

GPS6000-DEC

Remote GNSS Decoder

User Manual

Version 1.0

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The GPS6000-DEC Remote GNSS Decoder is guaranteed against failure due to faulty parts or workmanship for a period of five (5) years from date of purchase.

In the event of product failure due to faulty parts or workmanship within the warranty period, World Time Solutions Limited, at its own discretion, will either (a) repair the product, (b) supply a replacement product, (c) supply a functionally equivalent replacement product, or (d) refund the purchase price of the product.

The limited warranty will not apply if (a) the product has not been installed or operated as per our instructions, (b) the product has been modified in anyway.

In the event of failure, the GPS6000-DEC should be returned to the manufacturer for inspection and repair. Please visit our support pages for further details:

www.worldtimesolutions.com/support.html

TECHNICAL SUPPORT

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

www.worldtimesolutions.com/support.html

1 - Introduction

1.1 - Overview

The GPS6000-DEC converts GNSS satellite data into precise time data, accurately synchronising your time server with international atomic standards. Incorporating the latest in GNSS technology and multi-constellation support (*GPS/GLONASS/Galileo*), the GPS6000-DEC ensures accurate and reliable time on your systems, even in hostile RF environments.

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 decoder allows for operation in the most demanding weak signal and hostile RF environments. The GPS6000-DEC fully integrates with your time server, providing real time diagnostics and active antenna monitoring. Advanced anti-jam technology and multi-constellation support further increase system reliability.

The GPS6000-DEC has been purpose designed to allow simple installation into your data centre, connecting to your time server via existing cat 5 (or similar) structured cabling. This cabling methodology allows for the reliable installation of GNSS systems in large buildings, where long RF cable runs would be impractical.

The GPS6000-DEC is compatible with a range of GNSS antenna, lightning arrester and coaxial cabling options (*available separately*).

1.2 - The GNSS decoder

The GNSS decoder converts satellite data into highly accurate time information. The cable delay offset function ensures timing accuracy is maintained over long cable runs.

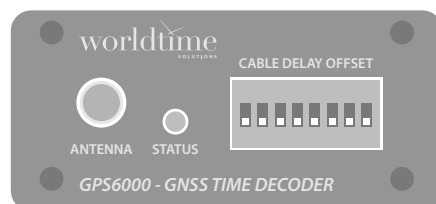


Figure 1.1 - Front view

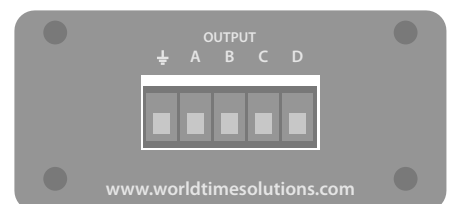


Figure 1.2 - Rear view

2 - Installing the GPS6000

Installing a GPS6000-DEC system is a straightforward procedure. All RF cables are supplied pre-terminated and no specialist tools are required. However, to ensure reliable and safe operation, care should be taken selecting appropriate locations for the GNSS antenna and lightning arrester (*both available separately*).

Please follow the installation guidelines below to ensure a trouble-free installation.

2.1 - System installation overview

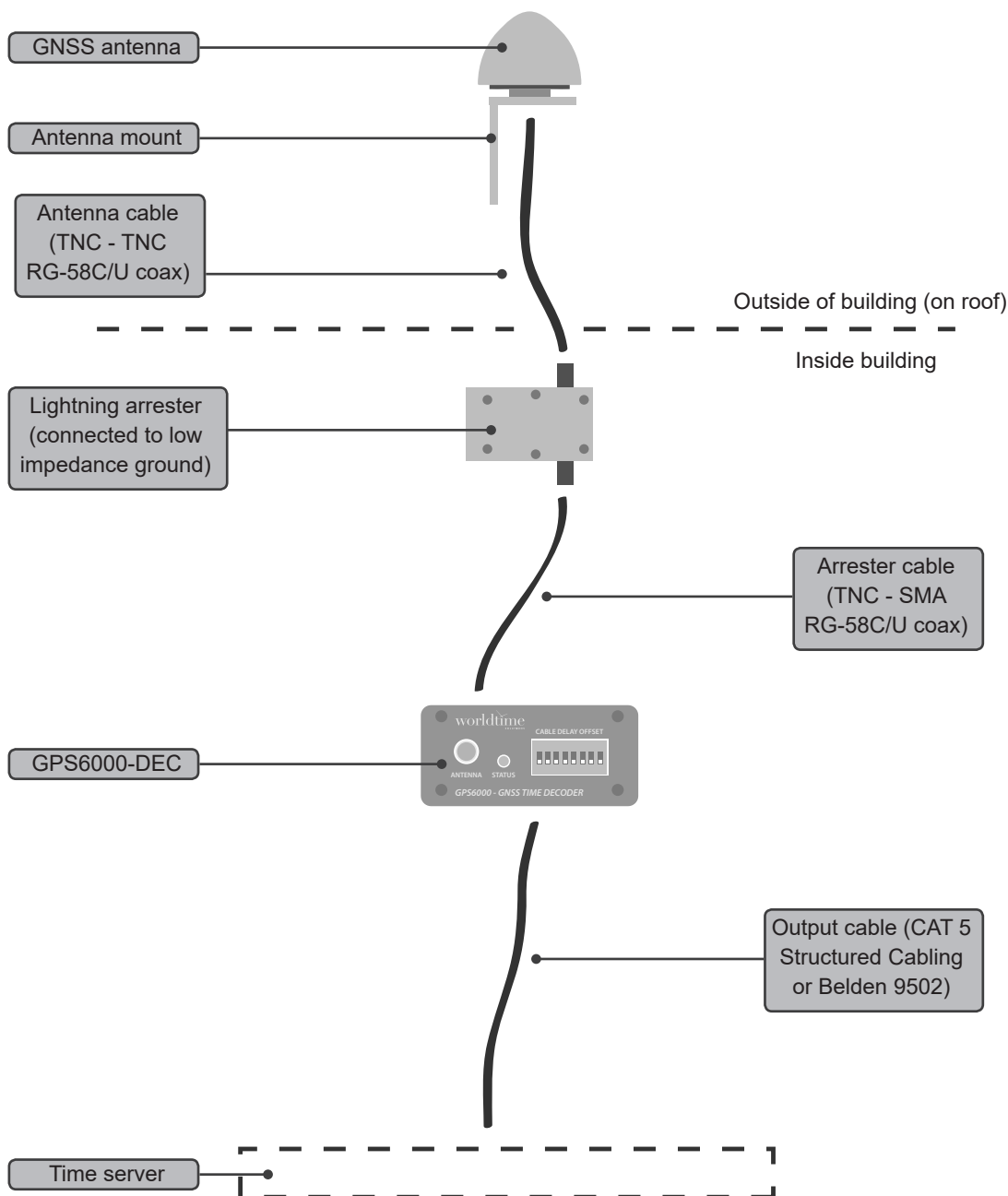


Figure 2.1 - GPS6000-DEC installation overview (including optional accessories)

2.2 - Installing the antenna (*available separately*)

The system requires the installation of a GNSS antenna (*available separately*). The choice of installation location is critical for reliable system operation.

2.2.1 - Selecting an installation location

The antenna should be installed externally, with the maximum possible sky visibility. For most installations, the ideal location will be the roof of your building (*the antenna is able to withstand extreme temperatures, excessive vibration, rain, snow and sunlight*).

Ideally, the antenna should have a clear uninterrupted 360° view of the horizon. For installations where an unobstructed view of the sky is not practical, the antenna should be installed with as large a view as possible of the sky towards the equator. Installing the antenna with a substantially reduced view of the sky will degrade system performance and may increase synchronisation time.

2.2.2 - Mounting the antenna

The antenna should be mounted with the top of the dome facing directly upwards and secured using the mounting bracket (*available separately*). Care should be taken to ensure the fixings used (*not supplied*) are suitable for the application.

2.2.3 - The antenna RF cable

The antenna should be connected to the lightning arrester via a pre-terminated RG-58C/U TNC to TNC coaxial cable. If you are installing a system without a lightning arrester, the antenna should be connected directly to the GPS6000-DEC Remote Decoder using a pre-terminated RG-58C/U TNC to SMA coaxial cable.

A range of pre-terminated cable lengths are available. Your sales advisor will be happy to assist you.

2.2.4 - Moisture protection

To prevent moisture penetrating the RF connection, the antenna/coax connection should be sealed using the supplied Self-Amalgamating Tape.

The tape should fully cover the coax heat shrink and the TNC connector, and should finish on the antenna mounting thread. The tape should be applied in successive half-lapped layers working up towards the antenna. To ensure good sealing of the RF connection, the tape should be gently stretched as applied.

PLEASE REFER TO THE SEPARATE INSTRUCTION SHEET FOR FURTHER DETAILS.

2.3 - Installing the optional lightning arrester

The optional lightning arrester connects between the antenna and GPS6000-DEC Remote GNSS decoder. The lightning arrester provides surge protection for the GNSS decoder (*and attached systems*) in the event of a lightning strike.

PLEASE NOTE: THE LIGHTNING ARRESTER MUST NOT BE INSTALLED EXTERNALLY.

The lightning arrester should be installed internally at the point where the antenna cable enters the building. It is important that the lightning arrester is grounded to a low impedance ground system for proper operation.

THE LIGHTNING ARRESTER IS SUPPLIED WITH A SEPARATE INSTRUCTION SHEET WITH FULL INSTALLATION DETAILS. PLEASE CONSULT THIS SEPARATE INSTRUCTION SHEET CAREFULLY WHEN INSTALLING YOUR LIGHTNING ARRESTER.

2.4 - Installing the GPS6000-DEC

2.4.1 - Mounting the GPS6000-DEC

The GPS6000-DEC converts the raw satellite data into highly accurate time information. The decoder should be installed internally, close to the output of the lightning arrester.

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

The GPS6000-DEC 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 2.2 below details the enclosure bracket fixing dimensions.

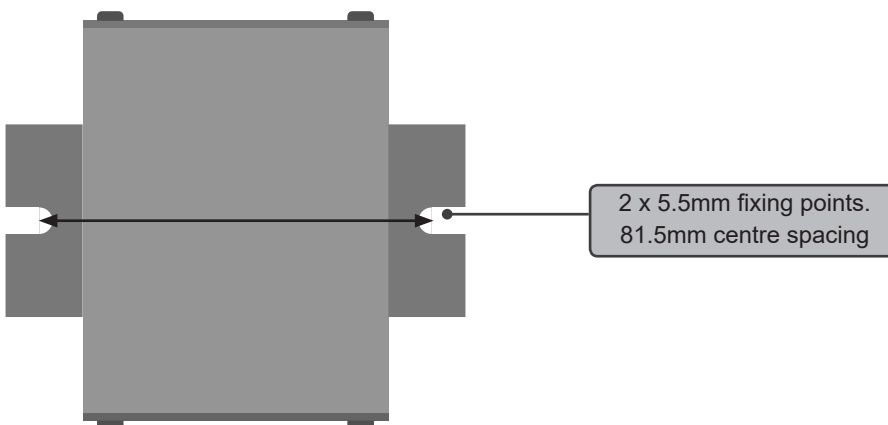


Figure 2.2 - GNSS decoder enclosure mounting dimensions

2.4.2 - The GPS6000-DEC RF Cable

The connection between the lightning arrester and the GPS6000-DEC should be made using a pre-terminated RG-58C/U TNC to SMA coaxial cable. If you are installing a system without a lightning arrester, the GPS6000-DEC Remote Decoder should be connected directly to the antenna.

A range of pre-terminated cable lengths are available. Your sales advisor will be happy to assist you.

2.4.3 - Connecting to the time server

To enable simple installation into a data centre or office complex, the GPS6000-DEC Remote Decoder can be connected to your time server using category 5, category 5e or category 6 structured cabling.

The GPS6000-DEC is supplied with a removable terminal block, allowing simple cable connections using a terminal screwdriver.

Table 2.1 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 2.1 - RJ45 / 8P8C structured cabling wiring detail

Alternatively, the connection to the time server can be made using a Belden 9502 two-pair screened cable (or similar). In this configuration, cable lengths up to a maximum total length of 150m (492ft) are possible.

2.5 - The cable delay offset

The GPS6000-DEC 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 (*see note over page*). 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 GPS6000-DEC decoder then automatically advances the time data by the required offset to correct for the cable propagation delay.

2.5.1 - Programming the cable delay offset

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 2.3 below, the left-hand switch is the most significant bit (*128m*) and the right-hand switch the least significant digit (*1m*).

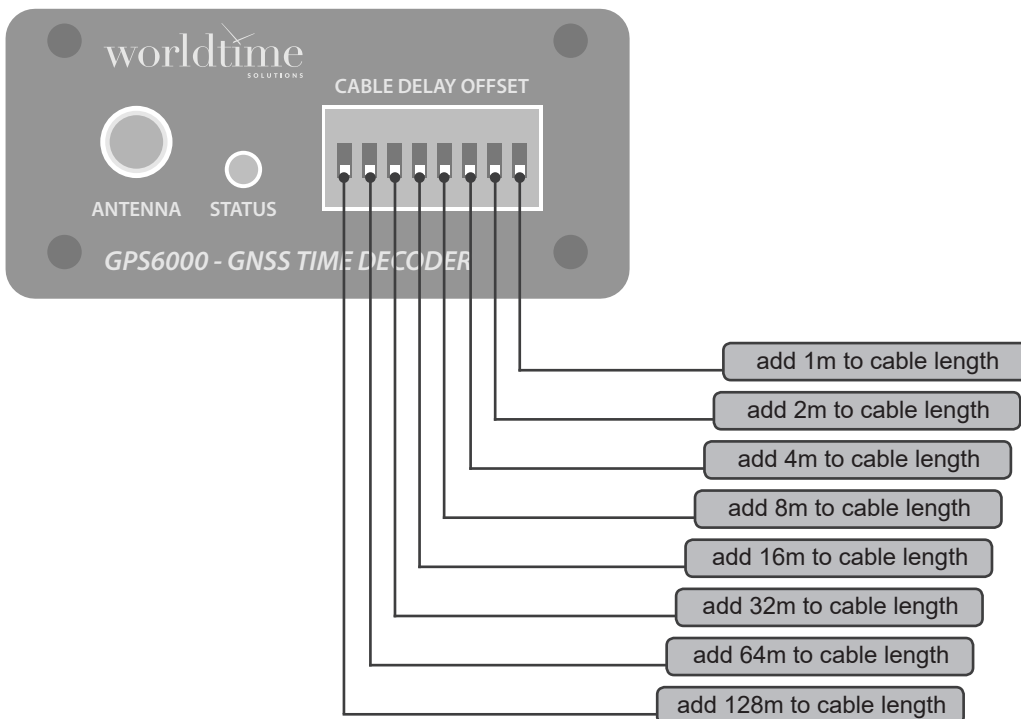


Figure 2.3 - The cable delay offset switch bank

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 2.4 below).

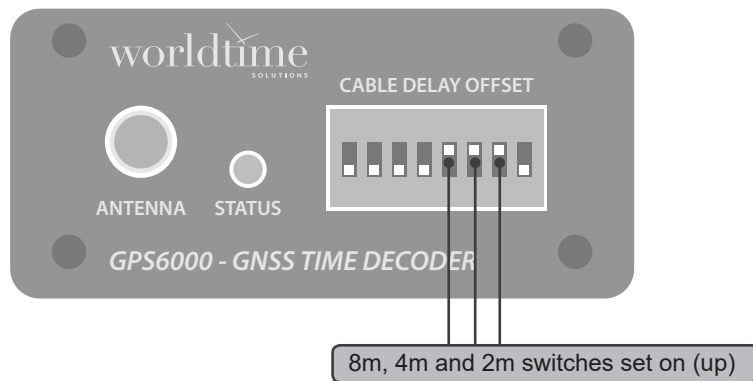


Figure 2.4 - Example 14m cable delay offset

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 2.5 below).

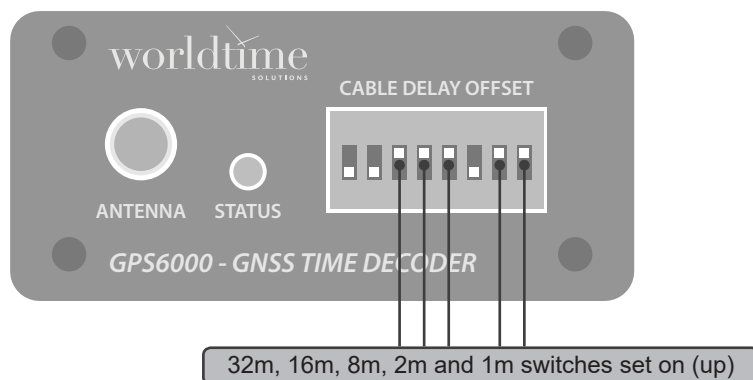


Figure 2.5 - Example 59m cable delay offset

A NOTE REGARDING THE CABLE DELAY OFFSET ACCURACY:

The GPS6000-DEC advances the time data by 5 nsec for every additional metre added to the cable delay offset value. This 5 nsec per metre value has been chosen as a good approximation to the velocity of propagation for RG-58C/U (at 66%, or 5.05 nsec/m). However, users wishing to achieve the highest level of accuracy should take account of the nominal velocity of propagation for Belden 9502 (at 60% or 5.56 nsec/m) and correspondingly increase the programmed cable delay offset at longer output cable lengths.

3 - System operation

Operation of the GPS6000-DEC 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-DEC.

3.1 - Theory of operation

When first powered-up, the GPS6000-DEC initiates a cold start search acquisition process. Satellites are tracked from all available GNSS constellations (*GPS/GLONASS/Galileo*) 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-DEC begins downloading GNSS almanac data (*containing orbit and status reference information for each satellite vehicle, along with UTC offset data*). The GPS6000-DEC must continuously track the GNSS satellites for around 15 minutes to download a complete almanac.

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

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

Note that if your GPS6000-DEC has previously performed a full self-survey and the location has not changed, a new self-survey will not be performed. The GPS6000-DEC will move directly from almanac download to high-accuracy timing mode. If the GPS6000-DEC 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-DEC is optimised for use in static installations. In normal operation, the GPS6000-DEC performs a self-survey then switches to high-accuracy timing mode (*where the system corrects only for clock errors*). In this mode, the GPS6000-DEC assumes the location does not change.

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

3.3 - Anti-jam protection

The GPS6000-DEC incorporates anti-jam technology features to prevent the effects of GNSS spoofing and GNSS jamming.

Please contact us if you require further details regarding the operation of these functions.

3.4 - Synchronisation status

The status LED provides a visual indication of the synchronisation status of your GPS6000-DEC. 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-DEC 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)

RF Performance:	
GNSS engine:	Anti-jam capable, multi-constellation, 32 satellite parallel tracking
Minimum acquisition sensitivity:	-148dBm (cold start)
Minimum tracking sensitivity:	-160dBm

Mechanical & Electrical Specifications:	
Enclosure:	85 x 65 x 30mm (3.35" x 2.56" x 1.18") aluminium enclosure with wall mount brackets
Weight:	0.2 kg
RF input:	SMA (female)
Cable delay compensation:	User programmable
Status monitoring:	Fully integrated diagnostic system with active antenna monitoring. Multi-colour status LED

Environmental Specifications:	
Operating temperature:	0 to 50°C
Relative humidity:	0% - 95%, noncondensing

Warranty & Support:	
Warranty:	5 years
Support:	Free-of-charge lifetime technical support

Standards compliance:	
Safety requirements:	BS EN 62368-1: 2024
Emission requirements:	BS EN 55032: 2015 +A1:2020
Immunity requirements:	BS EN 55035: 2017 +A11:2020
Radio equipment directive:	EN 303 413: V1.2.1 (2021-04)
CE / UKCA:	Meets all applicable directives
RoHS:	RoHS compliant

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