
Welcome To The System 1200 Newsletters!

A newsletter based on the features and functionality of the TPS1200 and GPS1200 instruments and the LGO software will be produced every second week.

As with the TPS1100 and System GPS500 newsletters, each newsletter will cover a different topic related to the use of System 1200 instruments or LGO.

Whether you are already familiar with System 1200 instruments, or a relative newcomer, the aim is that everybody will learn something from reading a newsletter!

So please don't just throw the newsletter in the bin or delete it from the inbox – you may just learn how to survey even quicker with System 1200....

Performance = Productivity

System 1200 – both the TPS and GPS instruments - are top of the range, performance survey instruments. Quite simply, they are the most productive survey instruments currently available on the market.

Want to finish surveys more quickly? Buy System 1200.

The first two newsletters will not only explain why the TPS1200 and GPS1200 instruments are the most productive instruments available, but it will also explain (and perhaps more importantly) why they are the most reliable instruments available.

It is all very good to finish a survey quickly, but if you get back to the office, or worse, when you deliver your results to the customer and find that some of the GPS points measured under trees are wrong or distance measurements to corners of buildings are wrong then real problems are just beginning...

This newsletter focuses on the speed and reliability of the RTK performance of the GPS1200 instrument.

The next newsletter will focus on the TPS1200 instrument – in particular the accuracy and reliability of the EDM.

Even if you are currently only interested in total stations, you should still read about GPS1200. If you only ever use GPS, you should still read about TPS1200 – you will find it interesting...

The Reliability of GPS1200

Quite simply, Leica GPS500 had the best RTK performance available. The System500 GPS newsletter (01-06 and 01-07) described the incredible speed and reliability of System500 RTK.


Ambiguities were fixed twice within 10 seconds and then, ambiguities were repeatedly fixed every 10 seconds to check the correctness of the position solution. Basically this meant that surveyors could measure points with cm accuracy more quickly and more reliably than with any other GPS survey system.

GPS1200 uses **SmartTrack** technology – exceptional satellite tracking performance – and **SmartCheck** – ensuring the highest reliability – which means that ambiguities are checked twice within 8 seconds and additionally, the reliability of fixed positions has been further improved to 99.99% for baselines all the way to 30km.

Future newsletters will explain individually the improved performance of the new AX1200 antenna and the new ME11 measurement engine, but this newsletter focuses on the result of these individual technologies. Basically, the new antenna combined with the new measurement engine delivers more and much "cleaner" satellite measurements – this is how GPS1200 RTK can out-perform any other GPS survey system – and this is the focus of this newsletter.

Don't believe us? Then look at the results of some of the tests below, which simulate a variety of typical survey conditions....

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Performance under trees

A simple test to compare the RTK performance of different GPS survey systems under trees is to set up the different systems under a tree and log the computed positions over a period of time. It is then possible to determine for both systems the percentage of time a fixed solution was available and more importantly, the correctness of the computed positions.

A GPS1200 rover and a rover from a major competitor were set up under a tree as shown below. Note, the tree is reasonably dense and the sensors are also set up relatively close to a building.



A second GPS1200 sensor and a second sensor from the same competitor were set up in open space as references to the rovers at a distance of 0.1km. This is a completely fair test.

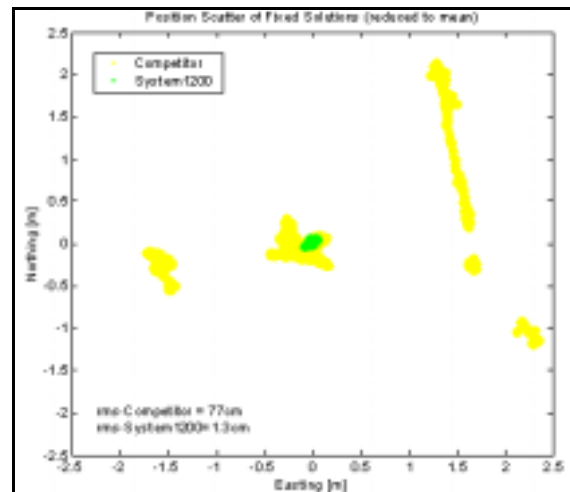
The test ran for 3.5 hours with positions being recorded every 5 seconds for both systems. All positions were recorded – phase fixed, code only and navigated positions. As the GPS sat-

ellites move around the sky, phase fixed solutions are lost and must be re-fixed.

The graph below shows the percentage of time for which a fixed position was available for both systems. At first glance it seems that the competitor (yellow) has easily out-performed GPS1200. For 56% of the 3.5 hours, the competitor was claiming a phase fixed position with GPS1200 only managing 43%.



However, now look at a plot of the phase fixed positions. This clearly shows how the competitor (again yellow) has computed a large number of positions up to **2m wrong in position**. The standard deviation of all phase fixed solutions is **0.77m**. The small group of green dots in the centre of the plot are the GPS1200 positions – these have a standard deviation of **0.013m**.



The percentage of positions computed by the competitor, which are claimed to be accurate to the cm level but which are actually greater than 15cm from the true position for the com-

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petitor is **27%** of all positions. For GPS1200, there are **none** – yes, **NONE**.

Quite simply, this is **SmartTrack** and **Smart-Check** at work – **SmartTrack** providing clean satellite observations and **SmartCheck** ensuring no wrong solutions are produced.

But what would this have meant for a surveyor in the field? Basically, using the competitor's equipment it is quite possible that the surveyor would have recorded positions believing them to be accurate when in actual fact they are wrong by up to 2m in position. Even worse, it would not have been noticed because the system gives no indication that the position is wrong.

The strength of GPS1200 is the reliability of the position solution – if a position is reported to be accurate to the cm level then it is very, very likely to be accurate to the cm level.

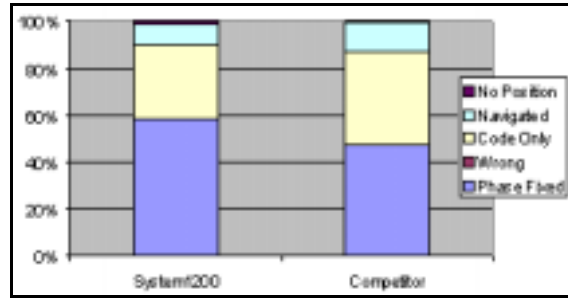
Surely it is better to have no position or to wait a longer time for a correct position than a wrong position? Would you trust in a system which can give so many wrong positions?

Long baselines

The following tests focus on the long range RTK performance of GPS1200 compared to that of the same competitor. Tests were made with a baseline distance of approximately 30km.

The antenna of a GPS1200 rover and the antenna of a rover from a competitor were mounted onto the roof of a car. The car was then driven around an area of generally good visibility to the sky, but often passing under bridges and close to other obstructions. Again, all positions were recorded – phase fixed, code only and navigated positions – for the duration of the test.

The chart below shows the ratio of the different solution types. It can clearly be seen that almost **60%** of all positions computed on GPS1200 are phase fixed – the number of phase fixed positions for the competitor is less than **50%**.



The actual numbers of the different position types is shown below – **20% more** phase fixed solutions for GPS1200 than the competitor.

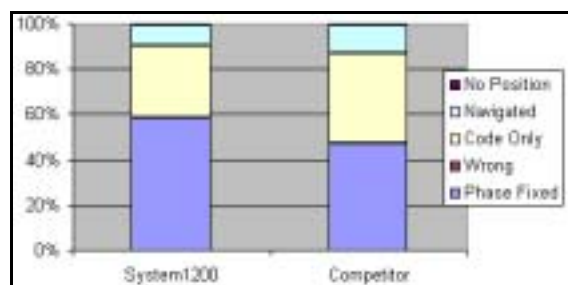
	GPS1200	Competitor
Phase Fixed	1290	1034
Code Only	694	878
Navigated	200	273

Clearly, for a surveyor working at long distance from the reference station, less time is spent waiting for ambiguities to be fixed, and more time is spent surveying points.

Short baselines with many obstructions

The same test was repeated as for long baseline - this time over a shorter baseline – 5km – but passing under many more bridges and trees and driving closer to buildings.

The chart below shows the tests of these results. For GPS1200, **23%** of all positions were phase fixed solutions – for the competitor, only **17%** of all positions were phase fixed solutions.



Again, the actual numbers of the different position types is shown below. There are obviously fewer phase fixed solutions due to the more difficult environment – but even so GPS1200

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produced 50% more phase fixed solutions than the competitor.

	GPS1200	Competitor
Phase Fixed	464	293
Code Only	1430	1596
Navigated	8	6

Once more, when working closer to the reference station and under difficult conditions GPS1200 out-performs the competitor.

Summary: How Important is Reliability?

All survey GPS manufacturers claim their systems are reliable. Due to the nature of GPS, unless ground truth is known it is very difficult to identify wrong solutions with GPS – the quality of a phase fixed solution will always show a low rms or coordinate quality value. The first test described above demonstrates this – a large percentage of phase fixed solution computed by the competitor's system have a low rms value – but are up to 2m away from the correct position.

The above tests prove that under all conditions – short or long baselines, open or obstructed sky – GPS1200 using **SmartTrack** and **SmartCheck** technology out-performs its closest competitor.

Consider this - most RTK rovers also contain some COGO functionality, which also sometimes has to make difficult calculations. It is obviously important that even when making these difficult calculations you still get the correct COGO results. **Would you buy an RTK rover, which may give you wrong COGO results when you start making difficult computations?**

More information on the performance of the GPS1200 GX1230 receiver and AX1202 antenna can be found in an independent paper published by Delft Technical University..

A future newsletter will also summarise this paper.



Please contact your local Selling Unit or local Leica dealer if there are specific topics you would like covered in these newsletters.

We welcome all suggestions for TPS1200, GPS1200, specific applications or LGO. We look forward to receive your idea.

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