

# 03 - RouteTrack Pi — gpssd Installation & GPS Validation

**Date:** December 24th, 2025

**Category:** Raspberry Pi / GPS / Linux Services

**Backlink:** [RouteTrack Pi — Connecting GPS Hardware](#)

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## Goal

This page covers:

- Installing `gpssd` and GPS tools (Global Positioning Satellite Daemon Tools)
- Confirming the USB GPS receiver is outputting raw NMEA sentences
- Creating a stable `/dev/gps0` device symlink via udev rules
- Running `gpssd` reliably as a **standalone systemd service**
- Validating that GPS data is readable through `gpspipe`
- I had to use a stand alone service because `gpssd` wouldn't work out of the box with my GPS Receiver.
- This is a workaround for that on this page.
- Some GPS units will work without bypassing TTP and using a separate standalone systemd service.
- This page is specific to the GPS I used that needed a workaround.

**Device:** GlobalSat BU-353N USB GPS Receiver

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## Install gpssd + tools

Run:

```
sudo apt update
sudo apt install -y gpsd gpsd-clients
```

This installs:

- `gpsd` (daemon)
- `gpstool`, `cgps` (client tools)

## Confirm the GPS receiver is detected

Plug in the USB GPS receiver, then verify the device appears:

```
ls -l /dev/ttyUSB*
```

example:

```
zippyb@pi-gps:~ $ ls -l /dev/ttyUSB*
crw-rw---- 1 root dialout 188, 0 Dec 24 18:26 /dev/ttyUSB0
zippyb@pi-gps:~ $
```

Linux sees the GPS receiver.

## Validate raw NMEA output from the GPS

Before involving `gpsd`, verify the GPS is actually transmitting:

```
sudo stty -F /dev/ttyUSB0 4800 cs8 -cstopb -parenb -ixon -ixoff -crtcts -echo
sudo timeout 8 cat /dev/ttyUSB0 | head -n 20
```

Expected output should look like:

```
$GPGGA,...  
$GPGSA,...  
$GPRMC,...
```

If you see NMEA sentences, the receiver is working at **4800 baud**.

# Create a stable GPS symlink

## `/dev/gps0` (udev rule)

The GPS device may sometimes appear as a different tty device, so we create a stable symlink called `/dev/gps0`.

## Create the udev rule

```
sudo nano /etc/udev/rules.d/10-gps-pl2303.rules
```

Paste:

```
SUBSYSTEM=="tty", ATTRS{idVendor}=="067b", ATTRS{idProduct}=="23a3", SYMLINK+="gps0"
```

These id's come from udev's info:

- `idVendor=067b`
- `idProduct=23a3`

Reload udev and trigger:

```
sudo udevadm control --reload-rules  
sudo udevadm trigger  
sudo udevadm settle
```

Verify:

```
ls -l /dev/gps0
```

Expected:

```
zippyb@pi-gps:~ $ ls -l /dev/gps0
lrwxrwxrwx 1 root root 7 Dec 24 18:26 /dev/gps0 -> ttyUSB0
zippyb@pi-gps:~ $
```

# Disable gpsd.socket and build a standalone gpsd service

Socket activation can cause inconsistent behavior during testing, so this project uses a dedicated standalone systemd service.

## Disable/mask the socket unit

```
sudo systemctl disable --now gpsd.socket
sudo systemctl mask gpsd.socket
```

## Create `gpsd-standalone.service`

Create the service:

```
sudo nano /etc/systemd/system/gpsd-standalone.service
```

This is the code for setting up the new service:

```
[Unit]
Description=GPSD Standalone (RouteTrack)
After=network.target
Wants=network.target

[Service]
Type=simple
User=gpsd
Group=dialout
```

```
ExecStart=/usr/sbin/gpsd -N -n -b -s 4800 -S 2947 /dev/gps0
```

```
Restart=on-failure
```

```
RestartSec=2
```

```
[Install]
```

```
WantedBy=multi-user.target
```

## Important Notes

- `-s 4800` forces correct baud rate
- `-S 2947` binds gpsd to port 2947 (localhost)
- We intentionally **do not use** `-F /run/gpsd.sock` because it caused permission errors for the `gpsd` user under systemd.
- This service uses `/dev/gps0` so the device name stays consistent.

Enable + start:

```
sudo systemctl daemon-reload
sudo systemctl enable --now gpsd-standalone.service
```

Check status:

```
systemctl status gpsd-standalone.service --no-pager -l
```

**Notice it is enabled, active and running the line from the ExecStart:**

```
zippyb@pi-gps:~$ systemctl status gpsd-standalone.service --no-pager -l
● gpsd-standalone.service - GPSD Standalone (RouteTrack)
   Loaded: loaded (/etc/systemd/system/gpsd-standalone.service; enabled; preset: enabled)
   Active: active (running) since Wed 2025-12-24 18:37:15 CST; 13min ago
  Invocation: 4ea7a82250e94280ab2ce67e06478b50
    Main PID: 6690 (gpsd)
      Tasks: 2 (limit: 759)
         CPU: 19.017s
    CGroup: /system.slice/gpsd-standalone.service
            └─6690 /usr/sbin/gpsd -N -n -b -s 4800 -S 2947 /dev/gps0

Dec 24 18:37:15 pi-gps systemd[1]: Started gpsd-standalone.service - GPSD Standalone (RouteTrack).
zippyb@pi-gps:~$
```

# Confirm gpsd is listening on port 2947

Run:

```
ss -ltnp | grep 2947
```

It is listening on ipv4 and ipv6 ports:

```
zippyb@pi-gps:~ $ ss -ltnp | grep 2947
LISTEN 0      5            127.0.0.1:2947      0.0.0.0:*
LISTEN 0      5            [::]:2947          [::]:*
zippyb@pi-gps:~ $
```

## Validate GPS data through gpsd (JSON output)

Run:

```
gpspipe -w -n 25
```

Expected:

- TPV messages
- SKY messages
- mode: 3 when a fix is established
- latitude/longitude values updating

Example indicators showing some GPS coordinates:

```
zippyb@pi-gps:~ $ gpspipe -w -n 25
{"class": "VERSION", "release": "3.25", "rev": "3.25", "proto_major": 3, "proto_minor": 15}
{"class": "DEVICES", "devices": [{"class": "DEVICE", "path": "/dev/gps0", "driver": "NMEA0183", "readonly": "true", "activated": "2025-12-25T00:53:04.512Z", "flags": 1, "native": 0, "bps": 4800, "parity": "N", "stopbits": 1, "cycle": 1.00}]}
{"class": "WATCH", "enable": true, "json": true, "nmea": false, "raw": 0, "scaled": false, "timing": false, "split24": false, "pps": false}
{"class": "SKY", "device": "/dev/gps0", "gdop": 1.66, "hdop": 0.79, "pdop": 1.11, "tdop": 0.77, "xdop": 0.59, "ydop": 0.56, "vdop": 0.79, "uSat": 11}
{"class": "SKY", "device": "/dev/gps0", "gdop": 1.66, "hdop": 0.79, "pdop": 1.11, "tdop": 0.77, "xdop": 0.59, "ydop": 0.56, "vdop": 0.79, "uSat": 11}
{"class": "TPV", "device": "/dev/gps0", "mode": 3, "time": "2025-12-25T00:53:05.000Z", "ept": 0.005, "lat": 38.715658333, "lon": -89.939820000, "altHAE": 156.7000, "altMSL": 190.3000, "alt": 190.3000, "epx": 8.867, "epy": 8.367, "epv": 18.170, "track": 110.6300, "magtack": 108.7136, "magvar": -1.9, "speed": 0.129, "climb": 0.100, "eps": 17.73, "epc": 36.34, "geoidSep": -33.600, "eph": 15.010, "sep": 21.090}
{"class": "SKY", "device": "/dev/gps0", "gdop": 1.66, "hdop": 0.79, "pdop": 1.11, "tdop": 0.77, "xdop": 0.59, "ydop": 0.56, "vdop": 0.79, "uSat": 11}
{"class": "SKY", "device": "/dev/gps0", "gdop": 1.66, "hdop": 0.79, "pdop": 1.11, "tdop": 0.77, "xdop": 0.59, "ydop": 0.56, "vdop": 0.79, "uSat": 11}
{"class": "TPV", "device": "/dev/gps0", "mode": 3, "time": "2025-12-25T00:53:06.000Z", "ept": 0.005, "lat": 38.715658333, "lon": -89.939820000, "altHAE": 156.7000, "altMSL": 190.3000, "alt": 190.3000, "epx": 8.867, "epy": 8.367, "epv": 18.170, "track": 110.6300, "magtack": 108.7136, "magvar": -1.9, "speed": 0.185, "climb": 0.000, "eps": 17.73, "epc": 36.34, "geoidSep": -33.600, "eph": 15.010, "sep": 21.090}
```

Verifying Satellites and that everything is working:

use:

```
cgps
```

```
Time 2025-12-25T01:06:43.000Z ( 0)
Latitude 38.71539333 N
Longitude 89.93996167 W
Alt (HAE, MSL) 154.400, 188.000 m
Speed 0.09 km/h
Track (true, var) 88.0, -1.9 deg
Climb 0.00 m/min
Status 3D DGPS FIX (59 secs)
Long Err (XDOP, EPX) 0.59, +/- 2.2 m
Lat Err (YDOP, EPY) 0.56, +/- 2.1 m
Alt Err (VDOP, EPV) 0.78, +/- 4.5 m
2D Err (HDOP, CEP) 0.79, +/- 3.8 m
3D Err (PDOP, SEP) 1.11, +/- 5.3 m
Time Err (TDOP) 0.77
Geo Err (GDOP) 1.66
Speed Err (EPS) +/- 15.9 km/h
Track Err (EPD) n/a
Time offset 0.490405483 s
Grid Square EM58ar71
ECEF X, VX n/a n/a
ECEF Y, VY n/a n/a
ECEF Z, VZ n/a n/a
```

| Seen 12/Used 11 |    |     |      |       |      |     |
|-----------------|----|-----|------|-------|------|-----|
| GNSS            | S  | PRN | Elev | Azim  | SNR  | Use |
| GP              | 3  | 3   | 11.0 | 35.0  | 17.0 | Y   |
| GP              | 6  | 6   | 77.0 | 20.0  | 18.0 | Y   |
| GP              | 11 | 11  | 54.0 | 238.0 | 26.0 | Y   |
| GP              | 12 | 12  | 39.0 | 312.0 | 30.0 | Y   |
| GP              | 14 | 14  | 14.0 | 147.0 | 17.0 | Y   |
| GP              | 17 | 17  | 38.0 | 79.0  | 32.0 | Y   |
| GP              | 19 | 19  | 57.0 | 60.0  | 20.0 | Y   |
| GP              | 20 | 20  | 25.0 | 184.0 | 30.0 | Y   |
| GP              | 21 | 21  | 18.0 | 177.0 | 17.0 | Y   |
| GP              | 22 | 22  | 33.0 | 147.0 | 29.0 | Y   |
| GP              | 24 | 24  | 19.0 | 255.0 | 23.0 | Y   |
| SB131           | 44 | 44  | 37.0 | 219.0 | 30.0 | N   |

```
200,"magtrack":86.1037,"magvar":-1.9,"speed":0.026,"climb":0.000,"eps":4.43,"epc":8.97,"geoidSep":-33.600,"eph":3.753,"sep":5.273}
{"class":"SKY","device":"/dev/gps0","gdop":1.66,"hdop":0.79,"pdop":1.11,"tdop":0.77,"xdop":0.59,"ydop":0.56,"vdop":0.78,"uSat":11}
{"class":"SKY","device":"/dev/gps0","gdop":1.66,"hdop":0.79,"pdop":1.11,"tdop":0.77,"xdop":0.59,"ydop":0.56,"vdop":0.78,"uSat":11}
```

## Next Steps

The GPS subsystem is now stable, validated, and running as a dedicated systemd service. Upcoming work will build on this foundation:

- **Integrate gpsd with RouteTrack**
  - Consume GPS data via localhost port `2947`
  - Parse TPV updates for real-time position tracking
- **Add health checks**
  - Monitor gpsd service status
  - Alert if GPS fix drops below `mode: 3`
- **Visualization**
  - Map GPS coordinates to a live or logged route view
  - Export NMEA or JSON logs for later analysis

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