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Description

This guide provides tips on how to work with GDA2020 with Leica Captivate GNSS products.

GDA2020 is a static datum (just like GDA94), however, the co-ordinates differ approximately 1.5 – 1.8m in a north easterly direction due to tectonic plate movement.

When should I start using GDA2020?

Check what your local state regulations are. Some states switched to GDA2020 at the beginning of 2019. In NSW, SCIMS data has become available in GDA2020 since July 2019.

We recommend new jobs to use GDA2020 and existing jobs to stay in GDA94 unless there is a good likelihood of continuing with GDA2020. Where possible avoid having to transform coordinates as this requires additional office processing time and more potential for errors.

Do I need to use a transformation to work on GDA2020 with SmartNet?

No.

It is not necessary to use a transformation in your rover’s co-ordinate system.

The RTK Base Station’s coordinates determine the Reference Frame used by your rover.

If you use a CORS network such as SmartNet Aus, choose a GDA2020 mountpoint from the source table. The rover operates on the version of GDA that is selected from the mountpoint.

When using a network RTK solution of any type you will have the capacity to choose between both GDA94 and GDA2020 reference coordinates by choosing the correct mountpoint

– see below on Mountpoints for more information.

Co-ordinate system definitions for GDA2020 on your Captivate rover

Your existing MGA co-ordinate systems should be defined similarly to this.

Name	MGA56
Transformation	<None>
Ellipsoid	GRS 1980
Projection	UTM 56
Geoid model	AG09_NSW_VIC
CSCS model	<None>

Note that there is NO Transformation. The definition includes the GRS1980 Ellipsoid and the appropriate UTM zone Projection. It may also include a Geoid, in this case a 2009 file.

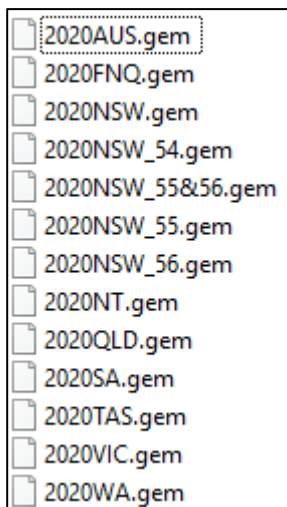
For GDA2020, we may simply update this for Geoid2020, however for clarity, it may be better to create or install new systems.

Installing co-ordinate system for GDA2020 on your Captivate rover

Download a full set of Australian Coordinate Systems here:

<https://survey.crkennedy.com.au/ts1569194378/attachments/BlogPost/66/CRK%20Website.zip>

This downloaded ZIP file includes 2020 Geoid files (GEM) for all of Australia and a set of coordinate systems (TRFSET.DAT). Download and unzip this file which includes the following.



NOTE: GDA2020 must be used with Geoid 2020. This is due to a change in the reference frame used. GDA2020 is based on ITRF2014 whereas GDA94 is based on ITRF92.

NOTE: For NSW there, are separate files for each UTM zone and also combined files covering Zone 55 & 56, and the whole state.

The TRFSET file includes the following:

Name	Ellipsoid	Projection	Geoid Model
WGS84	WGS 1984		
MGA56_94	GRS 1980	UTM 56	AUSGeoid09_NSW
MGA56_20	GRS 1980	UTM 56	2020NSW
MGA55_94	GRS1980	UTM 55	AG09_NSW_VIC
MGA55_20_VIC	GRS 1980	UTM 55	2020VIC
MGA55_20_TAS	GRS 1980	UTM 55	2020TAS
MGA55_20_QLD	GRS 1980	UTM 55	2020QLD
MGA55_20_NSW	GRS 1980	UTM 55	2020NSW
MGA55_20_FNQ	GRS 1980	UTM 55	2020FNQ
MGA54_94	GRS 1980	UTM 54	AG09_SA
MGA54_20	GRS 1980	UTM 54	2020SA
MGA53_94	GRS1980	UTM 53	AG09_SA
MGA53_20	GRS 1980	UTM 53	2020NT
MGA52_94	GRS 1980	UTM 52	AG09_WA
MGA52_20	GRS 1980	UTM 52	2020WA
MGA51_94	GRS 1980	UTM 51	AG09_WA
MGA51_20	GRS 1980	UTM 51	2020WA
MGA50_94	GRS1980	UTM 50	AG09_WA
MGA50_20	GRS 1980	UTM 50	2020WA
MGA49_94	GRS 1980	UTM 49	AG09_WA
MGA49_20	GRS1980	UTM 49	2020WA

This includes all UTM zones for Australia in both GDA94 & GDA2020 with appropriate Geoid files. For Zone 55 there are separate versions for each state with Geoid 2020.

NOTE: *it is NOT necessary to use a transformation. All you need to do is select either a GDA94/2020 mountpoint and the appropriate co-ordinate system to work in those co-ordinates. We do not recommend using a transformation. If you really need to transform data, we recommend doing it in the office using Infinity.*

To backup:

- If your rover has existing coordinate systems, you may want to delete or backup these first to avoid confusion.
- From the Home Screen select Settings, Tools, Transfer User Objects.
- Select the Object type you wish to transfer.
- Select from “Internal memory” To device “SD card” or “USB”. Select the individual object you wish to transfer: Coordinate system or Geoid field file.
- F1 – OK.
- Repeat for all objects or instead tick the box “Transfer all objects of the selected type” to transfer all in one step.

To delete:

- Press Enter on the object selection field.
- Select the object required.

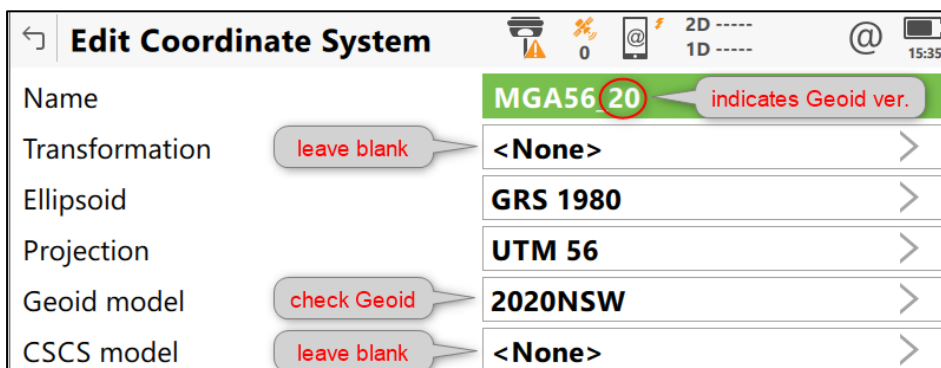
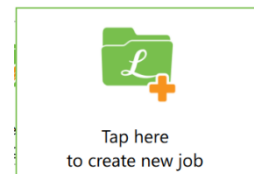
- F4 – Delete.

To install new files:

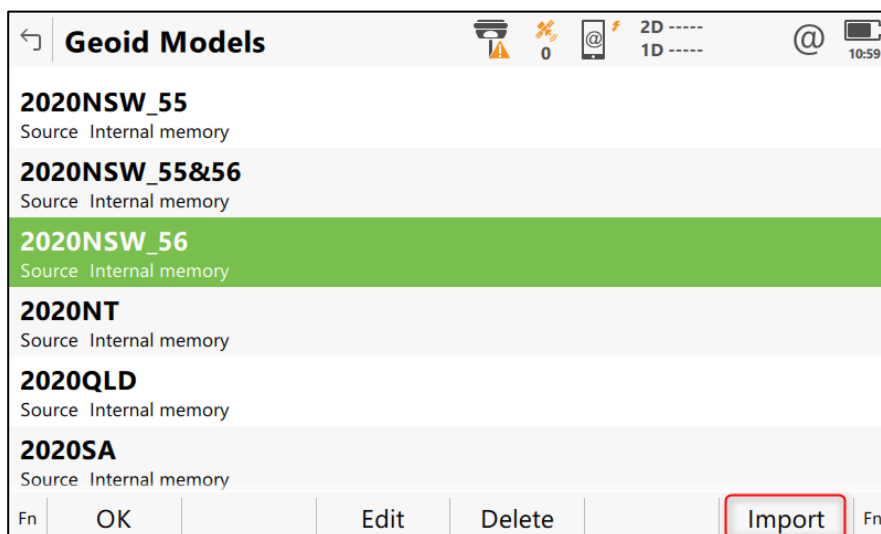
- Copy TRFSET.DAT to a USB stick or memory card in the \DBX folder.
- Copy the required GEM files to the \Data\Gps\Geoid folder and insert in your Captivate sensor.
- Select the “From” option you want and set “To device” to “Internal memory”.
- For some object types, you can transfer all objects of the same type in one step by selecting the checkbox.
- OK to continue.
- Repeat this process for each object type you require.

To check the new coordinate systems include the correct Geoid:

- Home / Job Carousel / Select “Tap here to create new job”.
- Coordinate System Page.
- Select the coordinate system
- F3 Edit.



- To change the Geoid selection, select this field and press Enter. If the required Geoid is not displayed, press F6 – Import and you should then be able to select the Geoid you want.



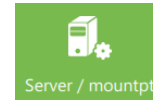
Selecting a GDA2020 mountpoint with SmartNet

The GPS rover operates on the version of GDA that is used by the RTK base. When using a network RTK solution of any type you will have the capacity to choose between both GDA94 and GDA2020 reference coordinates by choosing the correct mountpoint.

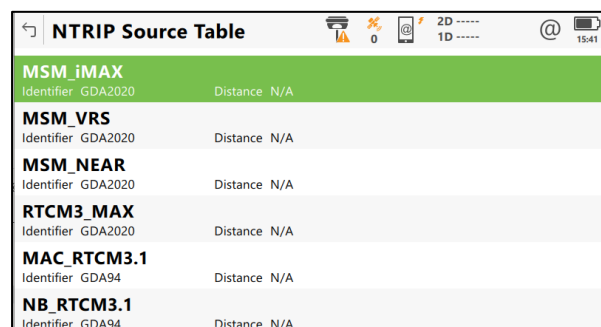
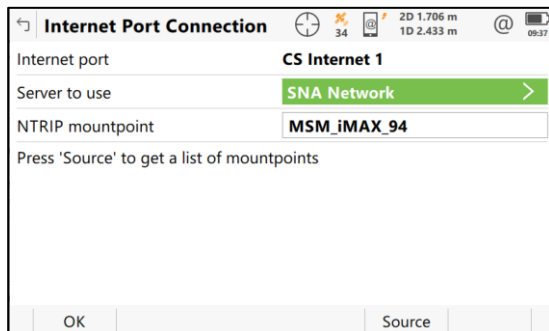
To change the mountpoint select the Phone



icon and then

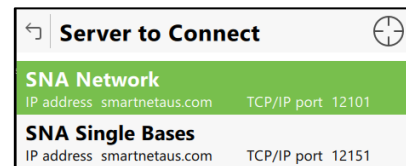
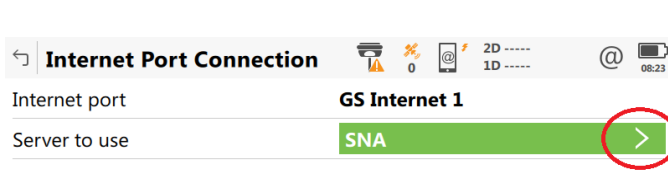


You can select different NTRIP mountpoints by choosing F5 Source.



The reference frame is listed as the identifier so select one with GDA2020.

We recommend having two servers: SNA Network and, SNA Single to allow easy switching to the single base solutions if required.



Understanding the SmartNet Mountpoint options

Depending on your Port setting you can choose from several different types of mountpoint. The table below shows the port numbers for each state. *Note that Port 1x101 provides the network mountpoints and Ports 1x151 provide the single baseline mountpoints.*

Table 2b: Port Number according to States

State	Ports for Survey and Agric Customers		
	Survey Network	Agric Network	Single Base
NSW/ACT	12101	12103	12151
NT	18101	18103	18151
QLD	14101	14103	14151
SA	15101	15103	15151
TAS	17101	17103	17151
VIC	13101	13103	13151
WA	16101	16103	16151

Mountpoints for network solutions

Using Port **1x101**, the mountpoint Source Table displays the options below. These all require a GGA position message be sent to SmartNet. An explanation of the mountpoint options follows.

<p>← NTRIP Source</p> <p>MSM_iMAX Identifier GDA2020</p> <p>MSM_VRS Identifier GDA2020</p> <p>MSM_NEAR Identifier GDA2020</p> <p>RTCM3_MAX Identifier GDA2020</p> <p>MAC_RTCM3.1 Identifier GDA94</p> <p>NB_RTCM3.1 Identifier GDA94</p> <p>VRS_RTCM3.1 Identifier GDA94</p> <p>iMAX_RTCM3.1 Identifier GDA94</p> <p>MSM_NEAR_94 Identifier GDA94</p> <p>MSM_VRS_94 Identifier GDA94</p> <p>MSM_iMAX_94 Identifier GDA94</p>	<p>Network Solution Types include MAC, iMAX, NB/NEAR & VRS.</p> <ul style="list-style-type: none"> • MAC – MAC (Master Auxiliary Concept) network solution is calculated using multiple reference stations in your area. The Master station is usually the nearest, and auxiliary correction information is sent from surrounding stations forming a network cell. The rover adapts its calculations as it deems necessary to optimize the solution. <i>(MAC Supports GPS/Glonass only), RTCM3_MAX and MAC_RTCM3.1 mountpoints are MAC solutions.</i> • NB / NEAR – (Nearest Base) a single baseline solution selected by the network to optimize the solution depending on the rover location. Depending on conditions, the selected station may not actually be the closest. • VRS – a VRS (Virtual Reference Station) network solution is calculated by the network server using multiple reference stations in your area and presented to the rover as a single station with short baseline. Limits the rover’s ability to do quality & integrity monitoring. • iMAX – (Individualised Master Auxiliary). Like MAC except the network computations are handled by the network server rather than the rover. <p>Message Protocols include RTCM3.1 & MSM.</p> <ul style="list-style-type: none"> • RTCM3.1 - supports GPS & Glonass only. • MSM - supports all constellations (GPS, Glonass, Galileo, Beidou – <i>G/R/E/C</i>).
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Other Points to Note

1. **MSM** mountpoints are configured to support 2 or 4 constellations depending on the network, at the level of reference station clusters (a local area of network reference stations). This means if enough stations support all 4 constellations, MSM mountpoints will only include *G/R/E/C* sites. Otherwise, the MSM mountpoint may include *G/R* only.

At time of writing, NSW, VIC and N/E QLD are covered by G/R/E/C on the MSM mountpoints. The rest of QLD, WA & SA are covered by G/R only. As the reference stations are upgraded in these states, MSM can be switched to support G/R/E/C.

2. **MSM** is supported by all Captivate versions, SmartWorx Viva requires 5.50 or higher, System1200 does not support MSM.
3. **MAC/MAX/iMAX** mountpoints will “fall back” to “Nearest” single base solutions if a network solution is not possible and “fall forward” back to a network solution if possible.
4. The **Identifier** field describes the GDA epoch used: 1994 or 2020.
5. **nRTK** denotes networked RTK solutions.

Mountpoint Information

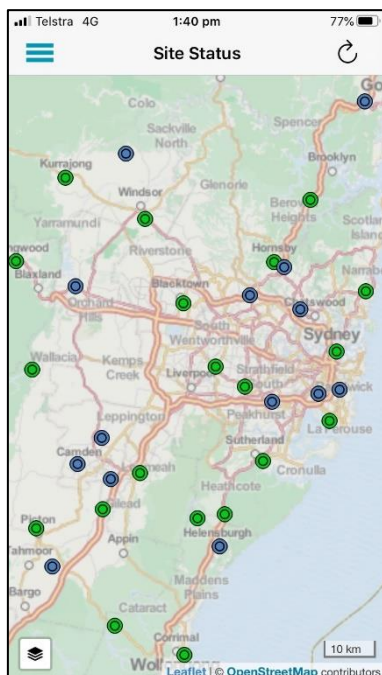
Mountpoint	Satellites ^{1, 2}		GDA Epoch		nRTK	Solution Computed by
	G/R	G/R/E/C	1994	2020		
MSM_iMAX		✓		✓	MAC	Network
MSM_VRS		✓		✓	VRS	Network
MSM_NEAR		✓		✓	Single	Network
RTCM3_MAX	✓			✓	MAC	Rover
MAC_RTCM3.1	✓		✓		MAC	Rover
NB_RTCM3.1	✓		✓		Single	Network
VRS_RTCM3.1	✓		✓		VRS	Network
iMAX_RTCM3.1	✓		✓		MAC	Network
MSM_NEAR_94		✓	✓		Single	Network
MSM_VRS_94		✓	✓		VRS	Network
MSM_iMAX_94		✓	✓		MAC	Network

1 = GPS (USA), R = Glonass (Russia), E = Galileo (Europe), C = Beidou (China)
2 = G/R/E/C applies to NSW, VIC & NE QLD only, as at Feb 2020

Choosing a Mountpoint

You need to know which constellations your rover supports. If it only supports GPS & Glonass you can still choose a mountpoint with RTCM3. If you want to use more constellations, choose an MSM mountpoint.

You should check the SmartNet coverage and status in your work area using the HxGN SmartNet app (available for iOS and Android). Is your job site covered by nRTK or single baseline only?



In the picture, **green icons** designate nRTK sites whilst **blue icons** denote other sites not contributing to nRTK solutions. This may be because they only support GPS/GLONASS, or because they use local site coordinates for a construction project and access to these may be restricted by your subscription.

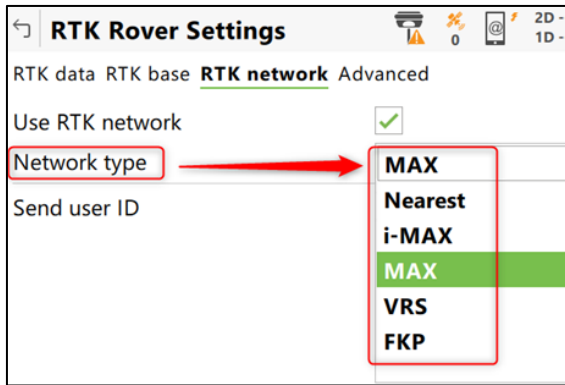
Select your mountpoint according to the satellite constellations you want to use, the GDA epoch required and the network solution type you want.

You can also choose a specific single base solution on Port 1x151.

RTK Network Settings

Your rover has a setting for the RTK Network Type, and you **MUST** ensure this is compatible with your Mountpoint. Failure to do this may mean the rover is slow or unable to resolve the RTK solution. This is because the base and rover settings must be the same to model tropospheric and ionospheric conditions.

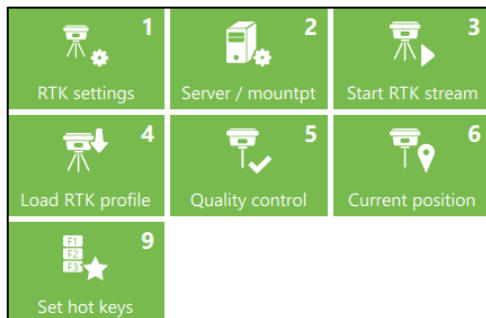
Settings > Connections > All other connections > GS connections, RTK Rover > F3 - Edit, RTK network page



To make these setting changes easier, you can set Hot Keys for easy access.

Assign GS – RTK Settings and GS – Select server/mountpoint, and any other desired favourites like below.

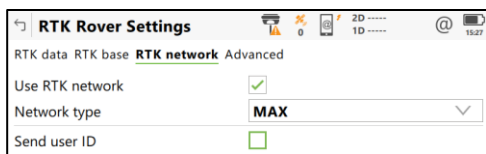
Favourites > Set hot keys



Now RTK Settings allows you to access the RTK Network Type, and Server/mountpoint allows you to select a mountpoint.

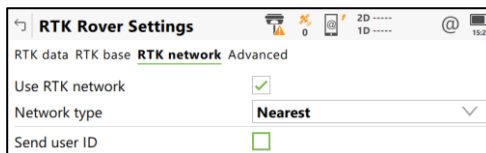
Alternatively, you can use RTK Profiles to assign the RTK Settings in your required combinations of Network Type and Mountpoint.

Settings > Connections > RTK Rover Wizard



RTCM3_MAX
Identifier GDA2020

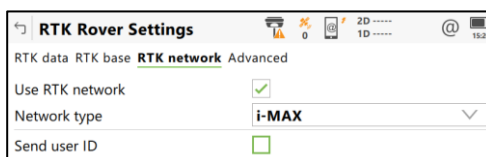
MAC_RTCM3.1
Identifier GDA94



MSM_NEAR
Identifier GDA2020

NB_RTCM3.1
Identifier GDA94

MSM_NEAR_94
Identifier GDA94



MSM_iMAX
Identifier GDA2020

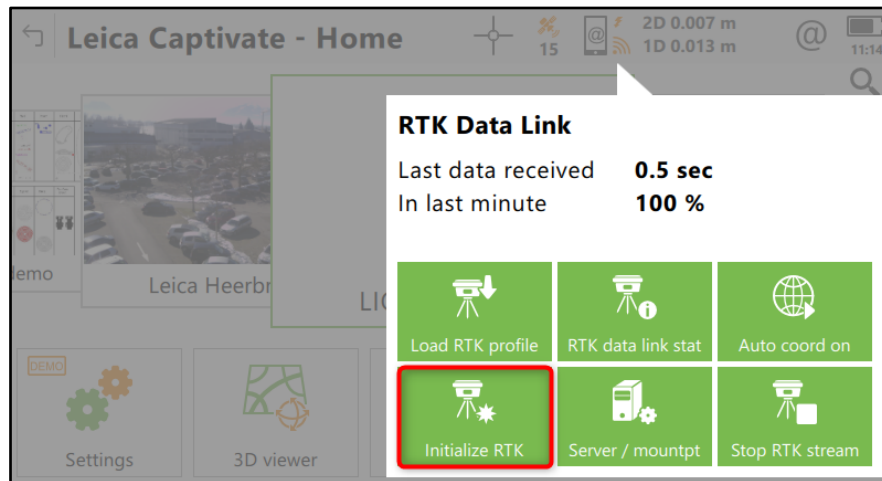
iMAX_RTCM3.1
Identifier GDA94

MSM_iMAX_94
Identifier GDA94

Initialize RTK

Leica SmartCheck continually verifies the RTK solution to achieve the most reliable result. You can also manually check the RTK solution using the option: **Initialize RTK**. This option deletes the current RTK solution and re-computes it. It is accessed via the *RTK Data Link* pop up bubble.

This option may be required by law for cadastral surveying in some regions.

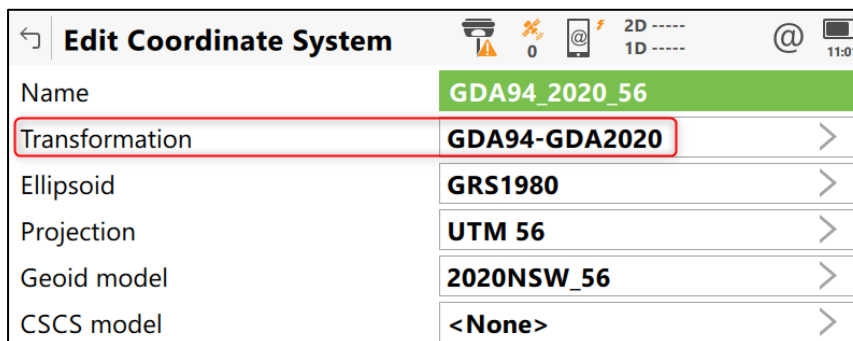


Transforming GDA data

If you collect data in the field using the wrong GDA version, you can transform it to the required GDA version using an appropriate transformation file attached to the job's coordinate system. In effect this swaps the reference frame used by the mountpoint.

NOTE: if you do this you should check on a known point to make sure of the results.

NOTE: we don't recommend this approach as it can easily lead to confusion and wrong results (the mountpoint reference is then different to the transformation reference frame). It would be better to do the transformations in an office software such as Infinity.



This example shows a transformation to go from GDA94 to GDA2020.

Please use the GDA2020 geoid with this transformation. Contact CR Kennedy Support for a copy of the transformations.

AusPos

If you use your own base station you can obtain GDA2020 coordinates for local site PMs from government state websites for example. All Auspos data is reported in Geoid 2020 and both GDA94 and GDA2020.

Other resources

There are some good resources online that will help answer your questions, else contact one of our support team on:

surveysupportstaff@crkennedy.com.au

<http://www.icsm.gov.au/datum/gda2020-fact-sheets>

Examples

A Surveyor Jack wants to work in NSW, Zone 56, GDA2020 with a network solution. He can set his job coordinate system to: with Server and Mountpoint:

General	Coordinate system	Codelist	Linked jobs	Linked
Coordinate system	MGA56_20			
Residuals	No distribution			
Transformation	<None>			
Ellipsoid	GRS 1980			
Projection	UTM 56			
Geoid model	2020NSW			
CSCS model	<None>			

SNA Network

IP address smartnetaus.com TCP/IP port 12101

MSM_iMAX

Identifier GDA2020

B Surveyor Katrina wants to work in NSW, Zone 55 with GDA94 and a Nearest Base solution. She can set the coordinate system to: with Server and Mountpoint:

General	Coordinate system	Codelist	Linked jobs	Linked
Coordinate system	MGA55_94			
Residuals	No distribution			
Transformation	<None>			
Ellipsoid	GRS1980			
Projection	UTM 55			
Geoid model	AG09_NSW_VIC			
CSCS model	<None>			

SNA Network

IP address smartnetaus.com TCP/IP port 12101

MSM_NEAR_94

Identifier GDA94

C Surveyor Jesse wants to work in NSW, Zone 56 with GDA2020 and a Single Base solution. He can set the coordinate system to: with Server and Mountpoint:

General	Coordinate system	Codelist	Linked jobs	Linked
Coordinate system	MGA56_20			
Residuals	No distribution			
Transformation	<None>			
Ellipsoid	GRS 1980			
Projection	UTM 56			
Geoid model	2020NSW			
CSCS model	<None>			

SNA Single Bases
 IP address smartnetaus.com TCP/IP port 12151

MSM_NWCS
 Identifier GDA2020

Troubleshooting

- A** You collect your data in GDA94 and later find out you need the results in GDA2020. You can do this in 2 straightforward ways:
- i) If the data is just on the controller and you do not have office software then attach a transformation to the job, by attaching the coordinate system containing the transformation GDA94 to GDA2020 the Lats and Longs will remain in GDA94 but your eastings and northings will be GDA2020.
 - ii) Export the job to Infinity as a GDA94 and then edit the reference stations to the GDA2020 values and all your rover data will shift accordingly. The lats / longs and eastings / northings are now in GDA2020
- B** You need to collect data in GDA2020 but set out points in GDA94 on the same site.
- Use the GDA94 settings whilst out on site, export your set out reports and values as required. Then use one of the steps above to change the job to GDA2020 to export the surveyed points as GDA2020.