Low-jitter GPS-locked precision frequency reference
450 Hz to 800 MHz output

This device outputs two synchronised low-jitter reference clocks locked to GPS signal.

Long term stability of output signal is defined by high accuracy of GPS Caesium references and theoretically approaches 1×10^{-12}.

Short term signal quality is defined by internal TCXO clock source providing high-quality, low phase noise clock signal with sub-picosecond RMS jitter.

Digital PLL allows main output reference frequency to have almost any value between 450Hz and 800MHz.

The second output frequency depends on the first output due to a common internal clock, if you need individual flexibility, multiple mini GPS units may be a better choice. If both outputs have the same frequency their relative phase shift can be adjusted. This can be used, for example, to generate two signals with 90° phase shift for use in I/Q mixer.

Both output signals square wave at 3.3V CMOS levels with 50 Ohms characteristic impedance. Their output drive levels can be adjusted and outputs can be enabled and disabled independently.

Output power level (measured at 10MHz, fundamental power channel):

+13.3dBm, drive setting 32mA

+12.7dBm, drive setting 24mA

+11.4dBm, drive setting 16mA

+7.7dBm, drive setting 8mA

The device comes in a carry case with USB cable and an active GPS antennna with magnetic base.

Operation requires continuous presence of GPS signal, however temporary loss will be tolerated seamlessly. Active or passive antennas are supported. **An active antenna with 3 metre cable is provided with the device but can be substituted if necessary.** GPS acquisition time after power-up is around 30 seconds. If GPS signal is lost, digital PLL will maintains best estimated output frequency based on historical data. On reacquisition of GPS lock, output is seamlessly brought back in sync with GPS reference. Entry and exit of frequency hold is glitch-less.

All frequency and output settings are fully user-configurable via USB connection from Windows PC.

GPS clock can be powered from USB input and/or external 5-12VDC power input. USB connection to Windows PC is required only for one-off configuration. All settings are stored inside the device and maintain values when off. The SMA antenna connector voltage is 3.3V. Most active antennas have a wide range voltage input (2.5v to 5v) as they have an analogue LNA inside that is not sensitive to power level. If you are not connecting our antennas please check the antenna data sheet.

Examples of use include:

10.000MHz, 1.000MHz or other frequency reference for lab equipment and instrumentation

reference for transmitter equipment - HAM rigs, propagation beacons, frequency markers

reference for receiving equipment, RTL SDRs (28.8MHz) and band scanners

calibration source for radio receivers

master clock for audio and video equipment, DACs and studio recording gear

Measured phase noise of GPS clock at 10MHz output is equal or better than:

-70 dBc/Hz at 1 Hz offset from the carrier

-100 dBc/Hz at 10 Hz

-125 dBc/Hz at 100 Hz

-143 dBc/Hz at 1 kHz

-150 dBc/Hz at 10 kHz

-152 dBc/Hz at 100 kHz

-155 dBc/Hz at 1 MHz

Power draw through USB is 250mA

We are happy to advise whether specific combination of output frequencies are achievable and preset them into the product before shipping. If you are not happy with your product for any reason just send it back and we will refund your purchase. Please contact us at support@leobodnar.com if you have any questions.

How to Use

Connect the device to a PC via the supplied USB cable. Configuration software can be downloaded from the Product Downloads tab at:
http://www.leobodnar.com/shop/index.php?main_page=product_info&cPath=107&products_id=234.

Open the software and set the desired frequency. You can find PLL setting by putting required freq in "Output 1" window and clicking "Find".

Then save it in the clock hardware by clicking "Update". If you want independent frequencies, adjust the PLL parameters (below Output2) manually and click "Update".

"Sleep" button shuts down internal micro controller for lowest noise level. It requires power cycle to wake it up again.

It does not need any drivers installed or even USB connection. You can use external 12V power supply without USB attached.

Settings for common Frequencies

After making the changes please restart the software to display new frequencies

24MHz and 1MHz

GPS Clock Configuration

Device details

Serial Number	G40349
Manufacturer	Leo Bodnar
Product	1.9
Version	GPS Reference Clock
Software	V9.11

Settings

☑ Enable Output 1   [Identify Output 1]

☑ Enable Output 2   [Identify Output 2]

32mA ▼ Output drive strength

24000000   Output 1, Hz

1000000 ▼   Output 2, Hz

[Find]   [Update]   [Sleep]

4000000	GPS reference, Hz
11	N31
11	N2_HS
1296	N2_LS
9	N1_HS
24	NC1_LS
576	NC2_LS

0 ▼ Phase shift, degrees

15   BW

F3 = 363636 Hz

Fosc = 5.184 GHz   **No GPS signal**

Signal loss count: 1   **No PLL lock**

25MHz und 10MHz

GPS Clock Configuration

Device details

Serial Number G43377
Manufacturer   Leo Bodnar Electronics
Product   GPS Reference Clock
Firmware Version 1.12
Software Version 9.12

Settings

☑ Enable Output 1   Identify Output 1
☑ Enable Output 2   Identify Output 2

32mA ▼ Output drive strength

25000000   Output 1, Hz
10000000 ▼ Output 2, Hz

Find   Update   Sleep

390625   GPS reference, Hz
4   N31
6   N2_HS
8192   N2_LS
4   N1_HS
48   NC1_LS
120   NC2_LS

0 ▼   Phase shift, degrees
15   BW

F3 = 97656 Hz

Fosc = 4.8 GHz   **No GPS signal**

Signal loss count: 1

40MHz und 25MHz

GPS	390625
N31	4
N2_HS	6
N2_HS	8192
N1_HS	4
NC1_LS	30
NC2_LS	48

24MHz and 10MHz

GPS Clock Configuration

Device details

Serial Number G40892

Manufacturer Leo Bodnar

Product 1.9

Version GPS Reference Clock

Software V9.11

Settings

☑ Enable Output 1   [Identify Output 1]

☑ Enable Output 2   [Identify Output 2]

[32mA ▼] Output drive strength

[240000000] Output 1, Hz

[240000000 ▼] Output 2, Hz

[Find]   [Update]   [Sleep]

[4000000] GPS reference, Hz

[2] N31

[11] N2_HS

[240] N2_LS

[11] N1_HS

[2] NC1_LS

[2] NC2_LS

[0 ▼] Phase shift, degrees

[15] BW

F3 = 2000000 Hz

Fosc = 5.28 GHz   **No GPS signal**

Signal loss count: 1   **No PLL lock**

10MHz and 96KHz

GPS Clock Configuration

Device details

Serial Number G40349

Manufacturer Leo Bodnar

Product GPS Reference Clock

Version 1.9

Settings

☑ Enable Output 1 Identify Output 1

☑ Enable Output 2 Identify Output 2

32mA ▼ Output drive strength

10000000 Output 1, Hz

96000 ▼ Output 2, Hz

Find Update Sleep

4687500 GPS reference, Hz

5 N31

11 N2_HS

512 N2_LS

11 N1_HS

48 NC1_LS

5000 NC2_LS

0 ▼ Phase shift, degrees

15 BW

F3 = 937500 Hz

Fosc = 5.28 GHz **No GPS signal**

Signal loss count: 1 **No PLL lock**

120MHz and 10MHz

GPS Clock Configuration

Device details

Serial Number   G40349

Manufacturer   Leo Bodnar

Product   1.9

Version   GPS Reference Clock

Software   V9.11

Settings

☑ Enable Output 1   [Identify Output 1]

☑ Enable Output 2   [Identify Output 2]

32mA   Output drive strength

120000000   Output 1, Hz

10000000   Output 2, Hz

[Find]   [Update]   [Sleep]

4687500   GPS reference, Hz

5   N31

11   N2_HS

512   N2_LS

11   N1_HS

4   NC1_LS

48   NC2_LS

0   Phase shift, degrees

15   BW

F3 = 937500 Hz

Fosc = 5.28 GHz   **No GPS signal**

Signal loss count: 1   **No PLL lock**

14.4MHz and 9.6MHz

GPS Clock Configuration

Device details

Serial Number: G40559
Manufacturer: Leo Bodnar
Product: GPS Reference Clock
Version: 1.9

Settings

☑ Enable Output 1   Identify Output 1
☑ Enable Output 2   Identify Output 2

32mA ▼ Output drive strength

14400000 Output 1, Hz
9600000 ▼ Output 2, Hz

Find   Update   Sleep

2560000 GPS reference, Hz
3   N31
11   N2_HS
540   N2_LS
11   N1_HS
32   NC1_LS
48   NC2_LS

0 ▼ Phase shift, degrees
15 BW

F3 = 853333 Hz
Fosc = 5.0688 GHz
Signal loss count: 1

GPS Clock FAQ

Quick use guide

1. Put frequency in output 1 field
2. Click "FIND"
3. There is no step 3.

On the power supply connector, which pin is the +ve and what is the recommended voltage?

Centre pin is "+" supply voltage is 5-14v voltages. Any excess voltage over 5v will be converted to heat, so it is recommended to use closer to 5v.
The case can become warm to the touch (40°c) at high voltage levels (12v +) this is normal operating.

How do I tell if the unit is locked onto a GPS signal?

The two status LEDs on the front of the device will be constantly on.
Also if the device is connected to the software the two warning messages will not be show.
'No PLL Lock' and 'No GPS Signal' will be shown if there is a problem connecting to the GPS signal.

What do the two LEDs mean?

The LEDs will flash when the clock is searching for a GPS lock and remain constantly lit when GPS lock is successful.

In the software, what does Signal Loss Count mean?

Signal Loss Count is an indicate or counter of how many times the signal has been lost since power up. If you leave the unit unattended it might be useful to know if it had lost the signal while you were away and how many times this happened.

When I hit FIND or UPDATE on the software No PPL lock is displayed and then disappears. What does this mean?

Every time you program new frequency or update the old one by clicking the buttons "Find" or "Update" the system then recalibrates itself. This causes a temporary loss of lock for a few seconds. This is normal and only happens during frequency changes.