GPS6000-LITE

GPS Time Receiver

User Manual

Version 1.3

worldtime SOLUTIONS

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TECHNICAL SUPPORT

To obtain help with the installation or operation of the GPS6000-LITE, please visit our web site at:

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1 - Introduction

1.1 - Overview

The GPS6000-LITE accurately synchronises your time server with international atomic standards. With 32 satellite parallel tracking and class-leading high performance design, the GNSS decoder supplies time data accurate to within 30 nsec of UTC. The user programmable cable delay compensation ensures timing accuracy is maintained, even over long cable runs.

The system has been engineered to ensure reliable performance. The high sensitivity GPS6000 decoder allows for operation in the most demanding weak signal and hostile RF environments. The GPS6000 fully integrates with your time server, providing real time diagnostics and active antenna monitoring.

Installing the GPS6000-LITE is simple. Both cables are supplied pre-terminated. The GPS6000 has also been purpose designed to allow cost saving installation into your data centre, optionally connecting to your time server via existing cat 5 structured cabling.

1.2 - Scope of supply

Scope of supply:

- 1 x GPS active patch antenna with 3m cable
- 1 x GNSS decoder
- 1 x 5m output cable
- 1 x user manual

1.3 - Options

- GPS6000-OUT-15: 15m *(49ft)* output cable
- GPS6000-OUT-50: 50m *(164ft)* output cable
- GPS6000-OUT-150: 150m *(492ft)* output cable

2 - Installing the GPS6000

2.1 - Installing the antenna

To ensure reliable operation, the GPS antenna needs to have at least a partial view of the sky *(increasing the amount of sky visible will provide correspondingly better performance)*. The antenna should be mounted either externally *(in a protected position)* or in an internal position with a view of the sky *(for example, on a window ledge)*.

If you choose to mount your antenna internally, best operation will be achieved by choosing a window facing towards the equator *(ensure the window is not coated with a metallised film as this may disrupt the GPS signals)*.

Having chosen a suitable installation location, secure the GPS antenna in position using the adhesive tape supplied.

Once installation is complete, connect the antenna cable to the 'ANTENNA' connection on the front of the GNSS decoder.

2.2 - Installing the GNSS decoder

The GNSS decoder converts the raw satellite data into highly accurate time information. The decoder should be installed internally, close to the GPS antenna *(the GPS antenna has a captive 3m (9ft) pre-terminated coaxial cable for connection to the decoder)*.

PLEASE NOTE: THE GNSS DECODER IS NOT SUITABLE FOR EXTERNAL INSTALLATION.

The decoder should be secured in position using the integral surface mounting brackets. Care should be taken to ensure the fixings used *(not supplied)* are suitable for the application. Figure 2.1 below details the enclosure bracket fixing dimensions.

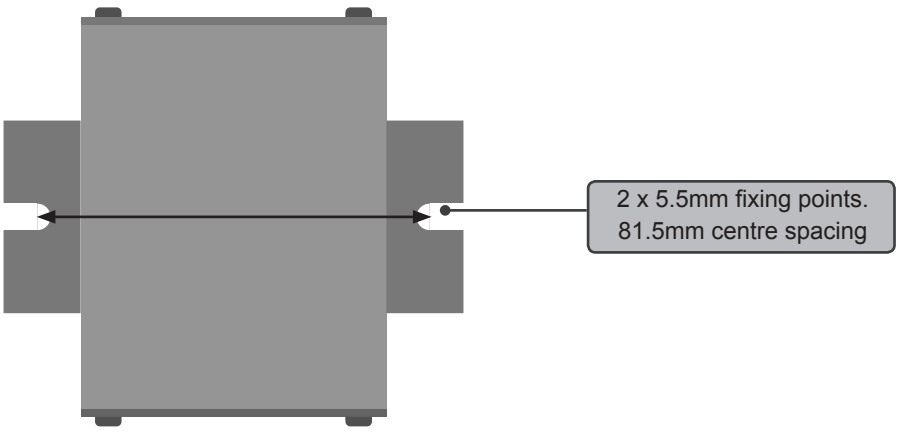

Figure 2.1 - GNSS decoder enclosure mounting dimensions

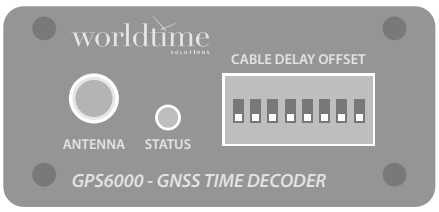

Figure 2.2 - The GNSS Decoder (front)

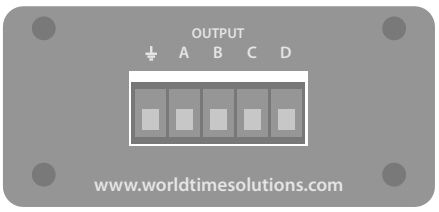

Figure 2.3 - The GNSS Decoder (rear)

2.3 - The output cable

The system is supplied as standard with a pre-terminated 5m *(16ft)* output cable for the connection between the GNSS decoder and your time server. Longer cables are optionally available if required. Alternatively, the output cable may be extended using Belden 9502 cable up to a maximum total length of 150m *(492ft)*. Table 2.1 details the cable colour scheme.

Terminal ID	Cable colour code
GND	Cable screen drain wire
A	Black / Red
B	Red
C	Black / White
D	White

Table 2.1 - Output cable connection detail

For low smoke/plenum applications, the supplied cable should be substituted for a Belden 82502 *(or equivalent)* type cable.

2.3.1 - Optional connection using structured cabling

To enable simple installation into a data centre or office complex, the GNSS decoder may be connected to your time server using category 5, category 5e or category 6 structured cabling.

Table 2.2 below details the suggested RJ45 / 8P8C pin connections. Using this configuration, cable lengths of up to 300m *(984ft)* may be used reliably.

RJ45 / 8P8C pin	T568A Colour	T568B Colour	GNSS decoder output pin
1	White / Green	White / Orange	A
2	Green	Orange	B
3	White / Orange	White / Green	A
4	Blue	Blue	D
5	White / Blue	White / Blue	C
6	Orange	Green	B
7	White / Brown	White / Brown	GND
8	Brown	Brown	GND

Table 2.2 - RJ45 / 8P8C structured cabling wiring detail

2.4 - The cable delay offset

The GPS6000-LITE is capable of providing time data accurate to within 30 nsec of UTC. At this level of accuracy, taking account of cable lengths becomes critical. Every metre of cable between the GNSS antenna and your time server causes an additional error of approximately 5 nsec. For long cable lengths, this accumulated error can become very significant.

The cable delay offset provides a simple solution to correct for errors due to cable propagation delays. The total cable length between the GNSS antenna and your time server is entered using the switch bank. The GNSS decoder then automatically advances the time data by the required offset to correct for the cable propagation delay.

GPS6000-LITE systems are supplied with the correct cable delay offset value pre-programmed. For a typical installation, this preset value should not need any adjustment. However, if required, the cable delay offset can be programmed using the following guidelines.

2.4.1 - Programming the cable delay offset

PLEASE NOTE: THE PRESET CABLE DELAY OFFSET SHOULD NOT NORMALLY REQUIRE ANY ADJUSTMENT.

The cable delay offset is programmed in metres using the cable delay offset switch bank. The total cable length *(in metres)* should be encoded in an 8 bit binary format and entered into the switch bank. Switches set to on *(the upper position)* are summed. As shown in figure 2.4 below, the left-hand switch is the most significant bit *(128m)* and the right-hand switch the least significant digit *(1m)*.

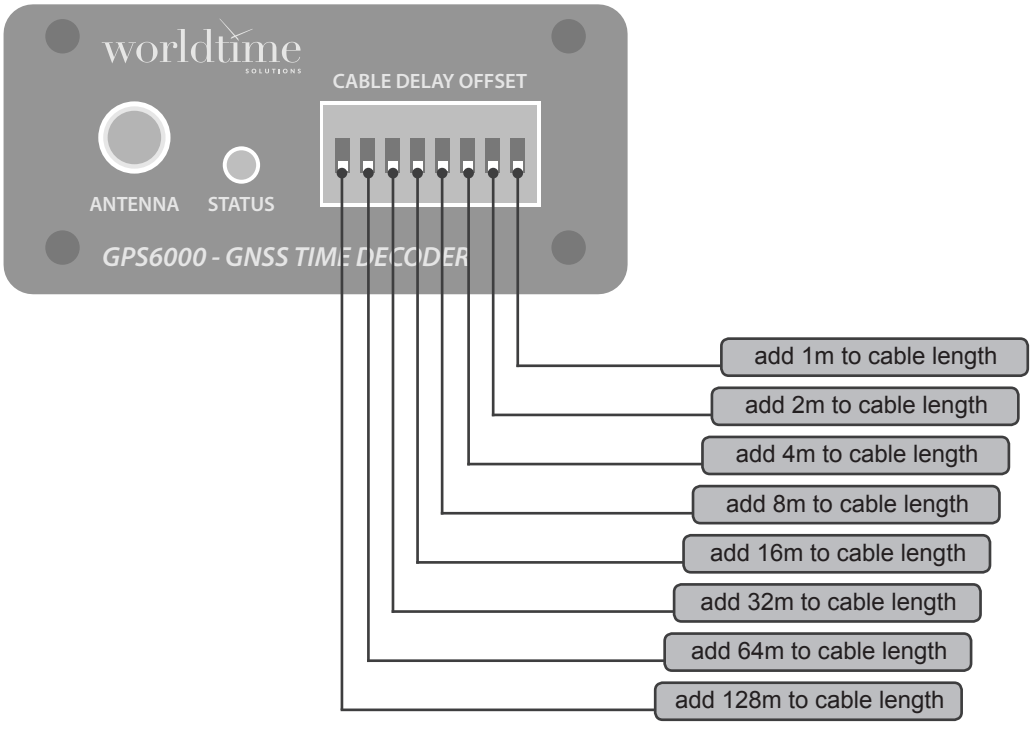

Figure 2.4 - The cable delay offset switch bank

For example, to set a total cable length of 14m *(or 00001110 in binary)*, set the 8m, 4m and 2m switches on *(as shown in figure 2.5 below)*.

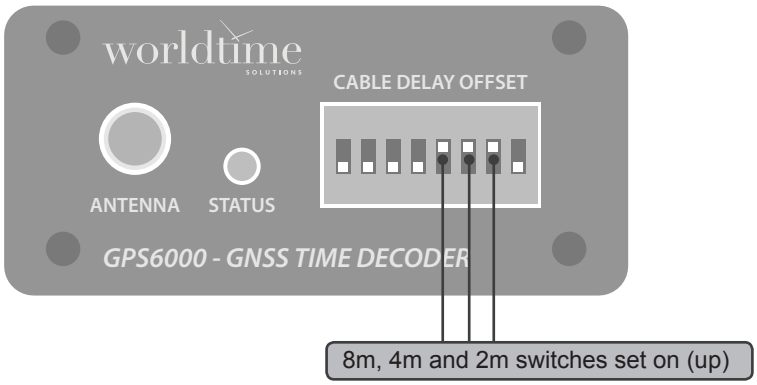

Figure 2.5 - Example 14m cable delay offset

Alternatively, to set a total cable length of 59m *(or 00111011 in binary)*, set the 32m, 16m, 8m, 2m and 1m switches on *(as shown in figure 2.6 below)*.

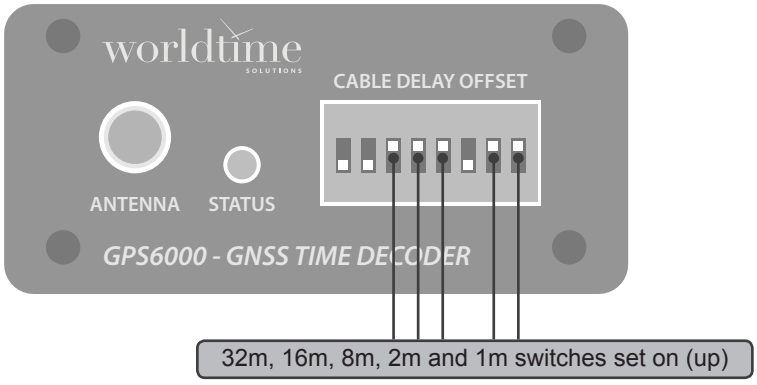

Figure 2.6 - Example 59m cable delay offset

3 - System operation

Operation of the GPS6000-LITE is fully automatic. The following theory of operation is supplied as a reference, to allow the user to gain a basic understanding of the technology used in the GPS6000-LITE.

3.1 - Theory of operation

When first powered-up, the GPS6000-LITE initiates a cold start search acquisition process. GPS Satellites are tracked and an initial location/timing solution is computed. Typically, the search acquisition process will complete within one minute.

After the search process has been successfully completed, the GPS6000-LITE begins downloading GPS almanac data *(containing orbit and status reference information for each satellite vehicle, along with UTC offset data)*. The GPS6000-LITE must continuously track the GPS satellites for around 15 minutes to download a complete almanac.

Once the almanac download is complete, the GPS6000-LITE begins transmitting time data and enters self-survey mode. In self-survey mode, the GPS6000-LITE computes a highly accurate reference location by averaging multiple position fixes.

After a successful self-survey has completed *(approximately 35 minutes of uninterrupted GPS tracking)*, the computed reference location is stored and the GPS6000-LITE moves to high-accuracy timing mode. In this mode, the GPS6000-LITE is able to provide time data accurate to within 30 nsec of UTC.

Note that if your GPS6000-LITE has previously performed a full self-survey and the location has not changed, a new self-survey will not be performed. The GPS6000-LITE will move directly from almanac download to high-accuracy timing mode. If the GPS6000-LITE has previously performed a full self-survey and the location has changed, a new self-survey will be performed.

3.2 - Operation in non-static applications

The GPS6000-LITE is optimised for use in static installations. In normal operation, the GPS6000-LITE performs a self-survey then switches to high-accuracy timing mode *(where the system corrects only for clock errors)*. In this mode, the GPS6000-LITE assumes the location does not change.

It is possible to use the GPS6000-LITE in non-static applications. However, the system will not operate in high-accuracy timing mode and timing accuracy will be degraded.

3.3 - Synchronisation status

The status LED provides a visual indication of the synchronisation status of your GPS6000-LITE. In normal operation, the status LED will be flashing green. A red LED indicates the system is not synchronised or there is an error. See table 3.1 for more details.

LED	Status
Solid red	System booting
Single red flash	Searching / downloading almanac data
Single green flash	Locked
Double red flash	Antenna disconnected
Triple red flash	Antenna shorted

Table 3.1 - Status LED functions

More detailed status information can be accessed via your time server. The GPS6000-LITE fully integrates with your time server, providing real time diagnostics and active antenna monitoring. Please refer to the user manual for your time server for further details.

A - Specifications

Timing performance:	
Synchronised accuracy:	30 nsec (1 sigma)

GNSS decoder:	
GNSS engine:	Anti-jam capable, 32 satellite parallel tracking
Minimum acquisition sensitivity:	-148dBm (cold start)
Minimum tracking sensitivity:	-160dBm
Operating temperature:	0 to 50ºC
Relative humidity:	0% - 95%, noncondensing
Enclosure:	85 x 65 x 30mm (3.35” x 2.56” x 1.18”) aluminium enclosure with wall mount brackets
Weight:	0.2 kg
Cable delay compensation:	User programmable
Status monitoring:	Fully integrated diagnostic system with active antenna monitoring. Multi-colour status LED

Antenna:	
Antenna:	IP67 adhesive mount GPS antenna
Gain:	29dB
Noise:	1.3dB
Operating temperature:	-30ºC to +75ºC
Dimensions:	33 x 44 x 14mm (1.30” x 1.73” x 0.55”)

Cabling:	
Antenna cable:	3m (9ft) captive pre-terminated RG-174 SMA coaxial
Output cable:	5m (16ft) pre-terminated Belden 9502 (two pair plus drain 24 AWG stranded cable with 100% foil shield and semirigid, sunlight resistant, Polyvinyl Chloride (PVC) jacket)

Standards compliance:	
Electrical Safety:	BS EN 60950-1:2006
Radio Disturbance:	BS EN 55022:2006
Immunity Characteristics:	BS EN 55024:2003
RoHS:	RoHS-Compliant

Scope of supply:	
GPS6000-LITE scope of supply:	1 x GNSS decoder 1 x GPS antenna with 3m cable 1 x 5m output cable

Options:	
GPS6000-OUT-15:	15m (49ft) output cable
GPS6000-OUT-50:	50m (164ft) output cable
GPS6000-OUT-150:	150m (492ft) output cable

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