

# User Guide for SPURO-X

## SPURO-X

Introducing SPURO-X by VestiTech, a premium LoRaWAN device for GPS tracking and motion detection. With offline data storage, IP67 protection, and a replaceable battery, SPURO-X guarantees long-lasting performance in any environment.

Designed for flexibility, VestiTech's embedded software makes it adaptable across industries such as tracking services, construction, logistics, agriculture and Livestock. SPURO-X is the ultimate multipurpose sensor, setting new standards in efficiency and reliability.

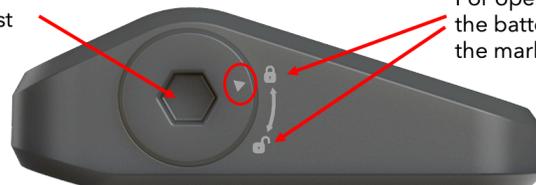


## Power the SPURO-X Device

To start, plug in the battery by opening the battery hatch with an Allen/Hex-key tool.

Important: The movement from "open to close" is just a 1/5 of a full circle so be careful when opening and closing. Symbols are described on the side of the tracker. The battery is installed with the negative pole inside, meaning the flat part inward.

For open and lock  
Use an Allen/Hex  
Key. NOTE be aware  
the short twist



For open and lock  
the battery hatch see  
the marker positions.

## Battery Type

SPURO-X uses an AA-size 3.6 V lithium battery. Use only 3.6 V lithium cells (not 1.5 V alkaline/NiMH). Battery performance can vary between manufacturers, especially in sub-zero temperatures and due to self-discharge over time (shelf life). The battery is not included.

## Mounting

SPURO-X is designed to work across many industries and mounting scenarios. Depending on your asset and environment, you can secure the device using collar bands/straps, screws, cable ties, hook-and-loop (Velcro) with adhesive, adhesive tape, or a magnet mount.

For best performance:

- Mount the device where it has the best possible view of the sky for GNSS reception.
- Avoid placing it directly against large metal surfaces, which can reduce GNSS and LoRaWAN radio performance.
- Ensure the mounting method can withstand vibration, weather, and handling in your application.

No sharp edges to secure a variety of mounting options.

- 1) Screws
- 2) Collars for Cattles or other animals
- 3) Backside for Velcro or double side tape



## Connect SPURO-X to Your Network

This section describes how to connect SPURO-X to a LoRaWAN network, either through a network operator or through a private LoRaWAN setup (your own gateways and LoRaWAN Network Server).

If you use VestiTech's service platform ONTRACK, device provisioning is automated, and standard service settings are pre-configured.

The device supports Over The Air Activation (OTAA):

SPURO-X joins the network using Over-the-Air Activation (OTAA). To provision a device, you need the following identifiers/keys for each tracker:

- 1) DevEUI
- 2) JoinEUI (sometimes called AppEUI)
- 3) AppKey

Get started

- 1) DEVEUI
- 2) Join EUI
- 3) APPKEY

QR Code

- Use the Mobile App



Enter these values in your LoRaWAN Network Server and ensure the correct regional parameters are selected (e.g., EU868/US915). When SPURO-X is powered on, it will send a join request and attempt to join the network.

After a successful join, refer to the Communication Protocol section for ports, payload formats, and configuration details.

## Firmware upgrade

The SPURO-X can be upgraded over LoRaWAN (OTA) or NFC.

## Device Setting Configurations

Below describes the type of device settings available today.

- Fixed number of GPS positions per day
- Fixed number of accelerometer values per day
- Fixed number of Temperature monitoring
- Fixed number of Battery monitoring
- Fixed number of LoRaWAN status messages per day
- On demand GPS position\*
- Enable motion detection from the accelerometer
  - Different settings of data points (GPS)
  - Different settings of data points (Accelerometer)
  - Enable alarms based on movements
- Off the grid data collections and data storage (no LoRaWAN coverage)\*

### Configuration settings:

SPURO-X will be delivered with a default configuration that can be updated with both NFC or LORA.

The SPURO-X has two modes “active and passive” mode. It switches between the two modes automatically depending on configuration and accelerometer movement.

gps_update	Set the GPS update interval in minutes, 0 for never (For example 60 will be every hour)
acc_update	Set the accelerometer update interval in minutes, 0 for never
temp_bat_update	Set the temp and battery update interval in minutes, 0 for never
active_gps_update	Set the GPS update interval in minutes in active mode (I.e movement detected over the threshold value from the accelerometer).
active_acc_update	Set the accelerometer update interval in minutes in active mode
lora_update	Max time between failed LORA updates in minutes
acc_window	Number of accelerometer values to calculate mean value of.
active_timeout	Return to passive mode after minutes under threshold.
alive_check	Report if an animal is alive or utilization on a machine etc
active_mode	Enable active mode during movement
active_threshold	Threshold to switch to active mode.

## SPURO-X Protocol

config_data		
uint16	gps_update	GPS update [min], 0 for never
uint16	acc_update	Acc update [min], 0 for never
uint16	temp_bat_update	Temp/bat update [min], for never
uint16	active_gps_update	GPS update in active mode [min], 0 for never
uint16	active_acc_update	Acc update in active mode [min], 0 for never
uint16	lora_update	Max time between failed LORA updates [min]

uint16	acc_window	Number of acc values to average.
uint16	active_timeout	Active to passive mode timeout [min]
uint8	alive	1-255=Report if animal is dead or alive (acc_update * 6 * value = minutes for report, Ex 10 min * 6 * 4 = 4h without movement for report) 0=no report
uint8	active_mode	0x0 = off, 0x1 on compare to previous, 0x3 on compare to baseline
uint8	active_threshold	0-63,
uint8	lora_data_rate	Always 1 for now
uint8	lora_settings	Always 0 for now

Get config. downlink port on port 11		
uint8	id	0
uint8	length	0

Set config and get confirmed config, downlink on port 11		
uint8	id	0
uint8	length	Size of struct below
config_data		

Current config, uplink on port 11		
uint8	Id	0
uint8	length	Size of struct below
config_data		

Gps message, uplink on port 10		
uint8	id	80
uint8	length	14
uint8	reserved	
uint8	reserved	
uint32	timestamp	UTC Unix epoch

int32	latitude	Divide by 600.000 [WGS84 decimal degrees]
int32	longitude	Divide by 600.000 [WGS84 decimal degrees]

Accelerometer message, uplink on port 10		
uint8	id	82
uint8	length	6
uint16	rms	Multiply with $3.93/(2048*\sqrt{3})*8$
int32	timestamp	UTC Unix epoch

Accelerometer dead/alive message, uplink on port 10		
uint8	id	86
uint8	length	6
uint8	alive	0=dead, 1=alive
uint8	reserved	
int32	timestamp	UTC Unix epoch

Temperature and battery message, uplink on port 10		
uint8	id	54
uint8	length	10
int16	temperature	10°C
uint16	battery	mV
uint16	reserved	
int32	timestamp	UTC Unix epoch

Status firmware message, uplink on port 12		
uint8	id	51
uint8	length	3
uint8	fw_major	
uint8	fw_minor	
uint8	fw_patch	

ActiveStatus, uplink on port 12		
uint8	id	52
uint8	length	1
uint8	active	0=passive/normal mode, 1=active_mode (motion detected)

Trigger measurement message, downlink on port 14		
uint8	id	8
uint8	length	1
uint8	type	1= GPS, 2=Acc, 3=Temp/Bat

Examples on device setting for different use cases (need more input)

- 1) Cars
- 2) Livestock
- 3) Construction

In addition: Description how the Accelerometer can be set for different use cases etc.

#### # Alarm on assets etc

```

gps_update      = 0    # No GPS positions when device is not moving
acc_update      = 0    # No accelerometer positions when device is not moving
temp_bat_update = 60*24 # Temp & Bat once per day
active_gps_update = 10  # New GPS position every 10 min when device is moving
active_acc_update = 10  # New accelerometer value every 10 min when device is moving
lora_update     = 60*4  # Maximum 4 hours between lora updates
acc_window      = 1    # 1 = No mean at all of accelerometer values
active_timeout  = 30   # Return to normal mode after 30 min below threshold
alive_check     = 0    # No alive check
active_mode     = 0b11  # bit 0: 0=off 1=on, bit 1: 0=C2P, 1=C2B, (Compare 2 baseline =
Even if the asset is moved really calm the alarm will go of)
active_threshold = 3    # 0-63 (63 is the highest threshold) 3 = Just a small movement will
cause the alarm

```

#### # Animals

```

gps_update      = 60*2  # GPS position every second hour

```

```

acc_update      = 10    # Accelerometer position every 10x3 minutes (see acc_window below)
temp_bat_update = 60*24 # Temp & Bat once per day
active_gps_update = 0    # This is not used since bit 0 in active_mode is zero
active_acc_update = 0    # This is not used since bit 0 in active_mode is zero
lora_update     = 60*4  # Maximum 4 hours between lora updates
acc_window      = 3    # Amount of RMS value averaged together before sending up
active_timeout  = 30    # This is not used since bit 0 in active_mode is zero
alive_check     = 1    # Report if animal is dead or alive
active_mode     = 0b00  # bit 0: 0=off 1=on, bit 1: 0=C2P, 1=C2B,
active_threshold = 0    # This is not used since bit 0 in active_mode is zero

```

#### # Machines

```

gps_update      = 60*6  # GPS position every sixth hour
acc_update      = 5    # Accelerometer position every 5x3 minutes (see acc_window below)
temp_bat_update = 60*24 # Temp & Bat once per day
active_gps_update = 60*6 # The same as in passive mode
active_acc_update = 5    # Increase sampling in active mode
lora_update     = 60    # Maximum 1 hour between lora updates
acc_window      = 3    # Amount of RMS value averaged together before sending up
active_timeout  = 30    # Return to normal mode after 30 minutes below threshold
alive_check     = 0    # No alive check
active_mode     = 0b01  # bit 0: 0=off 1=on, bit 1: 0=C2P, 1=C2B (Compare 2 Previous
sample = Only detect quick changes not slow onces over long time)
active_threshold = 20    # 0-63 (63 is the highest threshold) 20 = quite high threshold to report
is the machine is vibrating more than expected)

```

## Correct Disposal of this Product

This marking indicates that this product should not be disposed of with other household wastes throughout the EU. To prevent possible harm to the environment or human health from uncontrolled waste disposal, recycle it responsibly to promote the sustainable reuse of material resources. To return your used device, please use the return and collection system.



## Warnings!

For your safety, do not use the device on the plane, near hospitals, pacemakers, or any other areas/times that restrict the use of electronic devices.

Do not use near gas stations or any other dangerous environments (areas that might contain inflammable gas, gun powder, or other flammable substances).

Do not use in areas/times that restrict wireless electronic products.  
Immediately stop using the product if you see smoke, unusual smell, heat or find anything unusual about the device's state.

Do not open the device. Do not modify, alter, reverse engineer, tamper with, or repair the device.

*Simplified EU Declaration of Conformity*

## FCC Compliance : FCC ID: SPURO2BGLZ

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 operation.

**Warning:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**NOTE:** 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

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