

# GP-Probe DIN L1

GNSS probe with built-in RF blocker, onboard GNSS interference detection and LUA scripting. Compatible with GP-Cloud.

# Quick Start Guide

Document version 2.0



## Online user manual:

<https://support.gpspatron.com/support/solutions/folders/101000427657>



## Datasheet:

<https://gpspatron.com/gp-probe-din-l1-datasheet/>



# Copyright Information

GPSPATRON Sp. z o. o. All Rights Reserved.

## Declaration

GPSPATRON products are protected by patent law in and outside of the EU.

GPSPATRON reserves the right to modify or change parts of or the entire document at company's sole decision.

Any way of copying, extracting, or translating the contents of this manual is not allowed without the permission of GPSPATRON.

Note: GPSPATRON is the registered trademark of GPSPATRON Sp. z o. o.

## GPSPATRON Sp. z o. o.

Address: 20 Prosta str, Warsaw, Mazowieckie, 00-850, Poland.

Tax Identification Number (NIP): 5273018817

National Company Code (KRS): 0000991661

EU VAT: PL5273018817

<https://gpspatron.com/>

[sales@gpspatron.com](mailto:sales@gpspatron.com)

# General Safety Summary

Carefully read the following safety precautions to avoid any personal injury or damage to the instrument and any equipment connected to it. To avoid potential hazards, please use the instrument as specified.

## Electrical Safety

- The GP-Probe DIN L1 is designed for a power supply voltage ranging from 12 to 48 volts. Do not exceed this voltage range.
- Ensure that the power supply used with the GP-Probe DIN L1 is within the specified range and is sourced from a safe and reliable provider.
- Before making any electrical connections, make sure the device is powered off. This helps prevent electrical shock or device damage.

## Installation Safety

- Install the GP-Probe DIN L1 in locations free from excessive moisture, direct sunlight, and away from flammable materials.
- Do not install near any liquids or in locations where the device may come into contact with liquids.
- Ensure the device is securely attached and that there's no risk of it falling or being accidentally knocked over.

## Look Over All Terminals' Ratings

To avoid fire or electric shock, please look over all ratings and sign instruction of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.

## **Lightning protection**

GPSPATRON recommends installing lightning and surge protection equipment to protect GNSS antenna port on all permanent sites.

## **Cleaning**

Please perform the following steps to clean the instrument regularly according to its operating conditions.

1. Disconnect the instrument from all power sources, and then clean it with a soft wet cloth.
2. Clean the loose dust on the outside of the instrument with a soft cloth. When cleaning the LCD, take care to avoid scratching it.

To avoid damages to the surface of the instrument, please do not use any corrosive liquid or chemical cleanser.

Make sure that the instrument is completely dry before restarting it to avoid short circuits or personal injuries.

# Contents

- 1 Quick Start ..... 7
  - 1.1 First Power-On ..... 8
  - 1.2 GNSS Antennas Installation..... 9
  - 1.3 Connect GP-Probe to GP-Cloud..... 10
  - 1.4 Activate Onboard Signal Processing..... 14
  - 1.5 Device Response Configuration upon Event Detection ..... 20
- 2 Connector Description..... 22
- 3 Reset to Default Settings ..... 25
- 4 Troubleshooting..... 27

# 1 Quick Start

Welcome to the setup guide for the GP-Probe DIN L1, a sophisticated GNSS interference and anomaly detector. The GP-Probe DIN L1 offers two main data processing options: cloud-based GP-Cloud or onboard signal processing (OSP).

GP-Cloud provides extensive data analysis, storage, and monitoring for multiple devices, ideal for advanced analytics and remote monitoring. Alternatively, OSP processes data directly on the device, perfect for environments with limited or no internet access.

Running the GP-Probe DIN L1 is straightforward. Follow these essential steps:

- 1.1 First power-on
- 1.2 GNSS Antenna Installation
- 1.3 Connect GP-Probe to GP-Cloud  
OR
- 1.4 Activate Onboard Signal Processing
- 1.5 Device Response Configuration upon Event Detection

We recommend watching this introductory video to get started: <https://youtu.be/o2Z103R0v-c>



## 1.1 First Power-On

The GP-Probe DIN L1 does not have a power button. Simply connect the power cable, and the device will activate. If a GNSS antenna is not connected, an error message will display:



Connecting the antenna resolves this issue, and the probe will show "Connecting" followed by "Offline":



It is necessary to install a GNSS antenna and establish a connection to GP-Cloud or activate the Onboard Signal Processing option.

## 1.2 GNSS Antennas Installation

Installing the GNSS antenna correctly is crucial for maximizing the performance of your GP-Probe DIN L1. Here are the best practices to ensure optimal antenna setup:

- **Antenna Type:** For budget-conscious setups, a simple magnetic GNSS antenna placed on an office windowsill is sufficient. However, for enhanced system efficiency and reliability, investing in a higher-quality antenna and installation is recommended.
- **Minimum Signal-to-Noise Ratio (SNR):** Aim to achieve an average SNR greater than 30 dB. This level of signal quality is required for accurate operation of GNSS signal anomaly detection algorithms.
- **Antenna Placement:** Install the antenna in a position that provides an unobstructed view of the entire sky.
- **Avoid Industrial Interference:** Do not install the antenna near industrial equipment. Machinery and electronic devices can emit interference that might disrupt GNSS signal reception, leading to inaccurate data or false anomalies.
- **Minimize Signal Reflections:** Place the antenna away from surfaces that can reflect GNSS signals, such as large metal objects or reflective coatings on buildings. Reflections can cause multipath effects, where the signal bounces off a surface before reaching the antenna, thus distorting the original signal.
- **Avoid Tree Coverage:** Be cautious about installing the antenna under tree branches. During windy conditions, the movement of branches can lead to fluctuating satellite signal strengths, potentially triggering false detections by the anomaly detector.

By adhering to these guidelines, you can ensure that your GP-Probe DIN L1 has the best possible conditions for capturing accurate GNSS data, thus enhancing its performance in detecting and analyzing GNSS interference.

## 1.3 Connect GP-Probe to GP-Cloud

To connect GP-Probe to GP-Cloud you need to follow the following three steps:

- Register GP-Probe in GP-Cloud.
- Configure GP Probe.
- Calibrate GP-Cloud algorithms.
- Adjust detection thresholds.

In order to register, you need to know the unique GP-Probe ID. It can be found on the device screen and in the Web Configuration Panel:



The registration can solely be performed by the system admin on GP-Cloud's user interface:

- Navigate to the "Probes" menu and click on "Add New Probe".
- In the popup, choose the probe's model, make up a password (remember it for the next step), and type in the probe's ID.

Learn more here about how to register a GP-Probe in the cloud:

<https://support.gpspatron.com/en/support/solutions/articles/101000492697-gp-probe-registration-in-gp-cloud>



## GP-Probe Configuration

For GP-Probe configuration you should login to the Web Configuration Panel with the following default credentials:

Default URL: <http://192.168.0.120>

Default user: admin

Default password: admin

Then proceed as follows:

- Navigate to the "Connection Config" menu.
- Enter the URL/IP of your GP-Cloud server instance. If you're using our cloud service, then leave gp-cloud.io
- Enter the API password you created when registering the probe in the GP-Cloud.
- Set up the network IP connection as required:

**GPSPATRON** Log out

Status Measurement Config **Connection Config** Output Ports Config Admin

**Provided by your GP-Cloud administrator**

GP-CLOUD SERVER	Field	Value	Notes
GP-CLOUD SERVER	URL	test.gp-cloud.io	The URL of your GP-Cloud server instance
	Port	443	
	API Password		Password for GP-Probe authentication

Apply

LAN	Field	Value	Options
LAN	IP Type		<input type="radio"/> Fixed IP <input checked="" type="radio"/> DHCP Client
	IP	192.168.0.120	
	Mask	255.255.255.0	
	Gateway	192.168.0.1	
	MAC	76-1D-90-EE-95-B2	

DNS	Field	Value
DNS	Primary	8.8.8.8
	Secondary	0.0.0.0

Apply

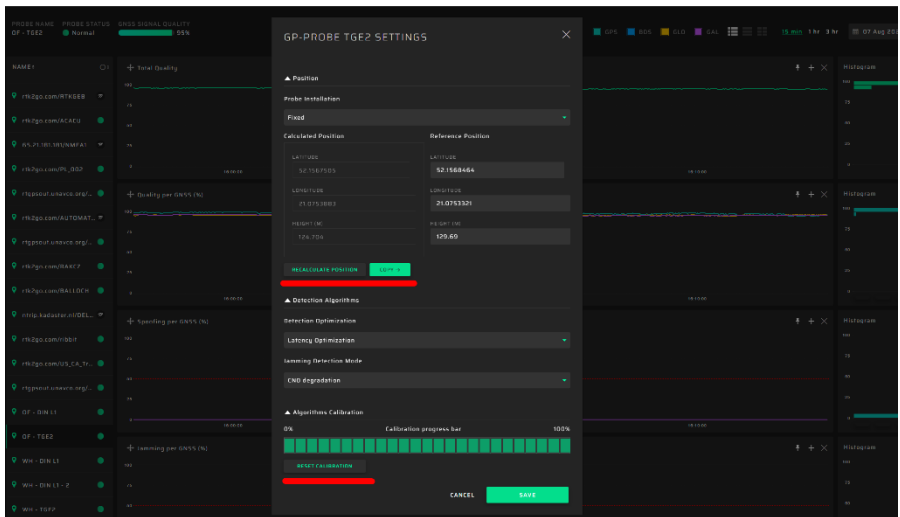
Next, on the 'Measurement Config' page, under 'Data Processing' section, select 'GP-Cloud':



That's it! Your GP-Probe should now be connected and ready to stream data.

### GP-Cloud Algorithm Configuration

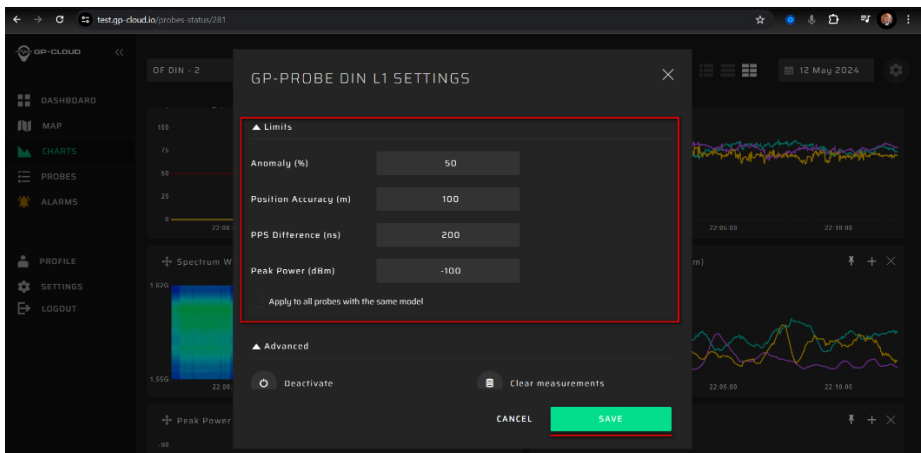
Now you can access the data coming from the probe through your GP-Cloud account, but the probe's status may not be displayed as "Normal". It is more likely to show "Anomaly" or "Low Position Accuracy". To rectify this, simply open the Probe Config Popup, recalculate a new reference position, and reset the calibration:



## Adjusting the Detection Thresholds

Adjust detection thresholds through the Probe Config Popup in the GP-Cloud interface. Proper configuration ensures the GP-Probe DIN L1 operates efficiently under various environmental conditions.

- **Anomaly Detection Threshold:** Set the anomaly detection threshold at 30% for clear sky visibility. For antennas on windowsills or in limited visibility areas, increase to 80%. If uncertain, start at 50% and adjust based on the anomalies observed.
- **'Low Position Accuracy' Detection Threshold:** Trigger a 'Low Position Accuracy' event when the 'Horizontal Position Accuracy' graph exceeds a set limit. A threshold of 15 meters is recommended for antennas with unobstructed sky views.
- **PPS Offset Detection Threshold:** When an external PPS signal source is connected and measurements appear on the 'PPS Offset' chart, set a threshold based on operational needs. Adjust to flag only significant PPS offset events.
- **Interference Detection Threshold:** Detect an 'Interference' event when the 'Peak Power' graph value surpasses a set limit. Set this threshold approximately 6 dB above the average Peak Power measured over several minutes.



## 1.4 Activate Onboard Signal Processing

Activating the onboard signal processing enables the built-in interference and anomaly detection algorithms on the GP-Probe DIN L1, allowing for independent operation without external cloud processing. Follow these detailed steps to configure the onboard signal processing effectively.

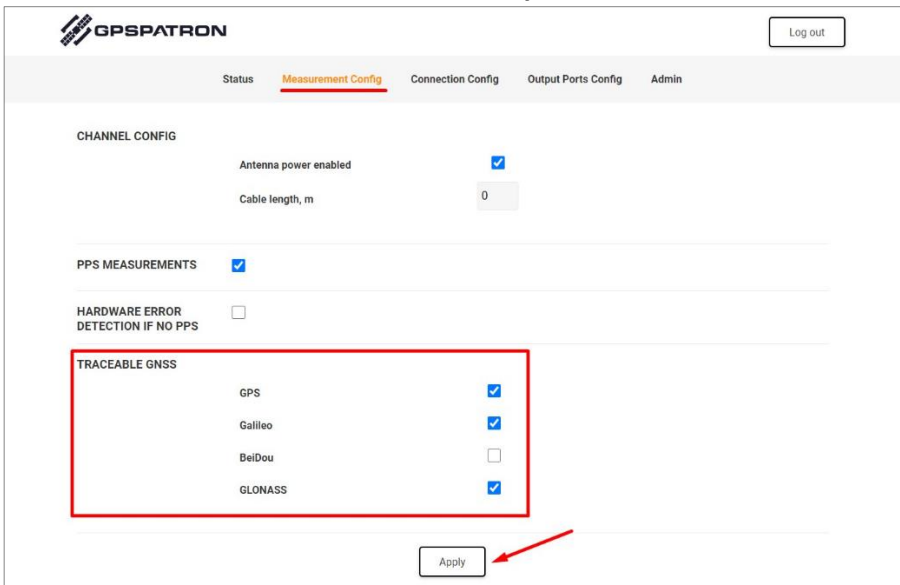
### 1 Access the Web Configuration Panel

- **Navigate to the Web Configuration Panel:** Open a web browser and enter the default URL: `http://192.168.0.120`.
- **Log In:** Use the default credentials—Username: "**admin**", Password: "**admin**".

### 2 Define Traceable GNSS:

- Go to the 'Measurement Config > Traceable GNSS'.
- Choose the GNSS systems you wish to track, such as GPS, Galileo, BeiDou, or GLONASS.
- Click 'Apply' to save these settings.

**Please, keep in mind that BeiDou and GLONASS cannot function simultaneously.**



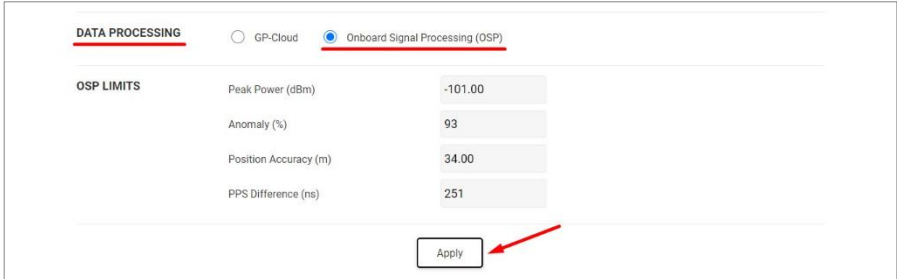
The screenshot displays the GPSPATRON web configuration interface. The top navigation bar includes 'Status', 'Measurement Config' (highlighted), 'Connection Config', 'Output Ports Config', and 'Admin'. A 'Log out' button is in the top right corner. The 'CHANNEL CONFIG' section shows 'Antenna power enabled' checked and 'Cable length, m' set to 0. The 'PPS MEASUREMENTS' section is checked. The 'HARDWARE ERROR DETECTION IF NO PPS' section is unchecked. The 'TRACEABLE GNSS' section is highlighted with a red box and contains the following settings:

GNSS System	Enabled
GPS	<input checked="" type="checkbox"/>
Galileo	<input checked="" type="checkbox"/>
BeiDou	<input type="checkbox"/>
GLONASS	<input checked="" type="checkbox"/>

An 'Apply' button is located at the bottom of the 'TRACEABLE GNSS' section, with a red arrow pointing to it.

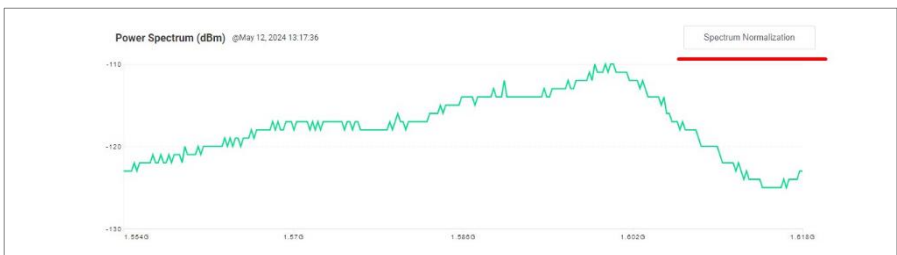
### 3 Set Data Processing to Onboard:

- Still, within the Measurement Config section, scroll down to Data Processing.
- Select Onboard Signal Processing (OSP) from the options.
- Click Apply to confirm the change.



### 4 Spectrum Normalization:

- Navigate to Status > Measurements in the web configuration panel.
- Locate the Power Spectrum graph and click on the Spectrum Normalization button. This action will align the spectrum flatness, accounting for any distortions caused by the GNSS antenna and its preamplifier:



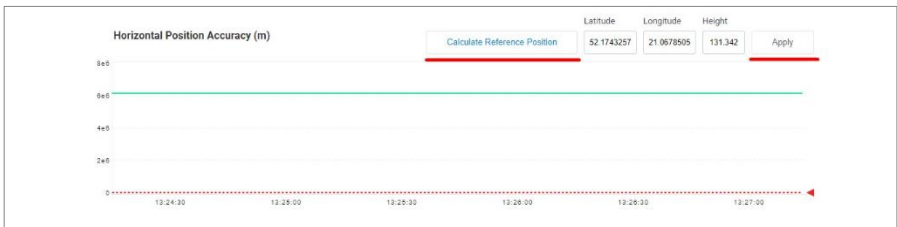
### 5 Anomaly Detection Algorithm Calibration:

- Allow the device to collect data for a minimum of 5 minutes. This duration is crucial to gather enough data for effective calibration.
- Click on the Calibrate Anomaly button next to the Anomaly graph to initiate the calibration process.



### 6 Setting Reference Position:

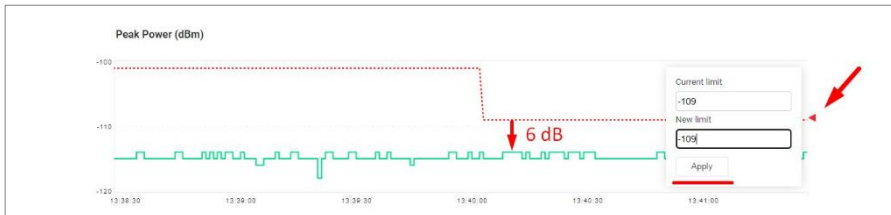
- For calibrating the probe reference position, click on the 'Calculate Reference Position' button next to the Horizontal Position Accuracy (m) graph.
- Click Apply to confirm the change:



Alternatively, you can manually set the Reference Position by navigating to Measurement Config > Reference Position section.

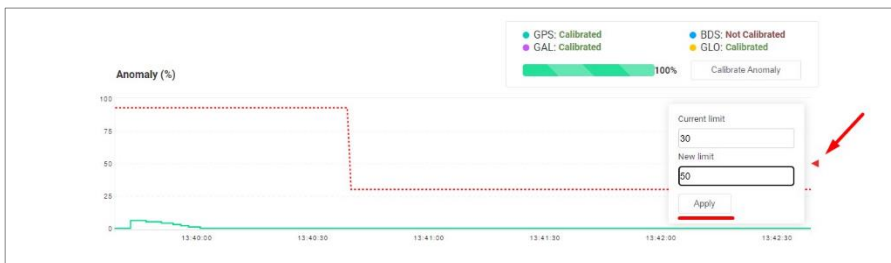
### 7 Adjusting Interference Detection Threshold:

- Next to the Peak Power graph, find a small red arrow. Use this control to adjust the interference detection threshold.
- We recommend setting this threshold approximately 6 dB above the average Peak Power observed over the last five minutes:



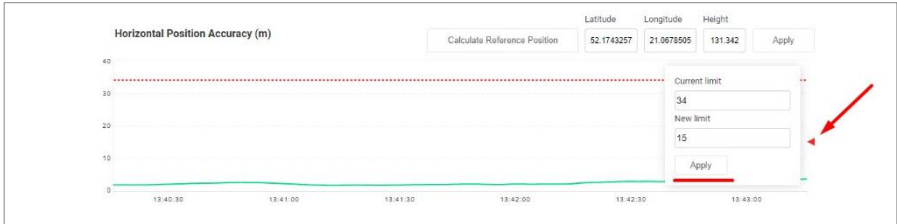
### 8 Adjusting Anomaly Detection Threshold:

- Use the red slider next to the Anomaly graph to set the anomaly detection threshold.
- If the GNSS antenna is in a location with clear sky visibility, a threshold of 30% is suggested.
- For antennas placed on windowsills or where sky visibility is limited, consider setting the threshold higher, around 80%.
- If uncertain, start at 50% and adjust based on the number of detected anomalies over a day, or continuously monitor of the anomaly graph for several hours via a connected browser.



### 9 Setting 'Low Position Accuracy' Detection Threshold:

- For the 'Horizontal Position Accuracy' graph, set the detection threshold for 'Low Position Accuracy' events in meters. We recommend a threshold of 15 meters for antennas with open-sky antenna installation.



### 10 Adjusting 'PPS Offset' Detection Threshold:

- If an external PPS signal source is connected and these measurements are enabled in Measurement Config, you can observe phase difference measurements in the PPS Offset graph.
- Set the appropriate threshold for your application to detect PPS Offset events:



After configuring these settings, the GP-Probe should display a 'Normal' status on its screen. If the status indicates otherwise, further adjustments of the detection thresholds may be necessary.

### 11 Monitoring Detected Incidents:

All detected incidents will be listed under 'Status > Detected Events'. Each incident record will include:

- Classification (Interference, Anomaly, Low Position Accuracy, PPS Offset)
- Event time and duration
- Maximum values during the incident (Central Frequency, Peak Power, Spectral Width, Anomaly Probability, Position Accuracy, PPS Offset)

The screenshot displays the GPSPATRON web interface for a GP-Probe DIN L1 device. The top navigation bar includes 'Status', 'Measurement Config', 'Connection Config', 'Output Ports Config', and 'Admin'. A 'Log out' button is in the top right. The main header shows 'GP-PROBE DIN L1' and 'Model: GP-Probe DIN L1 - PPS BL RL SCR'. A central status box indicates 'NORMAL' with control icons and a legend for GNSS and PPS inputs/outputs. Below this is a 'Detected Events' tab with a table of incidents. Two incidents are shown: ID 10238 (Interference) and ID 10237 (Anomaly). Each incident includes a spectral plot, duration, central frequency, peak power, spectrum width, and coordinates.

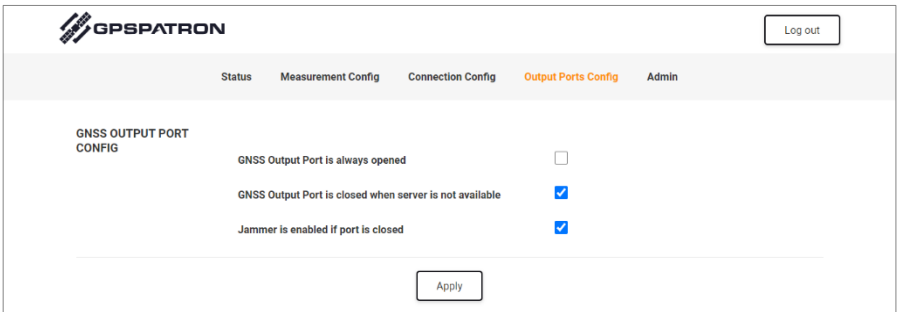
ID	STATUS	EVENT START / STOP	DURATION	ANOMALY
10238	Interference	May 10, 2024 16:40:51 May 10, 2024 16:47:48	00:06:57	100
10237	Anomaly	May 10, 2024 16:40:31 May 10, 2024 16:40:51	00:00:20	100

# 1.5

## Device Response Configuration upon Event Detection

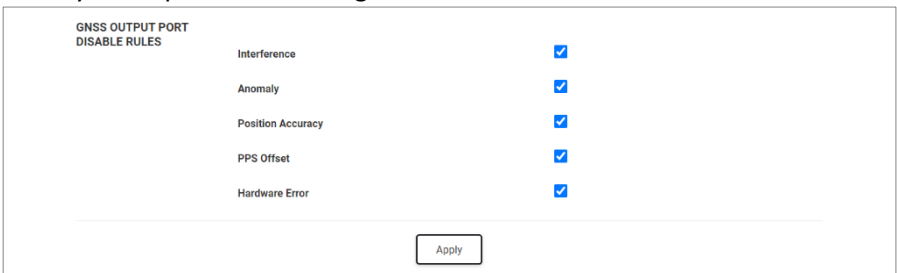
Configuring how your GP-Probe DIN L1 responds to various events is crucial for effective GNSS interference management and integration with other systems. This section provides an overview of integration methods and specific settings available on the "Output Ports Config" page.

The GNSS output port can be configured to always remain open, close when the server is unavailable. It is also possible to activate the built-in jammer, which will turn on if the port is closed. This ensures that counterfeit GNSS signals can be reliably blocked:



### GNSS Output Port Disable Rules:

You can configure the GNSS output port to disable upon detecting specific events such as interference, anomaly, low position accuracy, PPS offset, or hardware errors. If the checkboxes are enabled, the GNSS port will be closed when any event is detected. If the '*Jammer is enabled if port is closed*' checkbox is active, the built-in GNSS jammer will be enabled to reliably block powerful fake signals.



### PPS Output Port Disable Rules:

Similar to the GNSS output port, the PPS output port can be set to disable upon detecting any events. This ensures that the PPS output signal is always valid and goes off if any interference, anomaly, or signal quality degradation is detected.

PPS OUTPUT PORT DISABLE RULES	
Interference	<input checked="" type="checkbox"/>
Anomaly	<input checked="" type="checkbox"/>
Position Accuracy	<input checked="" type="checkbox"/>
PPS Offset	<input checked="" type="checkbox"/>
Hardware Error	<input checked="" type="checkbox"/>

### Relay Port Switching Rules:

The relay port can be configured to switch states when specific events are detected. This includes reacting to interference, anomalies, low position accuracy, PPS offset, and hardware errors. By setting these rules, you ensure that the relay port responds in a manner that helps mitigate the impact of detected events.

RELAY PORT SWITCHING RULES	
Interference	<input checked="" type="checkbox"/>
Anomaly	<input checked="" type="checkbox"/>
Position Accuracy	<input checked="" type="checkbox"/>
PPS Offset	<input checked="" type="checkbox"/>
Hardware Error	<input checked="" type="checkbox"/>

By configuring these settings, you can customize how your GP-Probe DIN L1 responds to various GNSS-related events, enhancing the system's ability to manage and mitigate interference.

**Now your device is ready to go.**

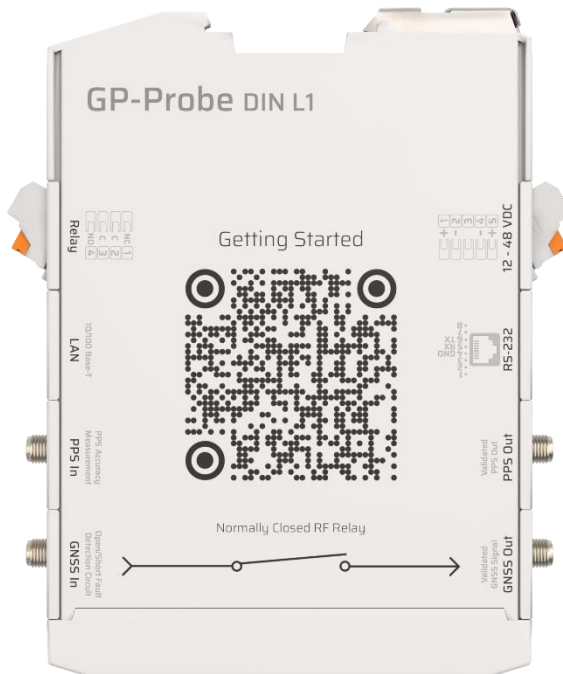
**Enjoy!**

## 2

# Connector Description

GP-Probe DIN L1 contains the following connectors:

- GNSS In
- GNSS Out
- PPS Input
- PPS Output
- NO/NC Relay
- RS-232
- LAN
- 12-48VDC Power connector



## **GNSS In**

Port for connecting an external GNSS antenna. GNSS antenna can be either active or passive.

The power supply voltage of the active antenna is 3.3 V. The port is equipped with current consumption monitoring circuits to detect short circuits and antenna failure.

## **GNSS Output**

GP-Probe DIN L1 is equipped with a GNSS output port that is connected to the GNSS input if the probe does not detect interference or GNSS signal anomaly.

If interference/anomaly is detected, the port is disabled by a built-in RF relay. To combat powerful fake GNSS signals, the probe is equipped with a built-in gns jammer that additionally blocks powerful fake signals leaking through the relay.

## **Power Port**

The GP-Probe DIN L1 is designed for a power supply voltage ranging from 12 to 48 volts. It is possible to connect two independent power supplies.

## **PPS Input/Output**

The GP-Probe DIN L1 has a PPS output coming from the built-in GNSS receiver. The pulse is generated only if the status of the GP-Probe DIN L1 is "Normal".

The GP-Probe DIN L1 has a built-in PPF phase difference measurement module. When an external pulse source, such as a time server, is connected to the "PPS In" port, the GP-Probe DIN L1 determines the phase difference every second and sends the data to GP-Cloud. If a specified threshold is exceeded, GP-Cloud sets the probe status to "PPS Offset".

The "PPS In" port supports low-voltage PPS signal sources.

## Relay Terminal

Integrating GP-Probe into existing infrastructure is made simple with the use of a relay. The relay's behavior can be configured through the web configuration panel. If interference is detected, the relay will switch, making it easy to control external equipment.

## RS-232

The ports are intended to control external equipment with an embedded LUA scripting engine. The sent commands, as well as the port operation modes, are determined by a script developed using the LUA language.

Learn more here about LUA scripting engine:

<https://support.gpspatron.com/support/solutions/folders/101000427666>



## LAN

The LAN port has a standard 10/100BASE-T RJ45 interface pinout. POE power supply is not supported.

## 3 Reset to Default Settings

If you have forgotten the password to access the Web Configuration Panel or if you need to switch the device to use a static IP address, you can reset the probe to the factory default settings.

When resetting, the following settings will be restored:

- IP type: static
- IP: 192.168.0.120
- username/password: user/user, admin/admin

Access settings for GP-Cloud and LUA script will not be affected.

To reset, you should:

Step 1: Disconnect the GP-Probe DIN L1 from the power source.

Step 2: Press and hold the "right" button located on the front panel.



Step 3: While holding the "right" button, reconnect the power supply to the device.

Step 4: Continue to hold the "right" button for five seconds until the message "Are you sure you want to reset settings?" appears on the screen:



Step 5: Release the button, then press and hold it again for another five seconds.

Following these steps will reset the GP-Probe DIN L1 to its factory default settings.

## 4 Troubleshooting

The GP-Probe DIN L1 has a built-in self-diagnostic system. When an error is detected, the device displays an error code on the screen and sends the error to GP-Cloud. All errors are saved in the GP-Cloud logs.

<b>Error code</b>	<b>Description</b>
<b>476</b>	GP-Probe DIN L1 built-in memory error
<b>477</b>	GNSS Port Driver Failure
<b>478</b>	GNSS Antenna Not Connected
<b>479</b>	GNSS Antenna Short Circuit
<b>481</b>	External PPS is not coming to the "PPS In" port
<b>482</b>	Low GNSS signal quality