

System 1200 Newsletter – No. 19

SmartStation

SMARTSTATION – A WORLD'S FIRST

On 31st January 2005, Leica Geosystems proudly announced to the world the very first total station with integrated GPS – the **System1200 SmartStation**.

Quite simply, this unique innovation will revolutionise the way surveyors think – in many cases it will remove the need to use a traverse in order to bring in control to the area to be surveyed or the need to use a complete RTK rover system in order to determine the coordinates of the total station.

It is no exaggeration to say that the time needed to establish control or to setup the total station with known coordinates can be reduced by up to 80%.



BUT WHAT CAN IT DO?...

Since the announcement there has been much discussion about the SmartStation in the surveying world - on the Internet in message boards, at surveying exhibitions, at surveying road-shows and in the emails we receive here at Leica Geosystems in Switzerland.

There seems to be some confusion and misunderstandings about what SmartStation is, what it can do and what it can't do. For example... **Can it be used as an RTK rover? Can it log raw data? Can it be used as an RTK reference? Why not put a GPS antenna on the reflector?**

The aim of this newsletter is to explain what is SmartStation, why it has been created and to answer most of the most commonly asked questions currently being asked about SmartStation.

Imagine – in 10 years time every total station will have integrated GPS and will be used as much as a total station or an RTK rover is used today.

And Leica Geosystems is the first.

SMARTSTATION – ACTUALLY NOTHING NEW

It is worth to first explain what exactly is SmartStation. A SmartStation comprises of 2 main components – the **TPS1200 total station** and the **SmartAntenna** – when the **SmartAntenna** is placed on top of the **total station** then this is now a **SmartStation**.

Of course, there is actually nothing new about the idea of a SmartStation...

Imagine a surveyor owns a complete RTK rover system and a total station. He firstly sets up a tripod over a point, mounts the GPS antenna on the tripod and measures the coordinates with the RTK rover. He now removes the antenna from the tripod, places the total station on the tripod and enters the coordinates he just measured with the RTK rover into the total station as the known coordinates for this point.

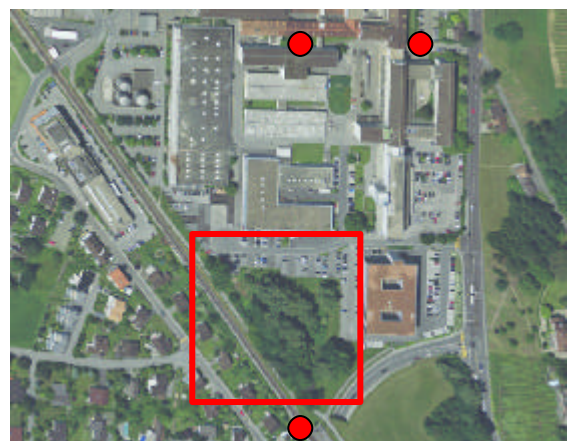
This is exactly what SmartStation does - but without the hassle. With one key-stroke, SmartStation computes an RTK position which is then used by the total station as the known coordinates of that point. Simple.

Also, consider this. The first surveyor actually has two complete survey systems in his truck – the complete RTK rover and the complete total station. He can only use one at a time, so the other survey system is always laying idle in the truck – this idle survey system could be being used by another surveyor on a different job. Not a very efficient use of resources.

And now this. The first surveyor has paid for a complete RTK rover and total station – say \$60,000-\$70,000. The SmartStation user has paid around half of this...

HOW DOES SMARTSTATION SAVE ME 80% OF SETUP TIME?

Imagine a surveyor is given the task to complete a typical topographic survey as shown below.



In the area within the red box, the footprints of all buildings must be surveyed, the positions of all trees, bushes and other vegetation areas must be measured, all man-holes, inspection covers and drain units must be surveyed and enough height points must be recorded in order to create a useful contouring of the surveyed area. The

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area is sufficiently crowded with trees and bushes, and since a lot of building footprints need to be measured, the survey cannot be completed by an RTK GPS rover alone.

All points must be recorded in the local coordinate system with orthometric heights – say a UTM coordinate system combined with the local geoid model.

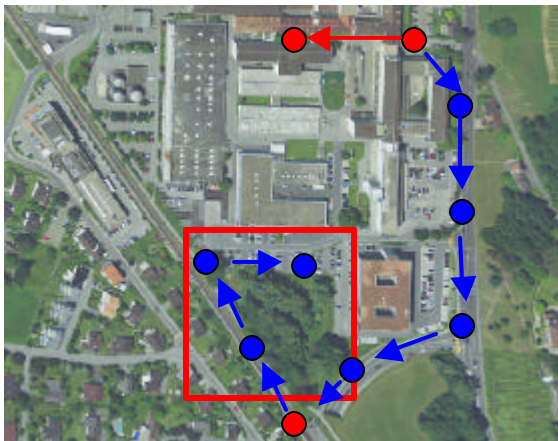
In the survey office, the surveyor will look at maps of the area and/or contact the local surveying or mapping agency in order to determine the location of local control points. As is normal, the control is not on the site itself, but one or two kilometres away – this control must be brought to the site. Indeed, with the increased use of GPS, many surveying and mapping agencies are no longer maintaining control points – so the reliability of the control points could anyway be in doubt.

As shown in the map, the control points shown by the circles are not ideally located.

The **non SmartStation surveyor** has 2 choices.

1. Use only a total station and bring in the control by means of a traverse.

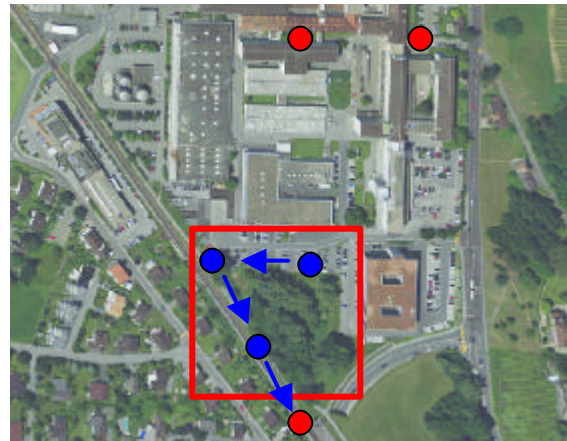
The single advantage here is that only one survey system is being used.



The disadvantage of course is the time needed to complete the traverse – the traverse above would take around **50mins** to complete. There is also probably the need to adjust the traverse in the office. There is also a higher chance for errors with this method.

2. Use an RTK rover in order to establish control directly on the site and then measure detail with the total station.

The advantage here is that the survey is likely to be completed more quickly and also there is minimal office work – the final coordinates of all points can be measured in the field.



The disadvantage of course is that one system is always laying idle. And it can almost be guaranteed that once the RTK rover is put away, it will need to be used again to establish one more control point, because there is one corner of the survey which cannot quite be surveyed! The time needed to establish the control points will be around **20mins**.

The SmartStation surveyor has a third option – and perhaps now you start to appreciate the beauty of SmartStation. This is firstly the freedom to optimally place the total station where it needs to be placed in order to survey as many detail points as possible – when traversing the position of each total station position is dictated by the need to see the previous backsight and ensure the next foresight is also optimally positioned. SmartStation removes these restrictions. Time needed to establish control is around **10mins**. And no second survey system is lying idle.

It is perhaps not so easy to fully understand the advantages of SmartStation until you actually use SmartStation - especially the freedom to place the SmartStation where the user wants to setup a total station position and not where the control points or traverse dictate. **Only when using SmartStation do the advantages of SmartStation become apparent.**

MORE QUESTIONS?

So now you know what SmartStation is and a little bit about what it can do – any more questions?

HOW DO I ORIENTATE MY SMARTSTATION?

SmartStation only provides the coordinates of the setup position – the total station must of course still be oriented.

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Once the coordinates of the setup position are known, then the easiest way to orientate the SmartStation is to aim at any known point in the area.

But this of course may not always be possible – control points are not always conveniently located. In this case as long as individual SmartStation setups are inter-visible then these setups can be used as orientation.

CAN I USE MY SMARTSTATION AS AN RTK ROVER?

Firstly, remember that a SmartStation is the combination of TPS1200 total station and SmartAntenna. So this would not very practicable to use as an RTK rover!

But the **SmartAntenna** can be placed onto a pole and combined with the new **GTX1230** sensor and the **RX1210** (or **RX1220**) controller to make a true RTK rover.

This means that the SmartStation is not a “dead-end” product. On the days when it is not needed to use the SmartAntenna with the total station as a SmartStation, then the SmartAntenna can be used as an RTK rover.

Note, the SmartAntenna can only be combined with the new GTX1230 sensor and not with existing GX1200 sensors.

CAN I LOG RAW GPS DATA WITH SMARTSTATION OR USE IT AS AN RTK REFERENCE STATION?

No. SmartStation is an RTK “rover” only – no raw GPS data logging is possible. SmartStation is geared to productivity – productivity is maximised when using RTK and getting final results in the field.

SmartStation can also not be used as an RTK reference station.

SO I NEED TO BE ABLE TO RECEIVE RTK CORRECTIONS FROM AN RTK REFERENCE STATION?

Correct. As for any GPS RTK rover, you need to be able to receive RTK corrections - SmartStation can use any RTK format - the same as any other RTK rover. This could be from your own RTK reference station setup in the field or permanently mounted on your survey or site office or increasingly, from an RTK network (SmartStation also supports all RTK network formats including the use of NTRIP). All RTK devices cur-

rently supported by System1200 GPS (Satellite 3AS, Pacific Crest PDL, GSM, Siemens MC45, CDMA etc) are also supported by the SmartStation.

Note also, that Leica now also offer the GRX1200 Lite reference station. This is an extremely low-priced reference station which can be used only to supply RTK corrections to the SmartStation.



Think about it. What percentage of the survey jobs you complete are within a 50km radius of your survey office? Probably more than 60%. So if you install a GRX1200 Lite reference station onto your survey office roof, then 60% of your survey jobs can now use SmartStation. This also saves the time and hassle in the field of setting up a field based RTK reference station. More time savings.

CAN ANY RTK ROVER USE RTK CORRECTIONS FROM A GRX1200 LITE?

No. The GRX1200 Lite is offered at a very low price and the RTK data format can only be used by SmartStation. It is however possible to upgrade your GRX1200 Lite to a GRX1200 such that the RTK corrections can then be used by other RTK rovers (other functionality such as raw data logging is then also possible).

HOW GOOD IS THE RTK PERFORMANCE OF A SMARTSTATION?

The RTK performance of a SmartStation is identical to that of a normal GPS1200 RTK rover.

Previous newsletters have already shown that System1200 GPS offers the best RTK performance available today above any other RTK system - high reliability under difficult conditions and over short or long baselines. System1200 RTK will regularly and reliably fix at distances up to and beyond 50km – this RTK performance is also available with SmartStation.

WHAT ABOUT MIXING GPS AND TPS DATA?

Good question. But remember that SmartStation is nothing new.

Many surveyors already use GPS to establish control in an area and then use a total station to survey the detail points. And there is nothing new with SmartStation. The simple rule to remember is the following: **If you can use RTK**



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GPS to complete a survey or stakeout job then you can use SmartStation.

I HAVE NEVER USED RTK GPS – IT ALL SEEMS VERY COMPLICATED

The idea that using RTK GPS is difficult is not true. Measuring a GPS point with SmartStation is as simple as pressing one button.

It is quite likely that you are already using your TPS1200 total station for all kinds of survey work – one day for an indoor building survey, the next day as a robotic total station on a topographic survey, the next day as a reflectorless instrument to measure a quarry face and the next day to stakeout pegs on a road construction job.

To ensure that your instrument is correctly configured for all these different ways of working, you are (hopefully) making full use of configuration sets. Simply choose the appropriate configuration set for the way the instrument is going to be used that day and start working. With SmartStation it is no different – if you will use SmartStation that day then choose that configuration set. No need to change many individual settings.

WHAT ABOUT HANDLING THE SURVEYED DATA?

This is the same as today with System1200 instruments - format files can be used to export the surveyed data into the required format. And because you no longer need to adjust a traverse in the office (SmartStation has removed the need for a traverse) the final results can be obtained in the field.

If you do want to look at your data in detail in the office then LGO (LEICA Geo-Office software) is available. V2 LGO will be available in April 2005 with many new features – particularly with regards to the handling, visualisation and processing of TPS data. You will be surprised what is possible!

WHY DID LEICA NOT PUT A GPS ANTENNA ON TOP OF THE REFLECTOR?

The idea to create a “super-pole” where a GPS antenna is placed on a TPS total station reflector is also not new. But think about it – what benefits does this give a surveyor?

You are now in the field with such a “super-pole” and are receiving RTK corrections and have also set up the total station. You can easily switch between measuring points with RTK or the TPS.

In an area where you have the option to measure either RTK points or TPS points (you have an open sky and have a line-of-sight to the total station) then you will use the method that measures and stores a point more quickly – this is probably using RTK. So now you are carrying a reflector around on the pole as dead-weight (it cannot be easily removed since the GPS antenna is mounted on it) and the total station is idle.

Now you come to an area where GPS points cannot be measured – you are either close to a building, under heavy trees or in bushes so you switch to using the total station. (Now you are carrying a GPS antenna around on the pole as dead-weight and the GPS RTK is idle). But because you are close to buildings or under trees or in bushes you are quite likely to lose line-of-sight to the total station.

So now you will have to move the total station such that the points which cannot be measured with GPS or from the first total station position can be measured. Nothing has been gained.

Plus, a super pole is more expensive than a SmartStation since you are basically still using a complete RTK GPS and total station system.

SUMMARY

Quite simply, until you get your hands on a SmartStation and use it in the field, you will not appreciate the simplicity of using a SmartStation and the freedom that it gives the surveyor to setup the total station where he wants.

SmartStation is a world first. In 10 years time every total station will have integrated GPS and surveyors will simply take it for granted – press one button to get the coordinates for the total station position and start working.

Remember, 30 years ago, the first distance meters were being placed on theodolites – the first total stations. What a revolution! And now this combination of survey techniques (angular measurements and distance measurements) is commonplace. A surveyor today without a total station is a surveyor out of business.

The same will be true for SmartStation. A surveyor without a total station and integrated GPS will not complete surveys as quickly as a surveyor with this technology....

Do you want to increase your productivity now or later?