

Using GPS with Axciscape



First things first! I am not an expert on GPS and have only recently introduced myself to this technology. So, please bear this in mind when reading this document as my terminology and understanding of it all may not be perfect! Please feel free to correct me; any help will be much appreciated.

I have limited resources to test all GPS based hardware but have three methods available. These are the *U-blox* 7 USB plug-in dongle, a *CoPilot* Bluetooth unit, and a *Toughbook CF-19* with built in GPS hardware.

Background

During implementation of the GPS feature I have learned much about its process and its limitations. The main issue is accuracy. When using a standard low cost GPS receiver (such as those above) accuracy can be anywhere up to 12m out; they cannot give precise positioning. So as an Arboriculturist, whose site work involves carrying out BS5837 based tree surveys, the positions of trees are fairly critical as even a 1 meter difference can have major implications for a proposed development. This is the main reason why I have refrained from embracing GPS in the past. However, it does have some value. It can give an indication, a rough idea and leave you to pick a spot! (something which you should then make a note of and include in a caveat). So, unless you have a very expensive system using some kind of ground based link, please don't expect GPS to provide you with perfect positioning. And even with such 'accurate' systems, I have had related plans handed to me showing trees in roads etc. You must apply common sense and just use it as an aid.

GPS Overview

I won't go into all the technical processes regarding GPS, just do a Google search for such info. But in simple terms GPS uses a number of satellites to get a location fix. The more satellites which your system can detect, the more accurate. If you can get, 9+ satellites showing on your receiver the positioning is pretty good and helpful. But having just 3 or 4 can give scary results with the GPS map icon dancing around, going off in a random direction before returning! Axciscape gives a satellite count on its map display to help in this matter.

The receiver needs good line of sight to the sky so when tucked away inside a built-up area it can cause issues. However, in such a situation you could probably plot quite accurately by eye providing the roads, buildings, drain covers etc are shown on your map!

When switching on, your receiver needs time to find the satellites and download their ephemeris data. This can take a while and may take up to 10 minutes. So, switch your receiver on prior to surveying.

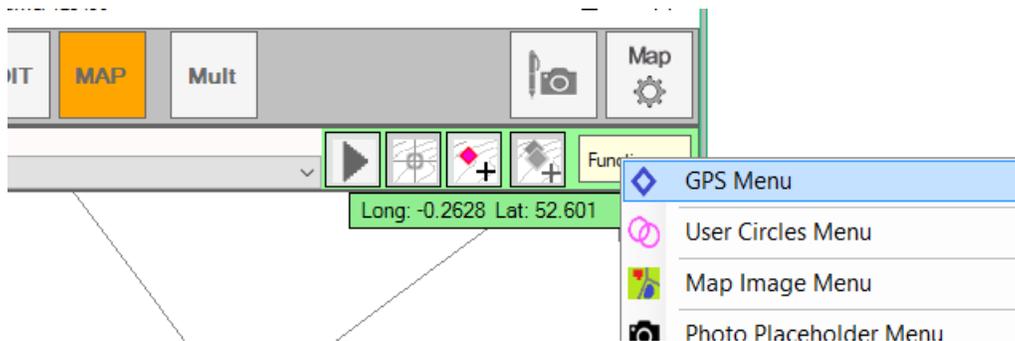
The GPS satellites send down signals which the receiver decodes and uses to calculate a latitude and longitude based land position. This is then sent to Axciscape which turns them into map coordinates.

Axciscape

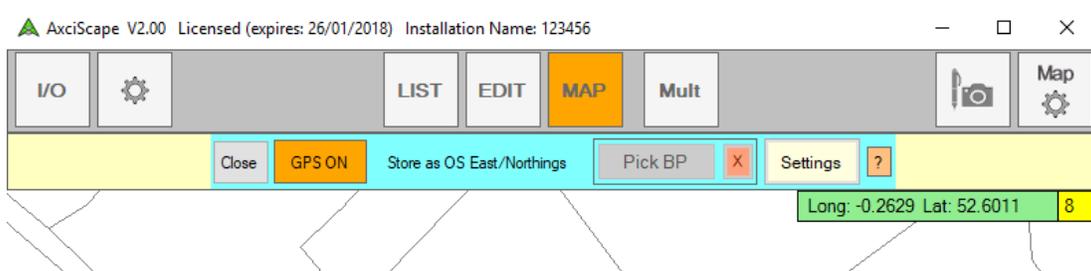
As I mentioned earlier I am not an expert and not brainy enough to implement all of the possible map conversions that may be encountered. So Axciscape is very limited in this regard. I have put together an algorithm to produce a fairly accurate OS Grid map position and also one for UTM mapping (which may not be so accurate)!

So, at this point in time the Axciscape GPS function is really UK based only unless you just require raw Latitude/longitude data or wish to risk the UTM conversion! I have tried the GPS on a number of sites in the UK and found the results quite good when a high number of satellites are visible.

The GPS Menu can be found by clicking the GPS Menu selection from the Functions menu (see below).



The GPS menu (below) enables you to switch it on/off, to enter the GPS settings screen and a button to allow the positioning of a basepoint (more about this later).

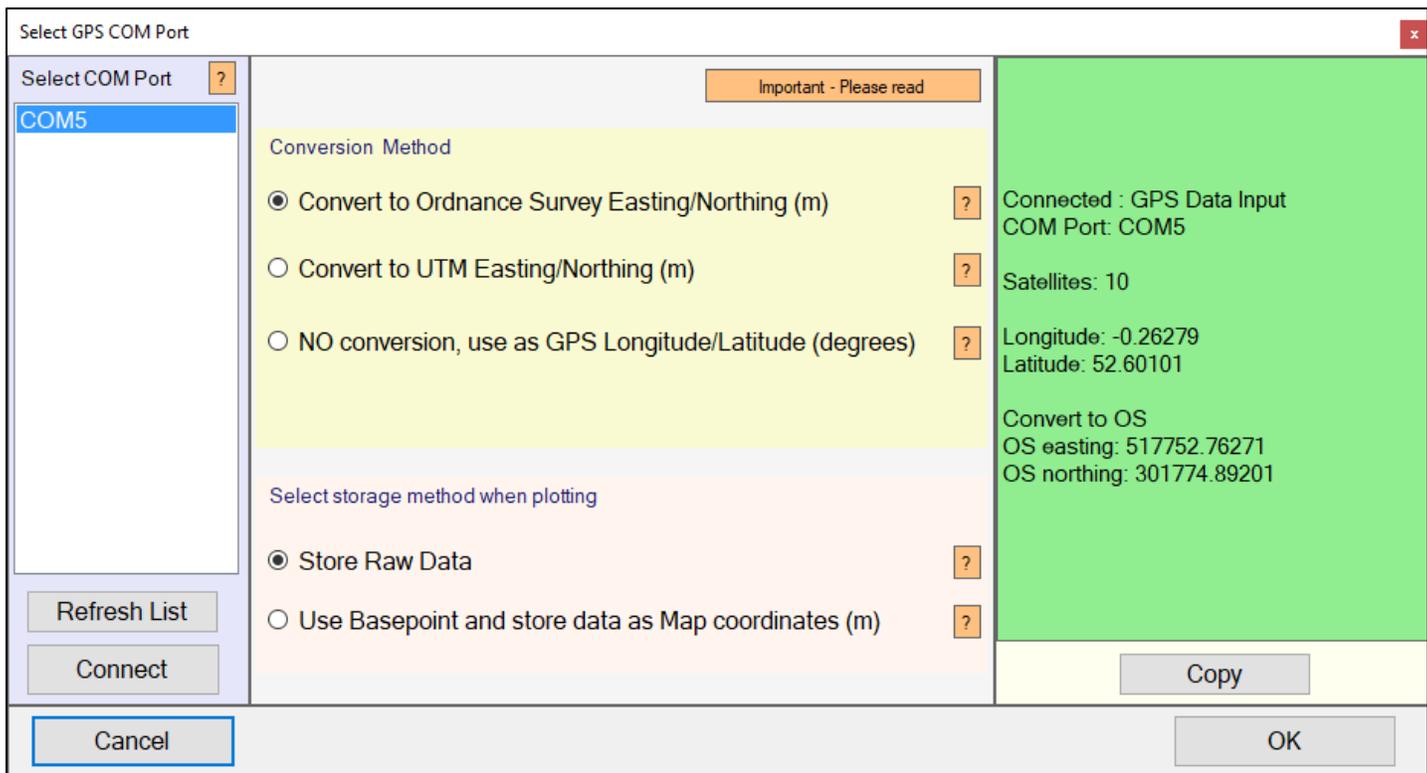


Connecting to your GPS receiver

AxiScope receives its data through a software COM port. These are now virtual ports as they only exist in software. The first PC's had real COM ports (RS232 connections) which were the only way to connect to external items such as printers; now of course we have intelligent USB ports. However, many products still use COM ports probably due to the easy way to interface with them. So even if an item is plugged into a USB socket, it may still be interfacing through a virtual COM port.

So once your GPS receiver is installed (follow the manufacturer's directions) and connected you need to identify its COM port from the settings list (select settings from the GPS menu bar in AxiScope). COM ports are very primitive, software cannot identify which hardware item they represent (unlike plug and play USB), so there are no descriptions; just a list of COM numbers! Best way to find your is to unplug any GPS receiver from the USB, select refresh on the settings screen, plug in the USB, refresh again and see which COM number appears. Beware though, different USB sockets will give a different COM number! If your receiver is built into the computer then you may have to wade through the list trying to connect, waiting, repeating until you find it.

In the following image, I only have one COM port on my list (my Toughbook has around 5)! You need to click on the COM port, select Connect and then wait. Providing it's the correct port, a green screen will appear showing data input. If the screen remains red for a long period then somethings wrong. The port may be incorrect or the driver for the receiver isn't working as it should.



Some USB based receivers can produce an issue with Windows 10 where initially it installs and works ok but then the COM port disappears and is replaced with a sensor based driver. This happened to me with my U-Blox7 dongle. At the end of this document I have described the issue and solution in detail.

If you don't have GPS receiver built into your tablet/laptop and have to use a USB based product then I would recommend a Bluetooth one. The receiver can then sit in your pocket, it has its own battery and you don't have a dongle hanging from the side of your tablet which is vulnerable to getting knocked about. You would first need to pair the devices using the Windows Bluetooth settings window. Then when the receiver is switched on, its COM port should appear in the above window (after a refresh).

Important: An unavoidable bug exists with using COM ports. This can materialize when disconnecting the receiver (by either switching off a Bluetooth device or unplugging a USB dongle); Axciscape may lock up/freeze as the program searches for GPS data through the COM port. Due to the primitive nature of these ports there is no way to obtain feedback on a connected devices status and thus catch the error. The only way around this is to reconnect the device and switch off GPS from within Axciscape before removing the device once again.

Selecting the Data Conversion Method

Looking at the previous image, you have three options for data use. You can convert to UK based OS grid, convert to UTM or just use the lat/long in its raw form. It's likely you will only use the OS conversion. However, if you are not UK based the UTM may be best when used with a basepoint. If you don't have a map, and intend to export the latitude/longitude to an external program for conversion then the 3rd option would be the way to go.

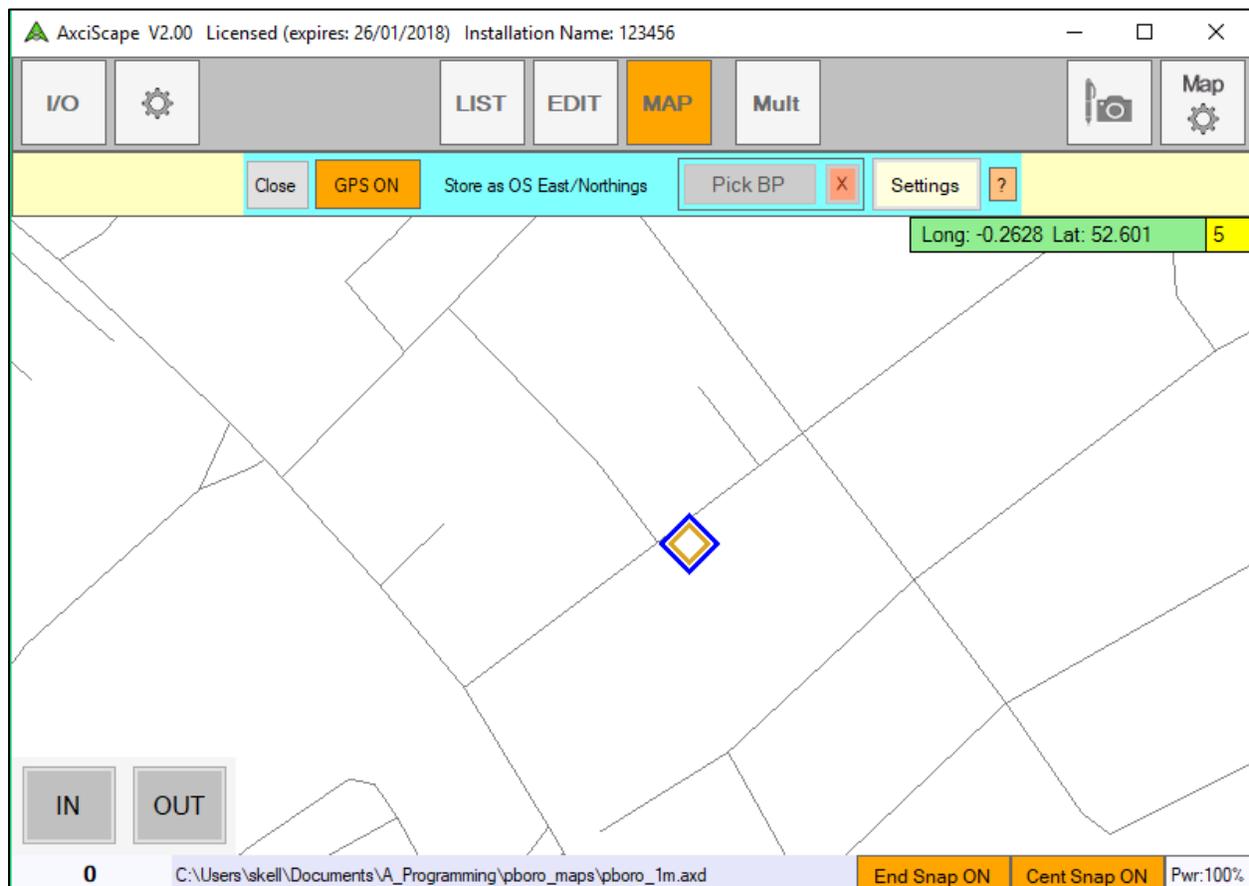
The two storage methods decide whether you want to store the above data unmodified (in its raw form) or used as a displacement with a Basepoint (see more on basepoint in the Maps section). Basically, if your map is aligned to the OS grid then you don't need to use a basepoint so select Store Raw data.

Maps

In the UK your map should ideally be using the OS Grid. Downloading the OS masterplan maps work well and are not too expensive. Of course, they don't compare to a proper topographical map but are better than nothing and coupled with GPS give a good indication of location. If you are supplied with a topo map then these may or may not be aligned to the OS Grid.

When enabling the GPS function in Axciscape a blue icon appears showing the position calculated from the receiver. As the received data changes so will the icon's location. As I mentioned earlier, with a low satellite count, this icon may well dance around in response to the changing received data.

The following image shows a free downloaded OS based map of my city (which was converted from a .shp file using Axciscape); the plan just shows a centerline of roads. For this example, I am sitting in a room with the GPS receiver next to me. The green box on the image showing the latitude/longitude also shows the number of satellites, which is currently 5. The resulting icon position is quite good bearing in mind the satellite count and my location inside a house. My house is actually half way along the sw blue edge of the icon; so the GPS is maybe 3-5m off centre.



Using a Basepoint

If your map is aligned to the OS Grid then the icon should appear. If its showing itself to be miles away then we need to use a Basepoint to synchronise the GPS location. To do this, first select 'Convert to OS' or 'UTM' in the conversion settings and 'Use Basepoint' in the data storage settings.

You now need to pick your basepoint on the map. You can only do this when on site and standing at a position which corresponds to something on the map. This could be for example, a drain cover, cctv box, lamppost,

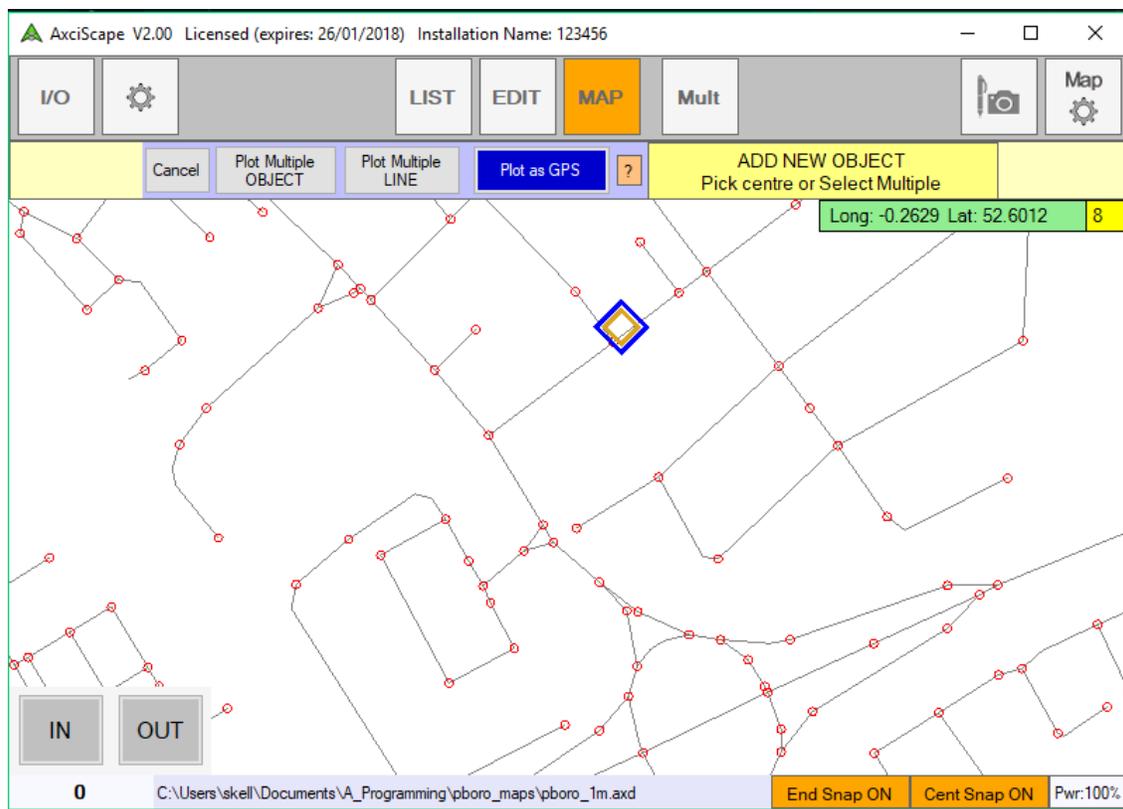
middle of a roundabout etc. Its best to use a location which is open rather than say a corner of a building which may interfere with satellite reception. Make sure you have good satellite reception, 9 or more is best. When you are positioned, click the 'Pick BP' button on the GPS menu and pick your location on the map. A Basepoint marker will appear, and the blue GPS icon should be on it or close by. Watch the GPS icon as it fluctuates and wait a few seconds for it to settle and pick the Basepoint again if you think it's off centre. The blue GPS icon should now follow you around site. You can repick the basepoint anytime if you think satellite reception has improved which will improve accuracy.

Plotting Trees or other Objects Using GPS

There are two methods to plot an object (such as a tree) using GPS. You can just do it by eye using the blue GPS marker as a reference point (after all you can't stand exactly on the same spot as the tree)! I tend to use this method for trees which are not plotted on a topo drawing; I use the GPS as a guide and freehand plot it using other features to help.

The other method is to use the blue 'Plot as GPS' buttons which will appear on the normal tree plotting menus. Clicking this button rather than clicking on the map will load in the current GPS position for a trees map position.

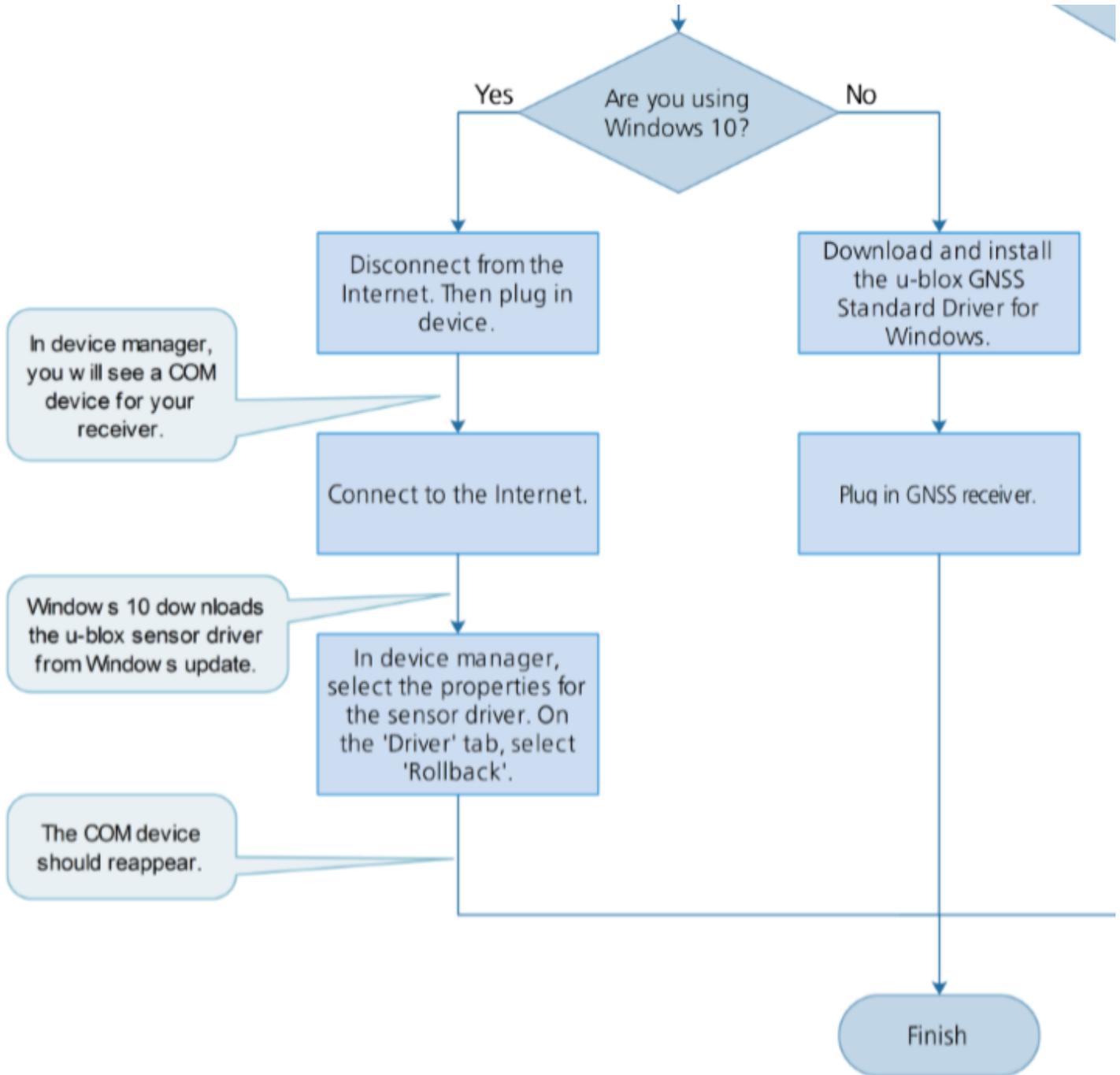
This image shows the blue 'Plot as GPS' option button which only appears when GPS is active. Click the button instead of picking a position on the map.



Lost COM Ports on USB Devices

This issue happened to me using the U-Blox7 receiver USB dongle. The problem relates to windows update over writing the installed COM driver which comes with the U-blox. The chart below is taken from U-Blox technical data and shows the procedure. It's basically a case of letting Windows automatically update the driver (to the

one we don't want) and then when disconnected from the internet, you need to roll back the driver in the driver properties. These are found in the COM ports properties which is found in Device Manager.



The following links may help with this problem.

<https://rtklibexplorer.wordpress.com/2016/11/10/issue-with-u-blox-usb-drivers/>

https://www.u-blox.com/sites/default/files/USBDriverWindowsSelectionGuide_%28UBX-15022403%29.pdf