

RTK With System 300 and System 500 (continued)

Newsletter No. 27 described how the reference station point ID and the co-ordinates of the reference received at the rover are different to the values entered at the reference station. Why?

The reason for these apparent anomalies is that we are using RTCM messages to send the RTK data from the System 300 reference to the System 500 rover. RTCM messages are industry standards and are strictly defined as to what data they contain. The structure of these messages does not allow the height of the reference antenna above the ground or the point ID of the reference station to be sent to the rover.

These messages also do not allow detailed information about the antenna and sensor being used at the reference to be transmitted – which is why you have to define on the System 500 rover what sensor and antenna is being used at the reference - as described last week.

So how are the reference station ID and antenna height problems handled?

Reference Station Point ID

When the System 500 rover receives RTCM messages, it has to give the reference station, from where it is receiving data, a point ID. By default, this will be **RTCM-Ref xxxx**, where **xxxx** is the ID number of the reference (this is different to the point ID). This number (which can be between 0000 and 1023) may be set by the user at the reference and can be contained within the RTCM message. So when the System 500 rover receives the RTCM message, it looks in the RTCM message

for this 4 digit reference number and uses it, as described above, as the point ID for the reference.

Reference Station Co-ords

The RTCM messages that are transmitted from the reference contain, amongst other things, information about the co-ordinates of the reference and the GPS observations that the reference has measured.

The co-ordinates that are sent from the reference to the rover are actually the co-ordinates of the L1 antenna phase centre at the reference, not the ground marker co-ordinates. (Antenna phase centres and antenna themselves will be covered in detail in a future newsletter.) Because the RTCM message sent from the reference to the rover cannot contain the height of the antenna above the ground marker, the System 500 rover will never know the true ground co-ordinates of the reference.

This can be seen when using a System 500 rover in the field. Access the **STATUS\Reference Stn Coords** panel (use **STATUS, 1 Survey, 1 Real-Time** then **F6(REF)**) to see the co-ordinates being received from the reference station. The words **Phase Centr** indicate these co-ordinates refer to the L1 phase centre of the reference.



Normally when using a System 500 reference, the words **Marker** will be seen.

When this System 500 data is imported into SKI-Pro, the co-ordinates that are imported

will not be the co-ordinates that were entered at the System 300 reference station, but the co-ordinates received by the System 500 rover – the L1 phase centre co-ordinates of the reference. This is, of course, completely correct.

v2.1 RTCM

Knowing the above, it would now be expected that the difference between the co-ordinates received by the rover and the co-ordinates actually entered into the reference would simply equal the height of the reference antenna above the ground.

But if the two sets of co-ordinates are compared, it will be seen that this is not the case. The height difference is not exactly the height of the reference antenna above the ground and additionally, there are also small differences in the horizontal co-ordinate values. Why?

It is because the format of the v2.1 RTCM messages only allows the reference station co-ordinates to be transmitted as WGS84 Cartesian co-ordinates to only two decimal places (cm level). The co-ordinates entered at the reference are correctly converted to WGS84 and then rounded to cm level. This is how all reference stations handle the reference station co-ordinates when using v2.1 RTCM messages and is due to the limitations of this RTCM message.

Remember

- RTCM messages cannot contain the **Antenna Height** or the **Point ID** of the reference station.
- The reference station co-ordinates are rounded to the cm level in v2.1 RTCM messages.