

# **Installation Guide**

## **Savi SensorTag ST-676-I ISO Container Door Tag with Sensors**

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**Version 1.0**



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Documentation for Savi SensorTag ST-676-I ISO Container Door Tag with Sensors,  
version 1.0

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## A Savi SensorTag ST-676-I ISO Container Door Tag with Sensors Specifications



# About Savi SensorTag ST-676-I ISO Container Door Tag with Sensors

Savi® SensorTag ST-676-I ISO Container Door Tag with Sensors is a high performance active RFID tag that works with Savi software to track and monitor the security status of containers as they move through the global supply chain. This device is fully compatible with fixed and portable Savi readers and features up to 300 feet (91.44 meters) of omni-directional line-of-sight range. Lithium battery life is typically four years. The ST-676-I tag is available with 128K of programmable memory. It includes a door clamp and external antennas. Using the door clamp, you affix the tag to the left door of an ISO-compliant container.

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**Note:** Savi SensorTag ST-676-I ISO Container Door Tag with Sensors only supports ISO 668: 1995(E) Series 1 freight containers.

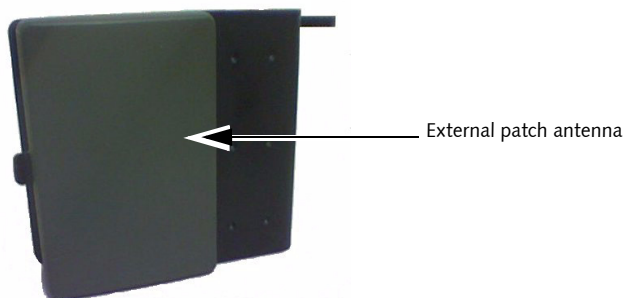
## Features

- ◆ 433 MHz, active RFID technology with up to 300-foot (91.44-meter) range for monitor, wake-up, RF write/read
- ◆ 123 KHz receiver for slot level, portal, or chokepoint tag wake-up and short range commissioning (12 feet [3.7 meters] or less)
- ◆ Small form factor, ideally suited for shipping containers
- ◆ Rugged, weatherproof design
- ◆ Powered by a lithium battery
- ◆ Intrusion detection sensors monitor door and light status
- ◆ Expandable sensor port connects to third-party sensor equipment
- ◆ Temperature, humidity, and shock sensors monitor the internal environment of a container
- ◆ 32K sensor memory

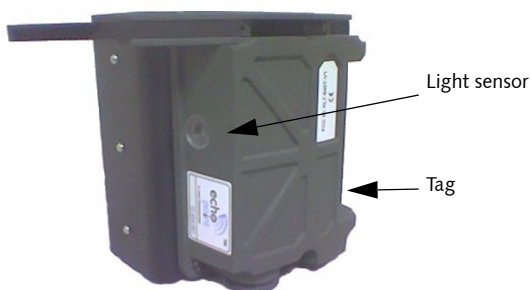
## Description

Figure 1-1 Savi SensorTag ST-676-I ISO Container Door Tag with Sensors

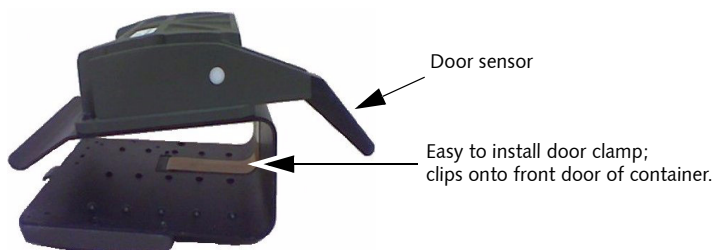
Front view



Back view



Top view of tag



## **Intrusion Detection Sensors**

The ST-676-I tags include door and light sensors. The door sensor monitors the amount of pressure between the door and the device. If the door is open and the device has not been electronically unsealed, the device sends a message to the monitoring software indicating that the device has been tampered. It also writes the time and date of the tamper to an event log. The device also includes a light sensor that triggers an alarm if light is detected inside the container.

## **Environmental Sensors**

The environmental sensors on the ST-676-I tags monitor the temperature and humidity within the container. You can set the maximum and minimum values, and if the temperature or humidity rises above or falls below this range, the device writes the time and date of the breach to the event log. For example, if you are shipping a product that needs to be kept at temperatures between x and y degrees, you can set the ST-676-I tag to record the date and time whenever the temperature breaches the maximum or minimum value.

## **Tamper-Protection Plate**

The tamper-protection plate's right angle flaps are bent to extend and protect the gap behind the plate as well as the tag plate. This plate prevents anyone from inserting a foreign object in an attempt to hold the tag plate in the closed position.

## **RFID Communication Module**

The communication module is positioned on the outside of the container and operates at 433 MHz. This enables the Savi SensorTag ST-676-I ISO Container Door Tag with Sensors to communicate back to the Savi network with excellent RF performance in both heavy metal and non line-of-sight environments.

## For More Information

### Guides to Read

For information about using:

- ◆ Signposts, see the *Savi Signpost SP-65X Series Installation Guide*
- ◆ Fixed readers, see the *Savi Fixed Reader SR-650-101 Installation Guide*
- ◆ Mobile readers, see the *Savi Mobile Reader SMR-650 for the Intermec 751G/A Mobile Computer and PC User Guide*

### Contacting Savi Support

If you cannot find the information you need, contact Savi Support.

- ◆ Check [www.savi.com/services/su.contact.shtml](http://www.savi.com/services/su.contact.shtml) for contact information.
- ◆ Send email to [help@savi.com](mailto:help@savi.com).
- ◆ Call 1-888-994-SAVI (North America only) or 1-408-743-8888 between 9 a.m. and 5 p.m. Pacific time.

When you contact Savi Support by telephone or email, have the following information available:

- ◆ Contact information (company name, your name, email, and phone number)
- ◆ Problem description
- ◆ Product type
- ◆ Software version
- ◆ Serial number or license information



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# Installing Savi SensorTag ST-676-I ISO Container Door Tag with Sensors

## Required Tools and Materials

Before you begin installation, make sure the following materials are available:

- ◆ Savi SensorTag ST-676-I ISO Container Door Tag with Sensors
- ◆ SaviTag Write Cable STA-1030
- ◆ One 3.6V lithium battery, size A (provided)
- ◆ A coin or flat-head screwdriver

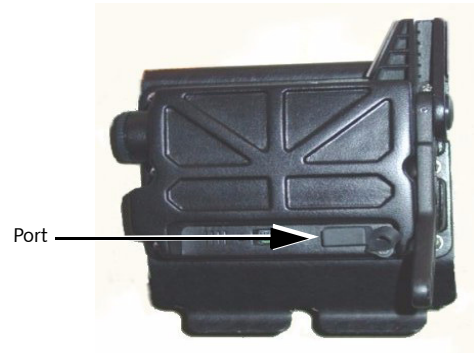
## Commissioning the Tag with SaviTag Write Cable STA-1030

You can commission Savi SensorTag ST-676-I ISO Container Door Tag with Sensors using SaviTag Write Cable STA-1030. You can also commission a tag using Savi software that operates on a mobile device, such as the Intermec® 741G/A or 751G/A Mobile Computer with an attached Savi® Mobile Reader SMR-650. You can purchase the cable, software, and mobile device separately.

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**Note:** Savi SensorTag ST-676-I ISO Container Door Tag with Sensors is shipped from the factory with the battery installed in the reverse direction to preserve battery life. Before you attempt to commission the tag, make sure the battery is properly installed. See “Replacing the Battery” on page 11.

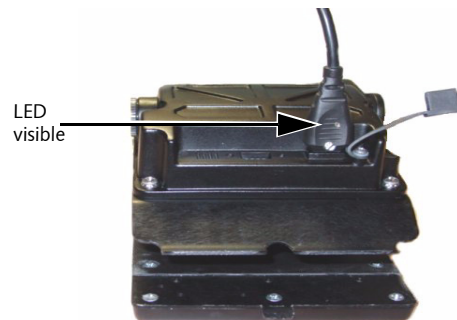
1. Connect SaviTag Write Cable STA-1030 to an available serial port on the host computer.
2. Locate the tag commissioning port on the Savi SensorTag ST-676-I ISO Container Door Tag with Sensors.



3. Unplug the rubber cap covering the port.



4. Insert SaviTag Write Cable STA-1030, with the LED up, into the Savi SensorTag ST-676-I ISO Container Door Tag with Sensors commissioning port. Start the tag commissioning application. The LED is lit when the application writes data to the tag.



## Replacing the Battery

Savi SensorTag ST-676-I ISO Container Door Tag with Sensors is equipped with non-volatile memory, which means stored data is not lost when you replace the battery.

1. Using a coin or flat-head screwdriver, turn the battery cover counterclockwise.

When removing the battery cover, hold on to it to avoid dropping it.



2. Remove the discharged battery from its compartment.

**Warning:** The lithium battery can be harmful to the environment. Follow current procedures for safely disposing of lithium batteries.

3. Install an A 3.6V lithium battery, matching the negative (–) and positive (+) terminals to the symbols shown on the tag housing. The tag will not work if you install the battery in the wrong direction (reversed).



The tag beeps twice if you install a fully charged battery. The tag beeps three times if you install a battery with low charge; replace it with a charged battery. When removing and replacing a charged battery, you may need to wait a few seconds after replacing the battery to hear the confirmation beep.

4. Replace the battery cover using a coin or screwdriver. With the coin placed in the battery cover groove, push the cover in. Turn the battery cover counterclockwise  $1/4$  to  $1/2$  of a turn to properly seat the cover. Turn the battery cover clockwise until it fits flush with the tag case. Be careful not to overtighten.

Make sure the battery cover is completely closed and that it is not cross-threaded.



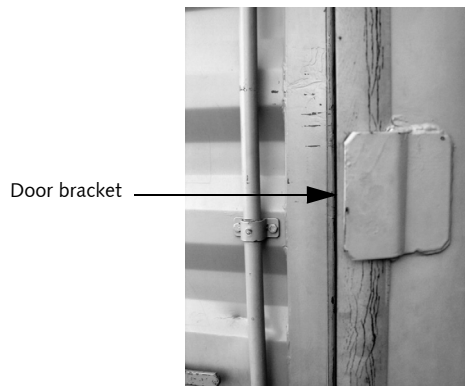
5. Dispose of the used battery according to local safety requirements.

## Tag Placement

Savi Technology recommends that you fit the Savi SensorTag ST-676-I ISO Container Door Tag with Sensors above the door bracket and on the left-hand door of the container. The recommended mounting location for the tag is shown in the following photos.



1. Open the right door of the container.
2. Align the device with the bracket on the right door, if possible.



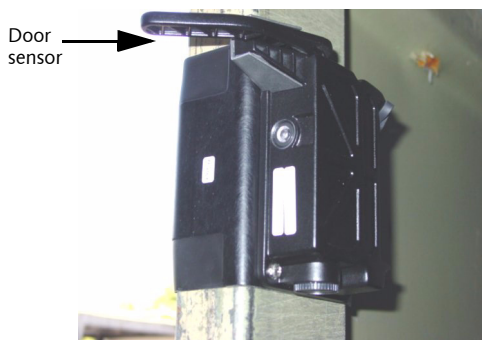
3. Using both hands, secure the device on the *left* door until it is flush.

This is a view from inside the container.



4. Move the door sensor to the left and ensure that the lever is fully extended before closing the container door.

This is a side view of the device mounted on the *left* door.



This is a view of the outside of the container



5. Close the right door.

This is a view of the tag on the container with both doors closed.



6. Seal the tag using the software on your mobile device. The door sensor recognizes when the right door is closed and when the container is dark.
7. After successfully sealing the tag, insert the container's bolt into the hasp.





# Savi SensorTag ST-676-I ISO Container Door Tag with Sensors Specifications

Specification	Description
Physical characteristics	<p><b>Tag</b> Height: 4.75 inches (12.07 cm) Width: 4.5 inches (11.43 cm) Depth: 1.5 inches (3.81 cm)</p> <p><b>Patch antenna</b> Height: 4.6 inches (11.68 cm) Width: 3.2 inches (8.13 cm) Depth: 0.5 inches (1.27 cm)</p> <p><b>Door clamp</b> Height: 4.75 inches (12.07 cm) Width: 5.25 inches (13.34 cm) Depth: 2 inches (5.08 cm)</p>
Total weight of tag	<p>16 ounces (453.59 g) without battery 16.8 ounces (476.27 g) with battery</p>
Environment	<p><b>Temperature:</b> -26°F to +158°F (-32°C to +70°C) operating; -40°F to +185°F (-40°C to +85°C) storage</p> <p><b>Humidity:</b> 100% non-condensing</p> <p><b>Altitude:</b> Maximum altitude = 40,000 feet (12,192m); MIL-STD-810E Method 500.3, Procedure I</p>

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## Savi SensorTag ST-676-I ISO Container Door Tag with Sensors Specifications

Specification	Description
RF receiver/transmitter	<p><b>Ultra High Frequency transceiver:</b></p> <p><b>Frequency:</b> 433.92 MHz</p> <p><b>Modulation:</b> FSK, deviation +/- 50 KHz</p> <p><b>Data rate:</b> 27.8 Kbps</p> <p><b>Data coding:</b> Manchester</p> <p><b>Communication range (unobstructed):</b> Typical range is up to 300 feet (91.44 meters) line-of-sight when mounted on a container and communicating with a Savi Fixed Reader SR-650-101 or SaviReader 410R. Typical range is 200 feet (61 meters) line-of-sight when mounted on a container and communicating with a Savi MobileReader SMR-650P-110 and SMR-650P-111 or Savi Mobile Reader SMR-650-212</p> <p><b>Maximum transmit power:</b> -7.4 dBm (0.18mW) typical; -2.4 dBm (0.6 mW) with ground reflection (uncommon)</p> <p><b>Air protocol:</b> BCS Commands, EBCS Commands (22-bit tag identification supported); Savi EchoPoint Air Protocol 2.1 (32-bit tag identification supported), Draft Standard for ISO 18185</p>
LF receiver (downlink)	<p><b>Low Frequency receiver (downlink)</b></p> <p><b>Frequency:</b> 123 KHz</p> <p><b>Modulation:</b> ASK On-Off Keying</p> <p><b>Data rate:</b> Average 1.6 Kbps, 50% duty cycle</p> <p><b>Data coding:</b> Pulse Width Modulation</p> <p><b>Communication range:</b> Up to 4 feet (1.22 meters) from Savi MobileReader SMR-650P-110 and SMR-650P-111 or Savi Mobile Reader SMR-650-212</p> <p>Up to 12 feet (3.66 meters) from Savi Signpost (models SP-600-xxx and SP-65x-xxx)</p> <p><b>Air protocol:</b> BCS Commands, EBCS Commands (22-bit tag identification supported); Savi EchoPoint Air Protocol 1.1</p>
Network	<p><b>Wireless:</b> RF read/write capable with Savi software that operates on a mobile device</p> <p><b>Wired:</b> Sensor expansion port and serial read/write capable via Savi Tag Write Cable STA-1030</p>
Memory	On board non-volatile 128K memory and 32K sensor memory for ST-676-I

Specification	Description
Hardware compatibility	<ul style="list-style-type: none"> <li>◆ Savi Mobile Reader SMR650P (model SMR-650P-xxx)</li> <li>◆ Savi Mobile Reader SMR-650 (models SMR-650-xxx)</li> <li>◆ Savi Fixed Reader SR-650</li> <li>◆ Savi Signpost SP 65x series</li> </ul>
Antenna	External patch antenna
Shock and vibration	<p><b>Shock:</b> MIL-STD-810E Mechanical Shock, Transit Drop Methods 516.4</p> <p><b>Vibration:</b> MIL-STD-810E Method 514.4, Category 10</p> <p><b>Loose cargo test:</b> MIL-STD-810F Method 514.5</p>
Protection type	Sealed to IP 54 ISO 1496 weatherproofing requirements
Power	<p><b>Battery type:</b> 3.6 volt primary lithium (Li-SOCI<sub>2</sub>), A size, user replaceable</p> <p><b>Battery life:</b> Approximately 4 years depending on usage</p> <p><b>Power management:</b> UHF sleep mode prevents unwanted collections, enabled/disabled by LF link</p> <p><b>Diagnostics:</b> Reports low tag battery status</p>
Regulatory approvals	<p><b>Radiated emission (intentional):</b> U.S. emission standards as contained in FCC Part 15 and European Community emission standards as contained in EN 300 220 (433 MHz)</p> <p><b>Electromagnetic immunity:</b> ESD compliance Exposed to 8 kV air discharge or 4 kV contact discharge in accordance with EN 301 489-1</p> <p><b>Radiated emission (unintentional):</b> U.S. emissions standards as contained in FCC Part 15 and European Community emission standards as contained in EN 301 489-1</p> <p><b>Safety approval:</b> U.S UL 1950; European EN 60950</p> <p><b>Ordnance Safety:</b> HERO certification</p> <p><b>Markings:</b> Savi logo, product model and serial number, EMC compliance (FCC/EN), and Ordnance/HERO</p>

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## Savi SensorTag ST-676-I ISO Container Door Tag with Sensors Specifications

Specification	Description
<b>Sensors</b>	<p><b>Door sensor:</b> Senses the right side of the container door in the closed or open position</p> <p><b>Light sensor:</b> Senses light coming through the door</p> <p><b>Temperature sensor:</b> Integrated temperature takes readings every five minutes (default; use Savi software to adjust settings). Mounted in its own compartment to isolate it from other circuit boards</p> <p><b>Humidity sensor:</b> Integrated humidity sensor takes readings every five minutes (default; use Savi software to adjust settings). Mounted in the same compartment as the temperature sensor</p> <p><b>Shock sensor:</b> Senses shock in the container above a set threshold</p>
<b>Mounting</b>	Contains a door clamp that clips onto the left-side door of a container
<b>Software</b>	EchoPoint FTMobile, EchoPoint EK-650, and Savi SmartChain Transportation Security System (TSS), Savi SmartChain Site Manager 5.6, Savi SmartChain Client Tools 4.x, TAV Tools 3.6, Savi Retriever 2.1
<b>Accessories</b>	Spare A size batteries; part number BAT-1125