

## Fencyboy Datasheet

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### Features

- Real-time voltage monitoring of every electric fence impulse **up to 15 kV**.
- Detects low-voltage conditions caused by vegetation, broken wires, poor grounding or energizer issues; can trigger immediate notifications.
- Compatible with existing electric fence systems.
- LoRaWAN® Class A device: **works with any network** (public or private) and **any data platform**. *Preconfigured one-minute setup with Data-cake available out of the box.*
- Single-use **Battery** (3 years runtime) or **Solar** (maintenance-free with rechargeable storage).
- Outdoor-ready **IP67** enclosure: rain, dust and UV resistant.
- Additional statistics and battery monitoring; API-friendly for custom backends.
- Low-power design with configurable sampling and transmission strategies.



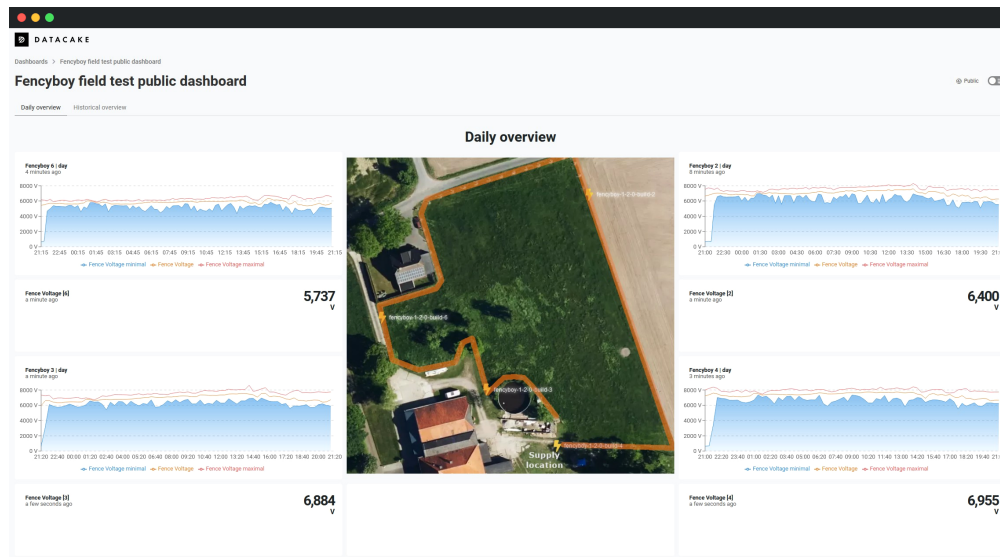
**Figure 1: Fencyboy v1.3.1 demo unit with clear cover and single-use battery mounted on wooden fence post.**

### Applications

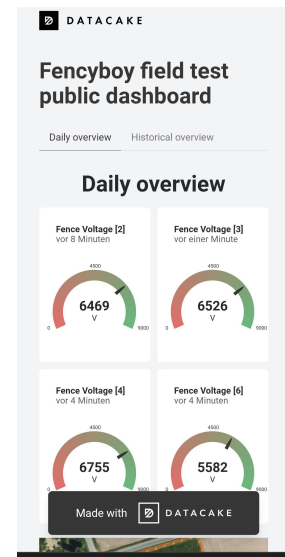
- **Wildlife and conservation:** Game reserves, national parks, and anti-poaching perimeters.
- **Equestrian and dairy:** Horses, paddocks, stables, dairy farms, and breeding operations.
- **Livestock protection:** Cattle, sheep, goats, poultry, and mixed grazing systems.
- **Agriculture and smart farming:** Remote farmland fencing, vegetation detection, and IoT integrations.
- **Infrastructure and industry:** Forestry, solar/wind farms, utilities, and construction sites.
- **Security and remote use:** Mobile or temporary fencing, disaster relief operations.

### General Description

**Fencyboy v1.3.1** is an electric fence sensor that measures the voltage of an ordinary electric fence used in agriculture. It captures the peak voltage of each energizer impulse each second and transmits the data using LoRaWAN® to any compatible network. The device detects low-voltage conditions caused by vegetation, broken wires, poor grounding or energizer issues, and can trigger immediate notifications. The data can be stored and visualized in any platform.



(a) Desktop view.



(b) Mobile view.

**Figure 2: Dashboards to visualize electric fence voltage with multiple sensors along the perimeter. Can be created using Datasheet, which is an easy optional way to visualize Fencyboy's data. Other platforms can be used as well.**

## Description

### How Does an Electric Fence Work?

Electric fencing is widely used in agriculture to keep animals within a pasture and protect them from predators (e.g., wolves). The fence is not continuously energized, but produces short impulses about once per second. Due to the high voltages of 3 kV to 15 kV, a electric shock is released upon touching the fence. However, the shock is harmless with limited energy, typically 0.2 J to 15 J. The energizer connected to the fence is powered by a battery, solar panel, or mains electricity.

### Electric Fence Maintenance

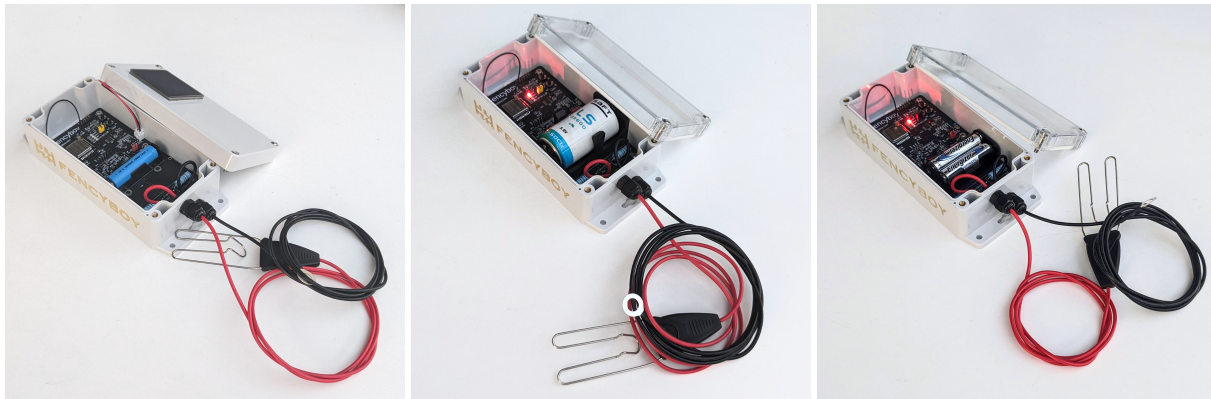
Animals can easily escape or get harmed in case of faulty fencing, causing considerable financial damage. Therefore, fences must always function correctly and be regularly maintained. Vegetation such as grasses and bushes reduces effectiveness by touching the wires and creating conductive paths to ground. In addition, fences may be damaged by fallen branches or storms. Checking fences is tedious and often neglected, as it usually requires walking the entire length and measuring voltages with a handheld meter.

### Real-time Electric Fence Monitoring with Fencyboy

Fencyboy enables real-time monitoring of electric fences in remote areas. It measures fence voltage continuously, stores and analyzes data locally, and transmits it via LoRaWAN® for processing and visualization as shown in Figure 2. Farmers receive immediate alerts and long-term trend analysis, e.g., for vegetation growth. By capturing every impulse, Fencyboy can detect abnormal events, indicating animal shocks or potential fence breaches. Multiple Fencyboy devices can be deployed together to monitor individual sections of the fence.

## Variants

The Fencyboy Electric Fence Sensor is available in multiple variants, primarily distinguished by the type of battery. The available variants are shown in Figure 3. Modifications are available upon request.



(a) Solar variant with rechargeable LiFePO4 battery and solar panel.

(b) Single-use variant with Li-SOCI2 D-cell battery.

(c) Single-use variant with two AA batteries.

**Figure 3: Fencyboy Electric Fence Sensor variants. Note: all variants come with a light-gray cover unlike the transparent one shown in the images.**

The solar variant (see Figure 3a) features a rechargeable AA LiFePO4 battery and a solar panel for continuous operation all year round. During winter times or at night, the battery serves as a backup to power the system for more than a month without any sunlight. The battery will be recharged automatically as soon as possible. The LiFePO4 chemistry is chosen for its safety, long cycle life and good performance at low temperatures compared to standard Li-Ion type batteries. The high quality solar panel is specifically coated with a durable protection layer to withstand harsh environmental conditions and especially UV radiation. It has a typical lifespan of 10 years and is mounted on the outside of the enclosure with a strong waterproof adhesive.

For locations where sufficient sunlight is not available, such as dense forests or areas with tall buildings, the solar variant may not be the best choice. In these cases, the single-use D-cell variant (see Figure 3b) can be used as an alternative. It is powered by a high energy Li-SOCI2 D-cell battery which provides long-lasting power specifically for low power devices like the Fencyboy. The battery is available from multiple suppliers with capacities ranging from 13 to 19 Ah, allowing the Fencyboy to operate for more than 3 years during normal operation.

For seasonal applications, such as rotating pastures or in the mountains, the single-use AA variant (see Figure 3c) can be a suitable choice. It is powered by two standard high energy AA batteries, which are widely available and easy to replace. This variant is ideal for temporary setups where the sensor needs to be deployed for a duration of up to 5 months. The batteries should be removed during storage to prevent leakage and damage to the device.

## Specifications

Unless otherwise noted:  $T_A = 20^\circ\text{C}$ ;  $V_{SYS} = 3.3\text{V}$ ; EU868 region; device powered within operating range.

**Table 1: Fence input Specifications**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions / Notes
Fence impulse voltage	$V_{\text{FENCE}}$	0.5	—	15	kV	Peak voltage capture of energizer pulses.
Fence impulse energy	$E_{\text{FENCE}}$	0.2	—	—	J	
Fence pulse period	$T_{\text{PULSE}}$	0.5	1.0	9.0	s	Measured between impulses.
Fence pulse duration	$T_{\text{DURATION}}$	—	100	—	us	
Fence pulse rise time	$T_{\text{RISE}}$	20	—	—	us	
Input impedance	$R_{\text{IN}}$	19	20	21	MΩ	High-impedance divider.

**Table 2: Energy Supply Specifications**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions / Notes
Operating voltage (system)	$V_{\text{SYS}}$	2.7	3.3	3.6	V	Unregulated system rail; Direct connection to battery.
Battery voltage (solar)	$V_{\text{SOLBATT}}$	2.73	3.2	3.42	V	LiFePO4 battery
Battery voltage D (single-use)	$V_{\text{SUSEBATTD}}$	—	3.6	3.6	V	Li-SOCI2 battery
Battery voltage 2xAA (single-use)	$V_{\text{SUSEBATTAA}}$	—	3.0	—	V	Two LR06 AA alkaline batteries in series (typically Zn-MnO2 with 2800 mAh)
System standby current	$I_{\text{STANDBY}}$	—	115	—	μA	Ready to detect impulse
System sampling current	$I_{\text{SAMPLING}}$	115	300	600	μA	typical at $T_{\text{PULSE}} = 1.0$ s, maximum at $T_{\text{PULSE}} = 0.5$ s
System TX current (14dB)	$I_{\text{TX14dB}}$	—	70 <sup>1</sup>	—	mA	e.g. EU868
System TX current (20dB)	$I_{\text{TX20dB}}$	—	105 <sup>1</sup>	—	mA	e.g. US915
Solar panel output power	$P_{\text{SOLAR}}$	-	0.32 <sup>2</sup>	—	W	STC (1000 W m <sup>-2</sup> , 25 °C)
Solar charger efficiency	$E_{\text{SOLAR}}$	-	85	-	%	

<sup>1</sup> According to the LoRaWAN® module manufacturer.

<sup>2</sup> According to the solar panel manufacturer.

**Table 3: Battery Life Approximations**

Parameter	Typ.	Unit	Conditions / Notes
Daily energy consumption	16 <sup>1</sup>	mAh/day	$V_{SYS} = 3.3V$ , rough approximation, no recharging
Discharge solar <sup>2</sup> no recharge, normal-use <sup>1</sup>	1.2	months	No sunlight, worst case
Recharge solar <sup>2</sup> , normal-use <sup>1</sup> , winter	69	mAh/day	1 PSH <sup>3</sup>
Recharge solar <sup>2</sup> , normal-use <sup>1</sup> , summer	409	mAh/day	5 PSH <sup>3</sup>
Discharge single-use Li-SOCl <sub>2</sub> <sup>4</sup> , normal-use <sup>1</sup>	3	years	
Discharge single-use Alkaline <sup>5</sup> , normal-use <sup>1</sup>	5	months	

<sup>1</sup> EU868, SF7, 10 minute data transmission interval,  $T_{PULSE} = 1.0s$ .

<sup>2</sup> Solar variant powered by 3.2 V, 600 mA h, IFR 14500, LiFePO<sub>4</sub>, AA battery.

<sup>3</sup> Peak sun hours per day, 1000 W m<sup>-2</sup>, 25 °C

<sup>4</sup> Single-use variant powered by 3.6 V, 17 A h, Li-SOCl<sub>2</sub> battery of type LS 33600 from Saft.

<sup>5</sup> Single-use variant powered by two 1.5 V, 2800 mA h, Alkaline battery of type LR06.

**Table 4: Wireless Specifications**

Parameter	Value	Conditions / Notes
Wireless technology	LoRaWAN®	Can also be operated in LoRa® P2P or mesh-tastic mode on request.
LoRaWAN® version	1.0.2	
LoRaWAN® class	A	
Features	OTAA, ADR	
Frequency plans	EU868, US915, AU915, AS923	
Transmit power	+14 dBm (EU868), +20 dBm (e.g., US915)	
Antenna	Wide Band FPC, 700-2700Mhz	8 dBi gain
Downlinks	Supported	See documentation <sup>1</sup>

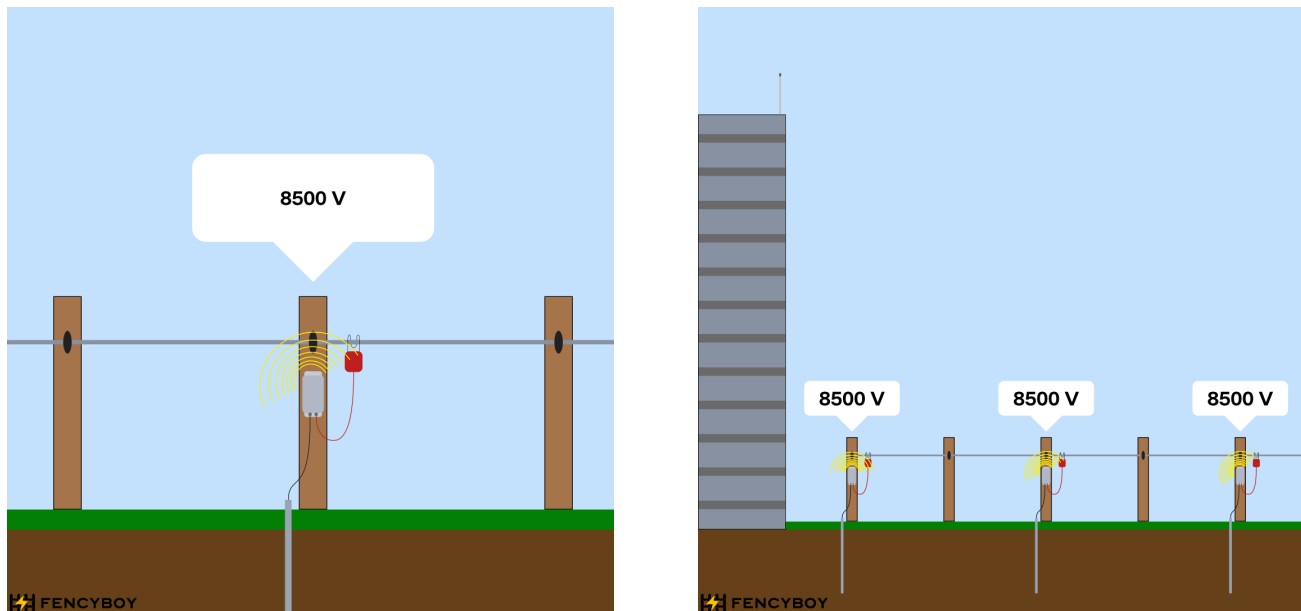
<sup>1</sup> <https://docs.fencyboy.com/features/downlinks>

**Table 5: Mechanical Specifications**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions / Notes
Weight solar with battery	$W_{SOLBATT}$	-	368	-	g	AA LiFePO4 battery.
Weight solar without battery	$W_{SOL}$	-	350	-	g	
Weight single-use with battery	$W_{SUSEBATTD}$	-	430	-	g	D Li-SOCI2 battery.
Weight single-use without battery	$W_{SUSE}$	-	340	-	g	
Dimension width	$D_W$	-	82	-	mm	Excluding cable glands.
Dimension height	$D_H$	-	190	-	mm	Excluding cable glands.
Dimension depth	$D_D$	-	55	-	mm	Excluding cable glands.
Enclosure screw type	—	-	M4	-	-	4x screws
Enclosure material	—	-	-	-	-	Polycarbonate.
Enclosure ingress protection	—	-	IP67 <sup>1</sup>	-	-	When properly assembled - see instructions.
Cable gland material	—	-	-	-	-	PA66 Polyamid Nylon
Cable gland ingress protection	—	-	IP68 <sup>1</sup>	-	-	Tightened during factory assembly.
Cable gland ventilation airflow	—	20	-	-	cc/min	@7kpa
Solar panel ingress protection	—	-	IPX7 <sup>1</sup>	-	-	Fixed to enclosure with 3M™ VHB™ sealant.
Operating temperature	$T_{OP}$	-20	20	60	°C	Negative temperatures reduce battery life significantly.
Operating humidity	$H_{OP}$	0	-	100	% RH	
Fence cable connector	—	-	-	-	-	Spring loaded fork
Fence cable length	$L_{CABLEF}$	-	90	-	cm	Red cable.
Earth cable connector	—	-	-	-	-	Ring terminal.
Earth cable length	$L_{CABLEE}$	-	140	-	cm	Black cable.

<sup>1</sup> According to the manufacturer.

## Operating and Mounting Instructions



(a) Single sensor setup.

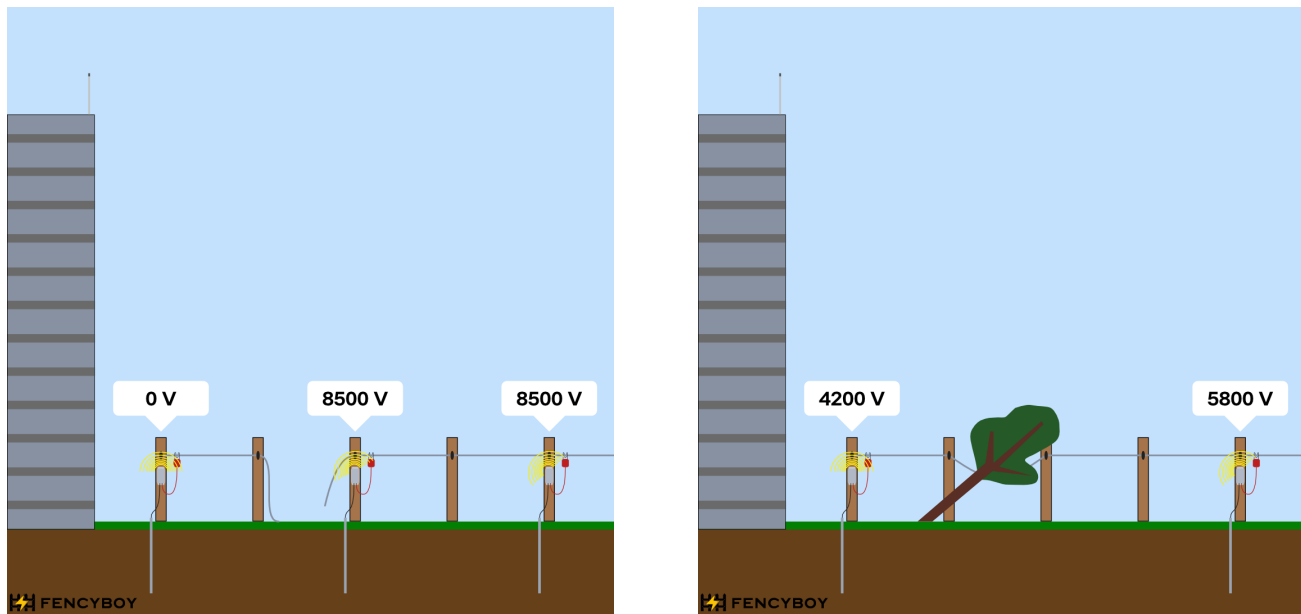
(b) Multiple sensors and gateway antenna.

**Figure 4:** Fencyboy sensors measure the fence voltage like 8500 V. At least one sensor is required, but several can be used for enhanced coverage. In the right image, the gateway antenna is visible on the tall silo, receiving data wirelessly.

**Normal Operation and Mounting:** To install a Fencyboy sensor, connect one wire to the electric fence and the other to a dedicated earth rod. The earth rod should be made of non-corrosive conductive material, ideally 1 m in length, and can be sourced from any local farm supply shop. The Fencyboy earth wire is equipped with a small flat O-type connector for easy attachment to the metal rod. The positive fence clamp has a heart shape, making it suitable for both typical metal wires and electric fence tape or band. For safety and durability, tidy up the cables so that animals cannot chew on them. Mount the Fencyboy unit to a thick wooden fence post using the flanges on the top and bottom of the enclosure, securing it with four screws. Ensure the cables and cable glands face downward to prevent water ingress. If using the solar panel variant, position the panel to face the sun—ideally angled, but vertical orientation is also acceptable.

**Important Mounting Precautions:** Do not mount the Fencyboy sensor to metal walls or metal structures, such as barns, as this can severely reduce wireless signal quality due to shielding effects. Always prefer mounting to a wooden fence post in an open field for optimal performance as shown in Figure 4a. Avoid overtightening the enclosure screws, mounting screws, or cable glands—excessive force can compromise the water resistance of the device rather than improve it. Use a proper earth rod, as described above, to ensure accurate voltage measurements because a poor earth connection can lead to incorrect readings which are influenced heavily by soil humidity. A long earth rod driven deep into the ground is recommended to minimize these effects.

**Efficient Fence Monitoring:** Fencyboy sensors provide real-time voltage monitoring for electric fences. With just one sensor, you can already detect faults such as a sudden voltage drop to 0 V (e.g., due to a cut wire) or a general voltage decrease from typical values like 8500 V down to 4200 V, which may indicate vegetation or a tree touching the fence. These changes can happen suddenly, such as when a tree falls on the fence, or gradually, as grass and other plants grow and make contact.



(a) Cut wire: Voltage drops to 0 V beyond the break.

(b) Tree on wire: Fault detected by voltage drop.

**Figure 5: Fault cases: Fencyboy sensors help localize and identify issues.**

When multiple Fencyboy sensors are installed on the same fence, as shown in Figure 5a, fault localization becomes even more precise. In the first subfigure, three sensors are present and the fence wire is cut before the last sensor. The last sensor reads 0 V, while the other two remain at 8500 V, since the energized segment is left floating and not shorted. If the cut wire were to touch the ground, a voltage drop would be observed on the energized part as well, and the last sensor would show some leakage voltage instead of 0 V.

The second subfigure (Figure 5b) illustrates a case where a tree has fallen on the fence. Here, both Fencyboy units register a voltage drop, but not to zero. This is expected, as the fault causes the voltage to decrease along the entire fence. Typically, the voltage will drop slightly more at measurement points after the fault location compared to those before it. However, other factors, such as changes in earth return resistance due to varying soil humidity, can also influence the readings. This is why using a good, long earth rod is important to minimize such unwanted effects.

## Payload Structure

For the most up-to-date and detailed information, see the online documentation:

<https://docs.fencyboy.com/features/measured-values>

After the first startup, the Fencyboy sensor will immediately send its current configuration as an uplink (see Table 6). Afterwards, it will send uplinks at regular intervals (default: every 10 minutes) containing the measured values listed in Table 7.

The payload decoder for popular platforms like The Things Network (TTN) and Datacake is available.

**Table 6: Configuration values included in the Fencyboy config payload.**

extbfName	Type/Range	Example	Description
Config Version	integer	4	Unique integer indicating the version of the configuration schema.
Send Interval	integer (minutes)	10	Time between uplinks from the device (default: 10 minutes).
Smart Sleep	boolean	True	Enables or disables smart sleep functionality.
Expected Time Between Impulses	integer (ms)	1000	Expected time between energy impulses on the fence, in milliseconds. Used for smart sleep and timeout.
Periodic Restart Time	integer (minutes)	20160	Time until device restarts automatically (default: 2 weeks = 20160 min).
Voltage Divider Multiplier	integer	5130	Ratio of the resistor voltage divider, used for voltage measurement calibration.
Maximum Battery Capacity	integer (mAh)	17000	Maximum battery capacity configured in the software.
Used Battery Capacity	float (mAh)	0.0	Total energy consumption tracked by the sensor, used to calculate remaining battery capacity.

**Table 7: Measured values included in a Fencyboy data packet.**

Name	Value range	Example	Description
ACTIVE_MODE	True or False	True	Indicates whether the fence is energized or not.
IMPULSES	integer $\geq 0$	400	Number of measured pulses since the last transmission.
FENCEVOLTAGE	float $\geq 0.0$	8500 V	Arithmetic mean of the measured voltages of all pulses since the last transmission (in volts).
FENCEVOLTAGEMIN	float $\geq 0.0$	8300 V	Minimum measured voltage of all pulses since the last transmission (in volts).
FENCEVOLTAGEMAX	float $\geq 0.0$	8700 V	Maximum measured voltage of all pulses since the last transmission (in volts).
FENCE_VOLTAGE_STD	float $\geq 0.0$	40 V	Standard deviation from the arithmetic mean of all measured voltages of all pulses since the last transmission (in volts).
TEMPERATURE	float	24 °C	Current ambient temperature in °C, measured in the housing of the Fencyboy.
BATTERYVOLTAGE	float $\geq 0.0$	3.2 V	Current voltage of the battery in the Fencyboy (in volts). Not the voltage of the battery that powers the electric fence.
REMAINING_CAPACITY	float $\geq 0.0$	551.2 mAh	Remaining charge of the battery in mAh. This value must be reset via downlink after a battery change.

## Downlinks

For the most up-to-date and detailed information, see the online documentation:

<https://docs.fencyboy.com/features/downlinks>

Fencyboy sensors can be controlled and configured remotely using LoRaWAN downlinks. These downlinks allow you to change configuration settings, manage the device lifecycle (such as restarting), and retrieve debug information. All downlink commands are accepted on port 2. Some commands require additional parameters, which must be provided in the correct format. After making changes to the configuration, it is recommended to save the new settings to EEPROM to ensure they persist after a restart. Saving to EEPROM can be done in the same downlink message as other commands (see subsection on sending multiple commands).

## Supported Downlink Commands

**Table 8: Supported Fencyboy downlink commands**

Description	Opcode	Parameter	Details
Restart device	0x10	uint16 (delay in min)	Restarts the device after the specified delay. E.g., 0x100005 restarts in 5 min.
Get time till restart	0x11	-	Returns time until next restart (uint16, min).
Set transmission interval	0x80	uint8 (interval-1, min)	Sets uplink interval. E.g., 0x8004 sets interval to 5 min.
Set expected time between impulses	0x81	uint16 (ms)	Sets expected time between impulses. E.g., 0x8103E8 sets to 1000 ms.
Set voltage divider multiplier	0x82	float (4 bytes)	Sets multiplier for voltage divider. E.g., 0x8245a14000 sets to 5160.
Set smart sleep status	0x83	uint8 (0/1)	Activates (1) or deactivates (0) smart sleep. E.g., 0x8301 activates.
Save config to EEPROM	0x90	-	Saves current config to EEPROM.
Load config from EEPROM	0x91	-	Loads config from EEPROM.
Get current config via uplink	0x92	-	Requests current config via uplink.
Reset config to default	0x93	-	Resets config to factory defaults.
Save used battery capacity	0xA0	-	Saves used battery capacity to EEPROM.
Reset used battery capacity	0xA1	-	Resets used battery capacity in EEPROM.

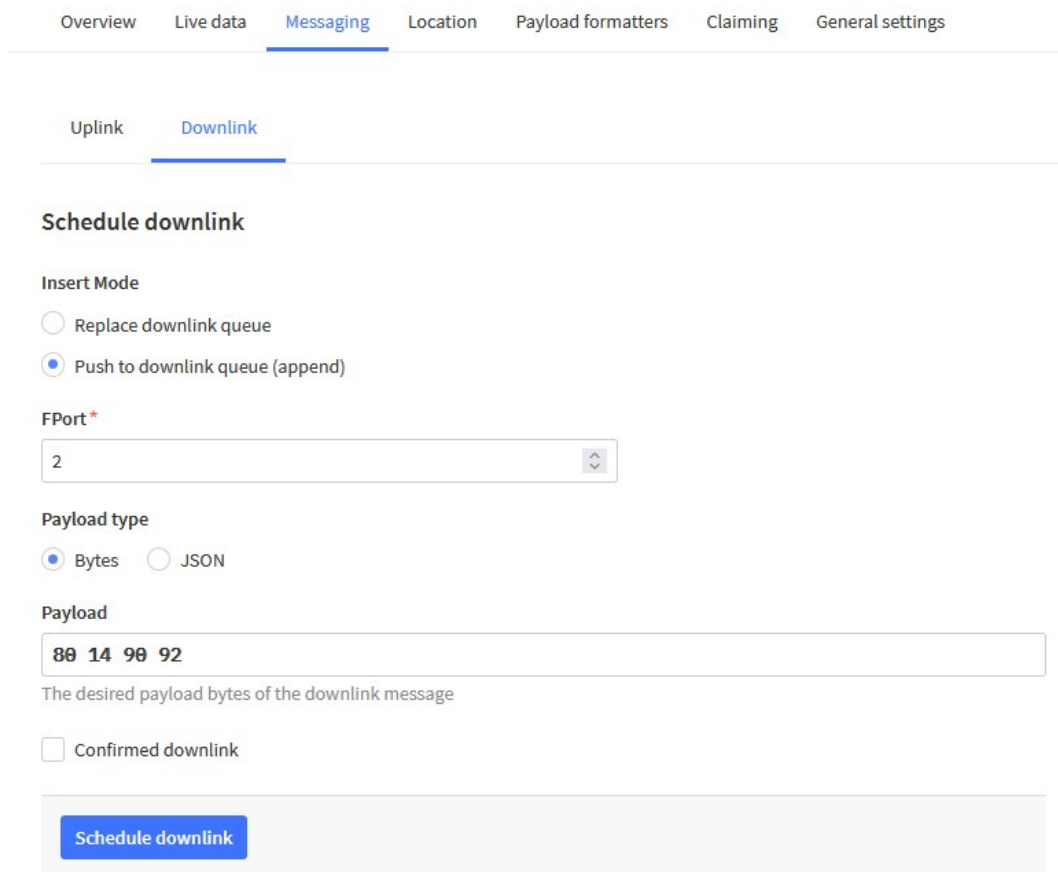
## Sending Multiple Commands

You can send up to 16 bytes of commands and parameters in a single downlink request. All commands are processed sequentially. For example, to permanently set the transmission interval to 15 minutes, send:

```
0x80149092
```

This sequence sets the interval, saves the config, and requests the current config as an uplink to confirm the change.

Downlinks can be sent from any platform such as The Things Stack web interface using the messaging function, as illustrated in Figure 6.



The screenshot shows the TTN web interface with the 'Messaging' tab selected. Under the 'Downlink' sub-tab, the 'Schedule downlink' form is displayed. The 'Insert Mode' section has two radio buttons: 'Replace downlink queue' (unselected) and 'Push to downlink queue (append)' (selected). The 'FPort\*' field is a dropdown menu showing '2'. The 'Payload type' section has two radio buttons: 'Bytes' (selected) and 'JSON' (unselected). The 'Payload' field is a text input containing '80 14 90 92'. Below the payload field is the text 'The desired payload bytes of the downlink message'. There is a checkbox for 'Confirmed downlink' which is currently unchecked. At the bottom of the form is a blue button labeled 'Schedule downlink'.

**Figure 6: Example of sending the downlink 0x80149092 using the TTN web interface.**

## Gallery



Figure 7: Fencyboy v1.3.1 with solar panel.



(a) Left view.



(b) Right view.



(c) Front-top view.

Figure 8: Different views of the Fencyboy v1.3.1 with solar panel.

## Legal and Contact Information

**Liability and Disclaimer:** All specifications and information provided in this datasheet are given on a best-effort basis. Actual performance and values may vary due to environmental conditions and deployment specifics. Fencyboy GmbH does not accept liability for damages or losses resulting from the use of this information. Fencyboy should only be operated with a proper electric fence energizer that complies with local regulations and IEC 60335-2-76:2018 (particular requirements for electric fence energizers).

If you have any questions or require clarification, please do not hesitate to contact us.

### Imprint

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Tom Stein (Gesellschafter und Geschäftsführer)

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