discouraged. Additionally, the warranty does not cover the device getting wet.

Mounting the Device

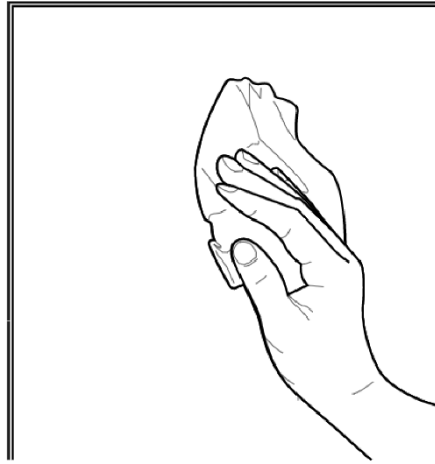
Method 1: Install Using Double-Sided Tape

Install the Vibration Sensor with double-sided tape on the back of the device.

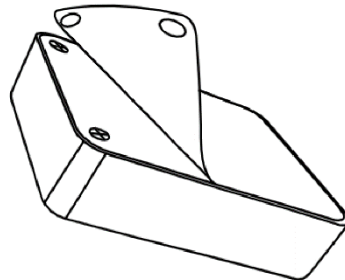


Double-sided mounting tape is very difficult to remove. Use caution mounting the device to delicate surfaces.

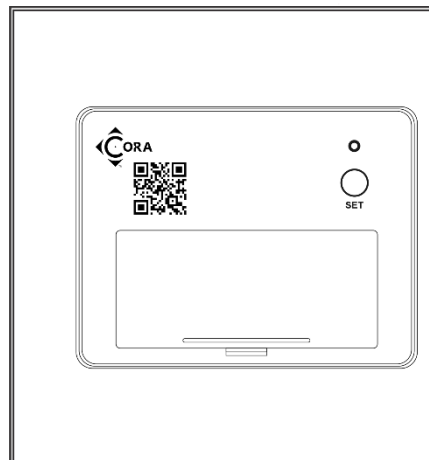
1. Find a suitable location for the sensor.
Clean the surface well and allow it to dry.
The surface must be free of moisture,
dirt, oil, grease, or cleaning chemicals.



2. Remove the protective plastic from the tape by peeling back from a corner.



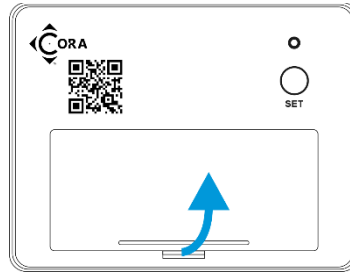
3. Place the sensor at the desired location,
pressing firmly for at least 5 seconds.



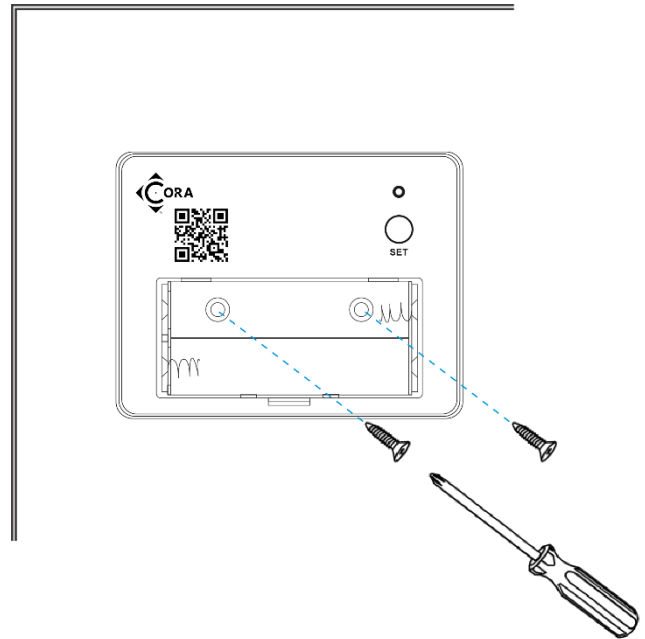
Method 2: Install Using Mounting Screws

Mount the Vibration Sensor to the surface with screws (not included).

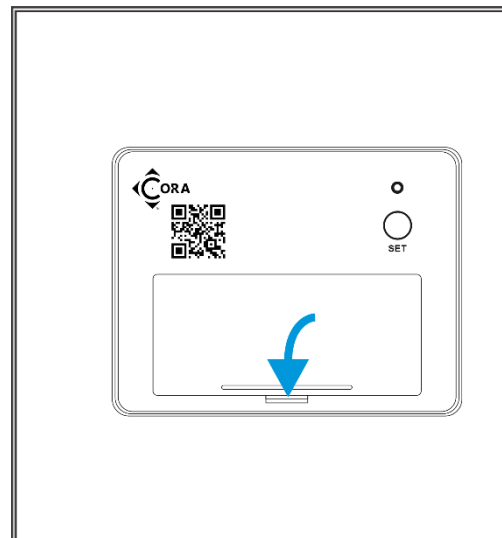
1. Open the battery cover and remove the batteries to gain access to the mounting holes on the back of the sensor.



2. Mount the sensor to the desired location using screws.

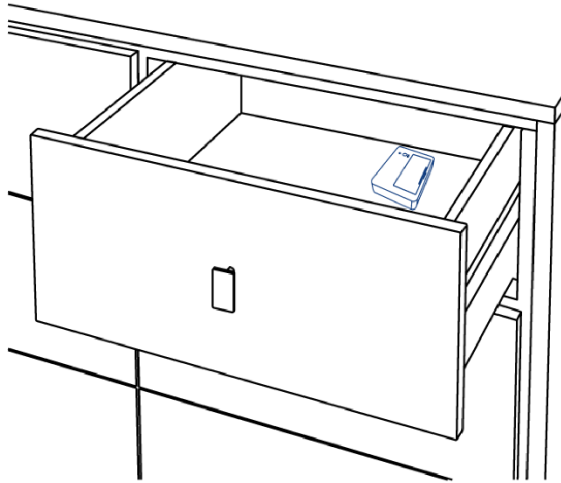


3. Reinstall the batteries and close the battery cover.

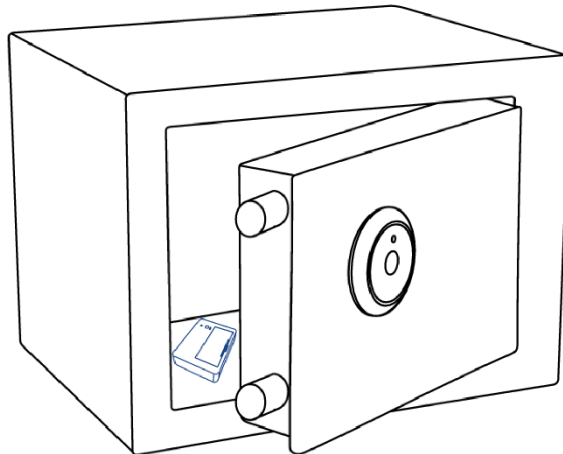


Method 3: Place in or on an Object

Example 1: In a Drawer



Example 2: In a storage box, safe, security box, or cabinet

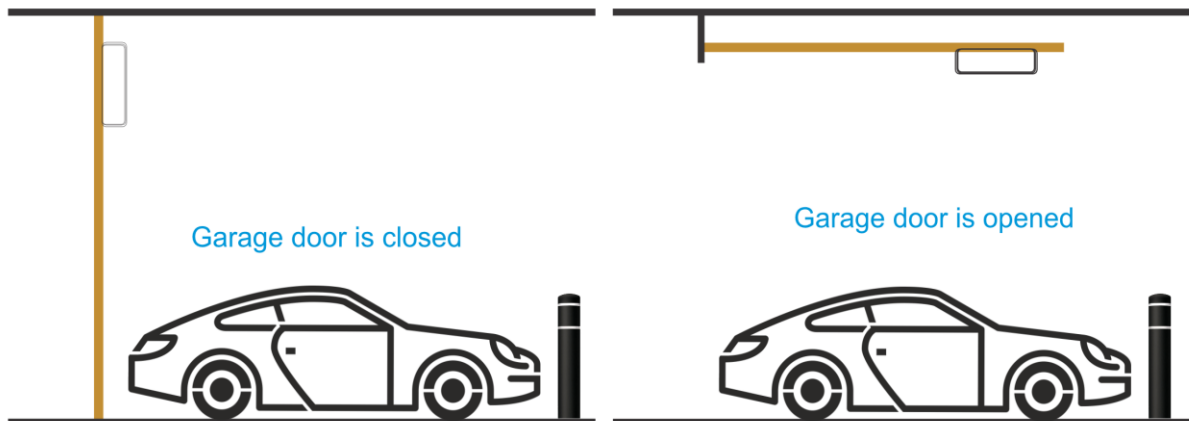


Test the Sensor

- ◆ It is best to perform a “functional test” of the sensor. For example, if a notification is desired when a firearm storage box is opened, the functional test should consist of opening the box. In this example, it is suggested to test opening the box when it is unlocked. This will test the vibration detection in the case the box was left unlocked.
- ◆ Have the application running when testing the application. Confirm the correct responses.
- ◆ Adjust the sensor sensitivity as needed. Always perform a functional test, if possible, after adjusting the sensitivity.

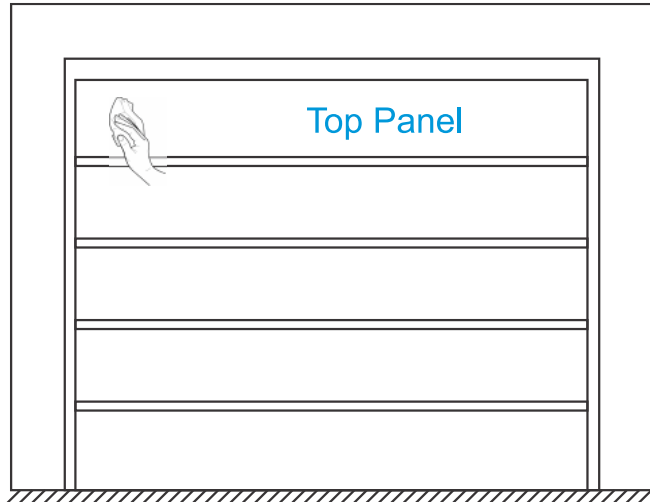
Garage Door Placement & Installation

1. The sensor is very difficult to relocate after being affixed to the mounting surface. Test the sensor location before permanently affixing the device to the surface. Use masking or painter's tape to secure the device to the surface for testing. Once the sensor is temporarily mounted, test the device prior to permanent installation.
1. For proper operation it is critical the Tilt and Vibration Sensor be **mounted on the top inside panel of a garage-door and must be oriented as shown in figure 3**. The sensor should be mounted as high on the garage-door as feasible. Otherwise, the door-open or door-closed indicators may not be accurate.
2. Ensure the selected installation area does not interfere with the garage door mechanism throughout the entire open or close motions.
3. Avoid exposing the sensor to strong impacts or vibration.
4. The Tilt & Vibration sensor's Garage-Door Mode is not compatible for roller doors and slide or slide hinged doors. It is only compatible for sectional doors or canopy garage doors.
5. After installation, operate your garage-door through one cycle. The sensor will automatically adjust to the correct open or close state.

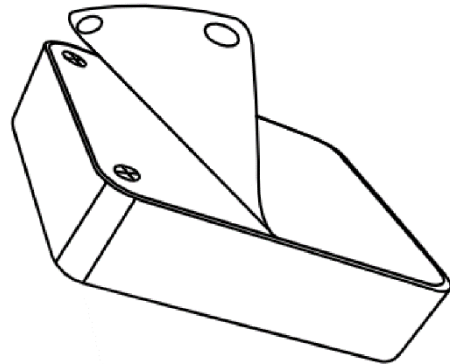


Method A: Installing with double-sided tape

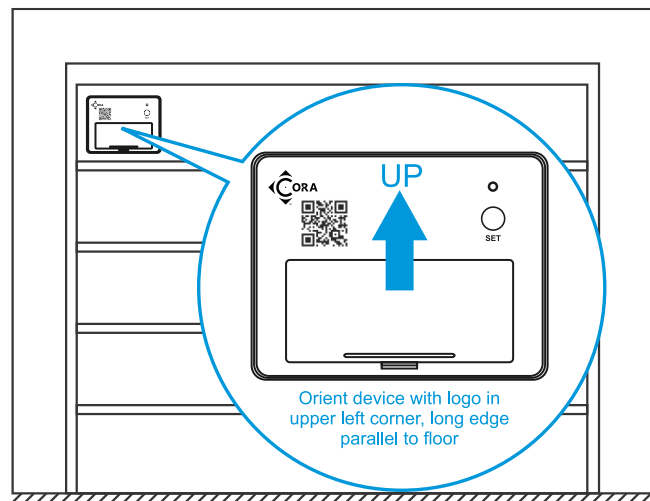
1. Clean the selected installation area. Choose a location on the top-panel of the garage door and as high as possible.



2. Remove the protective layer from the double-sided tape.

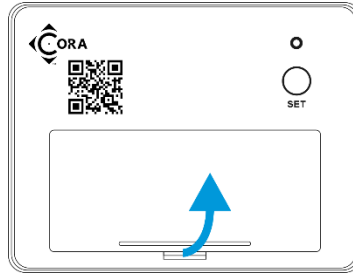


3. Keeping the sensor oriented as shown and parallel to the floor. Firmly press the sensor to the door for at least 5 seconds.



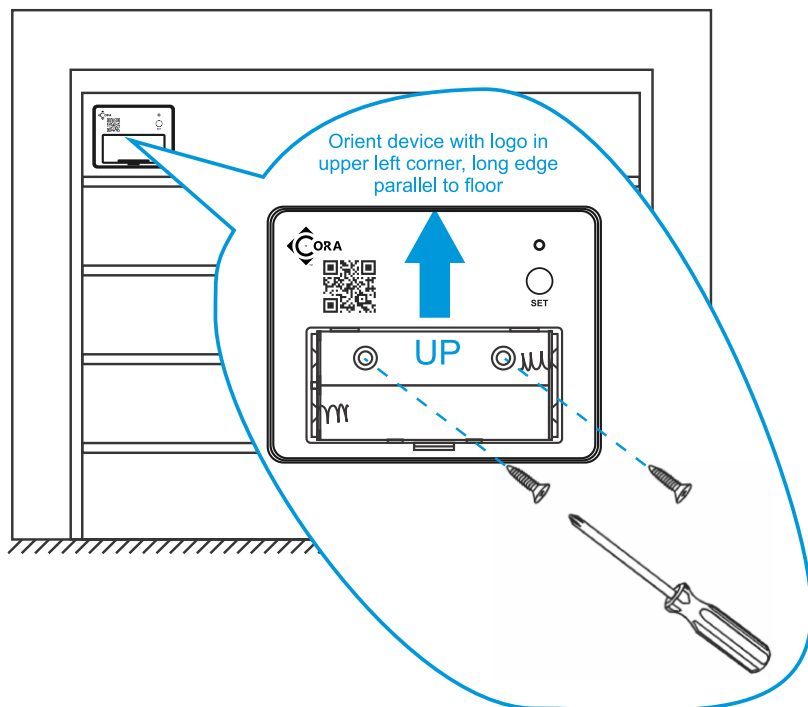
Method B: Installing with screws (not included)

4. For wall-mounting, open the battery cover and remove the batteries to gain access to the mounting holes on the back of the sensor.

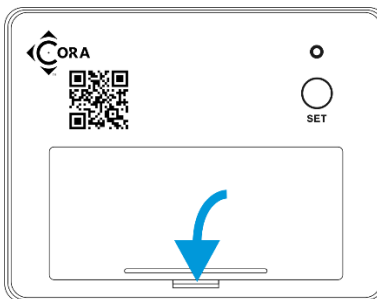


5. Keeping the sensor oriented as shown and parallel to the floor.

Mount the sensor to the garage door using screws (not included).



6. Reinstall the batteries and battery cover.



Event Notifications and Reports

The CS1040 Tilt & Vibration Sensor has different motion event notifications depending on operating configuration:

Configuration	Events	Behavior
Vibration Impulse Detector (mode 1)	Vibration detected	Reports any disturbance. Minimum interval 30 seconds.
Continuous Motion Sensor (mode 2)	Vibration started Vibration stopped	Reports start of motion. Reports motion stopped after 10 seconds of inactivity.
Garage Door Tilt Detector (modes 3 – 6)	Garage door closed Garage door opened Garage door motion Garage door reminder	Reports garage door closed. Reports garage door opened. Reports garage door in motion. Reports garage door opened reminder.

The default threshold for detection is 200mG (1 mG = 1/1000 G-force) in modes 1 and 2. In mode 3 - 6 (Garage Door Tilt) the default threshold is 250mG.

The sensor has a periodic Heartbeat/ Battery-status message that is sent to maintain LoRaWAN network connectivity and indicate battery status information. The default period for this message is 180 minutes and may be configured between two (2) minutes minimum and 48 hours maximum

Reset Notifications

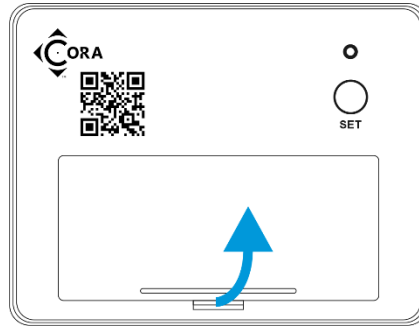
FACTORY RESET uplink messages will be sent after rebooting.

Firmware Version

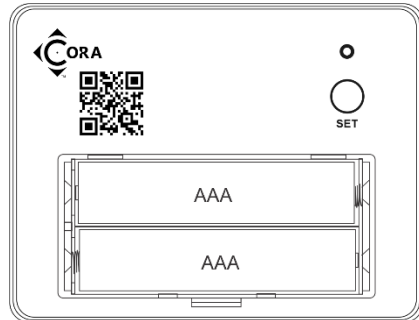
The firmware information can be retrieved via sending a downlink command. See *Configuration and Integration* for details.

Replacing the Batteries

1. Remove the battery cover by gently prying with your fingertip or tool at the edge as shown



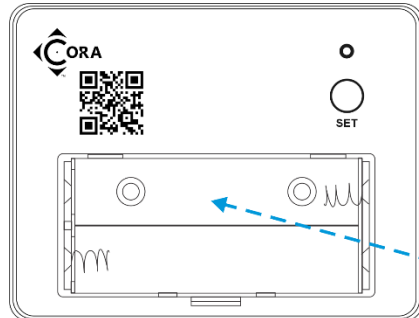
2. Remove the old batteries



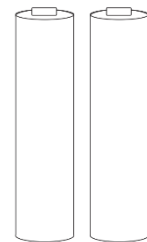
3. Install two new alkaline non-rechargeable batteries



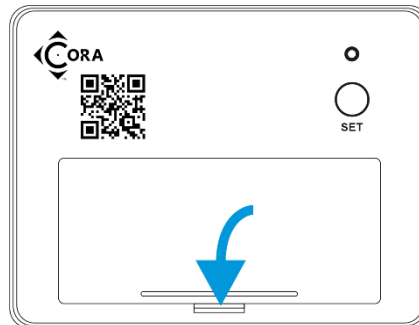
Do not mix old and new batteries



2 x AAA



4. Close the battery cover



Configuration and Integration

The CS1040 supports the following settings and features, which are configured via downlink messages.

Configuration	Description	Units	Default
Heartbeat / Battery Interval	Specifies the heartbeat message uplink interval	minutes	180 (3 hours)
Statistics Interval	How often the statistics are uplinked.	minutes	0: disabled
Clear Statistics	Downlink this message to clear the stored statistics	N/A	N/A
LED Mode	<ul style="list-style-type: none"> LED OFF (Stealth Mode) LED ON (Telemetry Only) LED ON (Sensor and Telemetry) 	N/A	LED ON (Sensor and Telemetry)
Notification Confirm / Unconfirmed Setting	If set to true, vibration notifications are confirmed uplink messages. Set to false to uplink without confirmation.	N/A	CONFIRMED MESSAGES
Notification Enable	<ul style="list-style-type: none"> Enable or Disable notifications. If disabled, the sensor operate as a counter / statistic only device. 	N/A	enabled
Firmware Version	Downlink this message to retrieve the firmware information	N/A	N/A

For information on decoding and encoding the sensor messages please visit the product page at [Cora CS1040 Tilt & Vibration Sensor - Codepoint Technologies](#).



Specifications

- ◆ LoRaWAN v1.03 Class A, Coralink™ Class A device
- ◆ U.S. 923 MHz, E.U. 868 MHz, China 470 MHz, and other frequencies available
- ◆ Color: White
- ◆ Dimensions [L x W x D]: 2.56 x 1.97 x 0.69 inches (65 x 50 x 16 mm)
- ◆ Multi-color status LED
- ◆ Set button
- ◆ Power: 2 AAA batteries (3V DC)
- ◆ **Environmental:**
 - Operating Temperature Range: -4°F – 122°F (0°C – 50°C)
 - Operating Humidity Range: < 95% non-condensing
- ◆ Intended for indoor use only

Ordering Information

Communication Options

Prior to ordering, determine the communication requirements:

- ◆ **Application Protocol:** Untethered Protocol Buffers (Protobuf) or CP-Flex OCM
- ◆ **Network Protocol:** LoRaWAN or Coralink
- ◆ **Operating Region and Frequency:** US915, EU868, CN470 (others available upon request)
- ◆ **Network Providers:** TTN, Helium, Chirp stack, etc.

Product SKU

When placing an order use the following SKU structure to determine the specific version, profile, hardware revision, and packaging needed for the application.

The specification below details the SKU fields and character length.

[id: 6]-[version:2]-[Profile:5]-[Packaging:2]

The fields are defined as follows.

Field name	Character Length	Description
ID	6	Device six (6) character identification code, Available options: CS1040 – Revision A Cora Tilt & Vibration Sensor
Version	2	Device version specification identifying one or key variations that differentiate this version of the component relative to others. Available options: UL – Untethered XMF Application / LoRaWAN protocols CL – Cora OCM / LoRaWAN protocols CC – Cora OCM / Coralink protocols
Profile	5	Profile code specifies a configuration that may be unique for an implementation. Available options: US9HT – U.S. 915 MHz Region supporting Helium, TTN sub-band 2. EU8ST – Europe 868 MHz region standard configuration CN4EZ – China 470 MHz region Easylinkin (Link ware) network configuration Other profiles are available upon request.

Packaging	2	Packaging configuration. This code determines the packaging format for the device. Available standard options: 00 – Standard reseller packaging. Device identification details included. 01 – Solution provider / reseller packaging. Only manufacturing ID provided. Provider receives CSV file with all identifiers to load into their database. 0X – Custom packaging option. Contact Codepoint for further information.
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Example SKUs:

- ◆ **CS1040-UL-US9HT-00** – Vibration sensor for U.S. region, untethered, supporting Helium and TTN sub-band 2.
- ◆ **CS1040-UL-EU8ST-01** – Vibration sensor for Europe region, untethered, standard configuration, packaged for solution provider distribution.
 - CS1040-CL-US9HT-00** – Vibration sensor configured for Cora OCM and CP-Flex cloud stack integration, Supports OCM V2 protocol specifications.

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ◆ Reorient or relocate the receiving antenna
- ◆ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- ◆ Increase the separation between the equipment and receiver
- ◆ Consult the dealer or an experienced radio / TV technician for help

- ◆ 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
 2. This device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

FCC RF radiation exposure statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. "To comply with FCC RF exposure compliance requirements, this grant is applicable to only Mobile Configurations. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter."