This page will show you how to use a Leica CS15 to configure a GS15 to be a rover for an RTK GPS survey.
Hint: You can click on any image to see a larger version.

Power up the GS15 Rover

Power on the second GS15 receiver – this will be the Rover – and wait for it to start up, then make sure the RTK Rover (arrow pointing down) LED lights up green.


Configure CS15 for Rover

You should probably be at the Base Menu and "Go to Work" (on right) If not you may be in the Job: "Your name" menu and the "Go to Work" button has "Survey & State Points" and "Start Base" as shown below on left.

If you have the left screen (Job: TEST –or whatever you named the job– and "Start Base Station") you simply need to click on the Go to work" and then select "Go to Base menu" – that will take you to the situation shown on the RIGHT image.

Go to Rover Menu

From the main menu, tap "Go to Work!" then "Go to Rover menu." The unit will take a few moments to connect to the GS15 rover unit. Note: Tap "No" if the Bluetooth connection Warning appears.
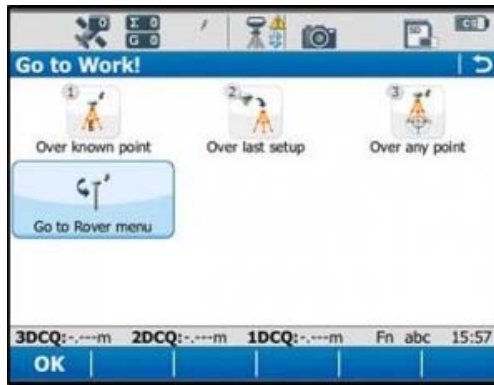
Satellite Tracking Settings

Once in the rover menu, tap "Instrument" → "GPS Settings" → "Satellite Tracking."

In the Tracking tab, make sure that GPS L5 and Glonass are checked on. Also make sure "Show message & audio warning when loss of lock occurs" is checked. The Advanced tab allows you to define other options for the job, and it is appropriate to use the system default settings. Tap OK when finished.
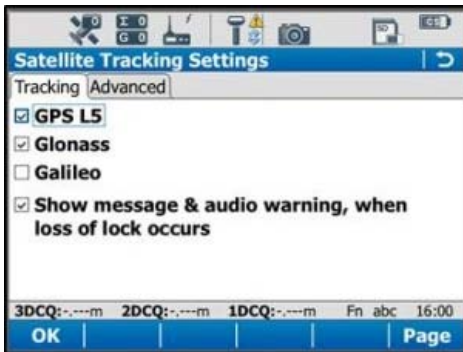
Quality Control Settings

On the rover main menu, tap "Instrument" → "GPS Settings" → "Quality Control." Here you can define your specifications for RTK point collection with the rover unit. For high precision survey work, it is a good idea to set the tolerance to less than or equal to 2 centimeters, as this will prevent the logging of an RTK point with error greater than this threshold. Tap OK to return to the main menu when finished.

Raw Data Logging Settings

On the rover main menu, tap "Instrument" → "GPS Settings" → "Raw Data Logging." Be sure the box for "Log data for post processing is checked on, then choose where you would like the data to be logged to.

We can log to either the receiver's (GS15) SD card or the controller's (CS15) SD card. Make sure the controller option has been selected from the drop down list. The remaining options are up to the user to define. Tap OK when done.

RTK Rover Settings: General Tab

On the rover main menu, tap "Instrument" → "Connections" → "All other connections." On the GS connections tab, tap the RTK Rover connection to highlight it, and then tap "Edit" at the bottom of the screen.

On the General tab, make sure the "Receive RTK data" box is checked on, then verify the following settings:

Connect Using: GS Port 3

RTK Device: Pac Crest ADL (note: different than shown in image above)

(Check on "Use external antenna on GS15")

RTK Data format: Leica 4G

(Leave the remaining 2 boxes unchecked)

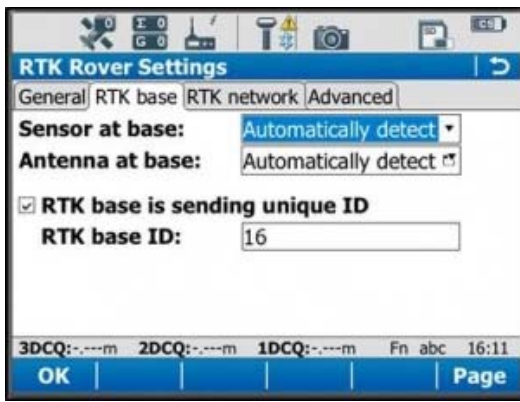## RTK Rover Settings: RTK Base Tab

On the RTK base tab, verify the following settings:

Sensor at base: Automatically Detect

Antenna at base: Automatically Detect

(Check on "RTK base is sending unique ID")

RTK base ID: 16

Tap OK in the bottom left corner. Tap OK if a warning about the antenna pops up. Now tap "Cntrl" at the bottom of the screen. Ensure the following settings are present:

Radio Type: Pac Crest ADL

Channel: 1

Actual frequency: 461.0250 MHz

Tap OK. Tap OK again to return to the main menu.

Finish Setup

At this point the equipment is set up. Now you can begin to take RTK points. You can begin your work or you can power down the CS15 by holding the power button down until the power options menu appears, and select "Turn off." You can also power down the GS15 receiver by holding the power button until the LEDs flash red.

Continue To...

Continue to "Leica GS15: Tripod Setup"

> **This page will show you how to use a Leica CS15 to configure a GS15 to be a base for an RTK GPS survey.**
> *Hint: You can click on any image to see a larger version.*

Go to Base Menu

Look at the real-time status icon at the top of the CS15 controller screen. If you see a jagged arrow pointed up, the CS15 is in the base menu, where you want to be. If the arrow is pointed down, the CS15 is in the rover menu. To switch to the base menu, tap "Go to Work!" then tap "Go to Base menu."

Satellite Tracking Settings

Once in the base menu, tap "Instrument" → "Base Settings" → "Satellite Tracking."

In the Tracking tab, make sure that GPS L5 and Glonass are checked on. Also make sure "Show message & audio warning when loss of lock occurs" is checked. The Advanced tab allows you to define other options for the job, and it is appropriate to use the system default settings. Tap OK when finished. You will return to the Base menu.
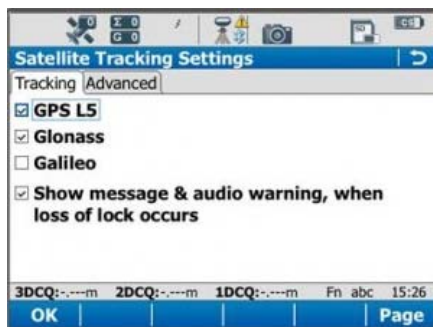
Raw Data Logging Settings

On the base menu, tap "Instrument" → "Base Settings" →"Raw Data Logging."

Make sure the box is checked for logging base data for post processing. Also confirm that the Data Type is in 'RINEX' format. Tap OK.
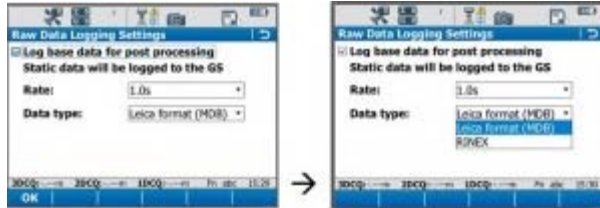
Enter Base Connection Settings

Back on the base menu, tap "Instrument" → "Base Connections" → "All other connections."

Tap the Base RTK 2 connection to highlight it, and then tap "Edit" at the bottom of the screen.
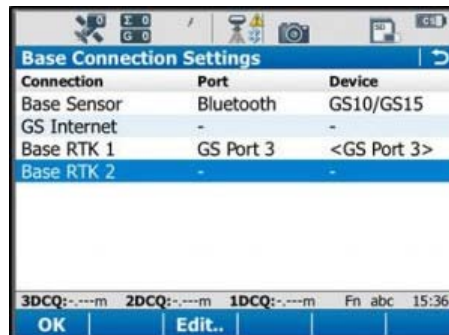
Base Connection Settings: General Tab

In the General tab, ensure the box is checked on for "Transmit RTK base info," then verify the following settings:

Connect Using:	GS Port 3
Device:	RTK TEST (not as shown on graphic)
RTK Data Format:	Leica 4G

Scroll down to see the checkbox for "Use External antenna on GS15." Generally, you want to use the external antenna, so make sure to check this box.

Base Connection Settings: Data Rates Tab

On the Data Rates tab, the default settings are generally fine, but double check the RTK base ID. It should be set to 16, and if it is, it can be left that way. Tap OK in the bottom left corner. Tap OK if a warning about the antenna pops up. Now tap "Cntrl" at the bottom of the screen.
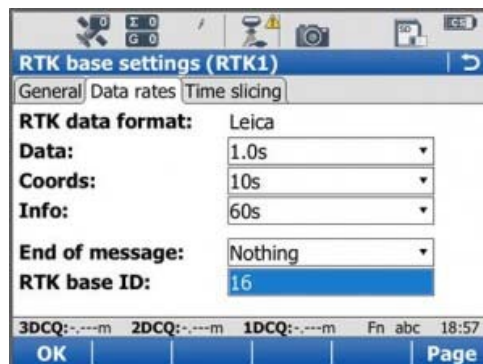
Ensure the following settings are present:

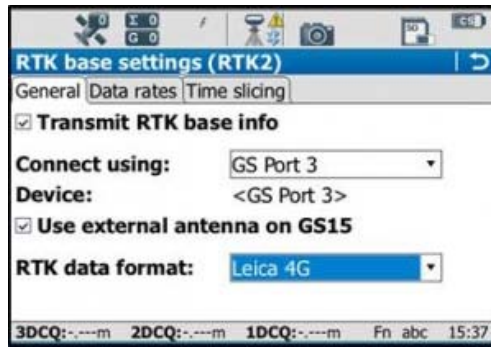|	
Radio Type:	Pac Crest ADL
Channel:	1
Actual frequency:	461.0250 MHz

* The "Actual frequency" will be set at "0.0000MHz" until the GS15 and CS15 are connected.

Tap OK. Tap OK again to return to the main menu.

Power up the GS15

Power up the GS15 receiver that you will be using as a base station (the one that has the SD card in it) by pressing and holding the power button until the 3 LEDs below it light up. Keep the other GS15 that will act as the rover turned off.

Note: It is important to understand what the buttons, symbols, and LED lights do and/or represent on the GS15 unit. A detailed description of button operation can be found in the Leica "GS10/GS15 User Manual" in section 2.1, pages 20-24. A detailed description of symbols and LEDs can be found in the same manual in section 3.5, pages 64-68. The GS15 is powered down by pressing and holding the power button until the LEDs turn red.

Put Base into RTK Mode

Make sure the GS15 unit is in RTK base mode, and set up to broadcast RTK corrections via the radio. To do this, check that the LED beneath the RTK base symbol (arrow pointing up) is lit up green. If the GS15 is in Rover mode (arrow pointing down), you may need to quickly press the function button to change it to Base mode.

Connect CS15 to GS15 via Bluetooth

The CS15 should automatically connect to the GS15 unit once it has entered base mode, via Bluetooth. On the CS15, you will see the Bluetooth symbol appear at the top of the screen. On the GS15, the LED beneath the Bluetooth symbol will turn blue.

If the CS15 does not automatically connect with the GS15, you can search for all visible Bluetooth devices.

Navigate in the Base menu: 'Instrument' → 'Base connections' → 'connect to base' and click on the "search" button on the bottom of the screen. The "Found Bluetooth devices" screen will appear. The GS15 will be listed under the 'Name:' column, named after its serial number. The serial number can be found on a white sticker on the lower side of the GS15, under the battery cover (e.g. "S/N: 1502919")

You may want to power down the GS15 by pressing and holding the power button until the LEDs turn red if you are in lab configuring but if in field then you can configure the RTK while base is on, BUT – be sure you are connected to the ROVER not the BASE. If you can confirm this by making sure that the Bluetooth connection is the correct serial number.

Continue To…

Continue to Part 4 of the series, "Leica GS15 RTK: Configuring a GS15 Receiver as a Rover."

]]> http://gmv.cast.uark.edu/gps/leica-gs15-rtk-configuring-a-gs15-receiver-as-a-base/feed/ 0 http://gmv.cast.uark.edu/gps/leica-gs15-rtk-configuring-the-cs15-field-controller/ http://gmv.cast.uark.edu/gps/leica-gs15-rtk-configuring-the-cs15-field-controller/#comments Wed, 06 Mar 2013 18:11:49 +0000 steph http://gmv.cast.uark.edu/?p=12480

This page will show you how to set the parameters on a Leica CS15 field controller in preparation for GPS survey.
Hint: You can click on any image to see a larger version.

Power up the CS15

Power on the CS15 controller by pressing and holding the power button until the screen turns on. The operating system will take a minute to boot up, and will automatically start up the Leica Smartworks interface. Click "No" if the bluetooth connections Warning message pops up.

You may get the Welcome screen. If so, click "Next".

Choose Survey Instrument

After powering on the controller, you may see the SmartWorx StartUp wizard. Confirm that "GPS Instrument" is selected in the drop-down in the "First Measure with:" menu, or the "use GPS only" radio box.
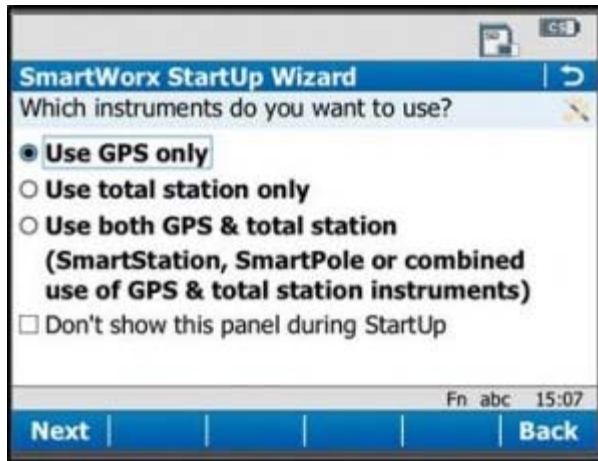
Choose a Job

If these have been turned off by previous users, then the first screen that appears will allow you to "Continue with last used job," create a "New Job," or "Choose working Job." For the purposes of this guide, select "New Job" and tap "Next" in the lower left corner.
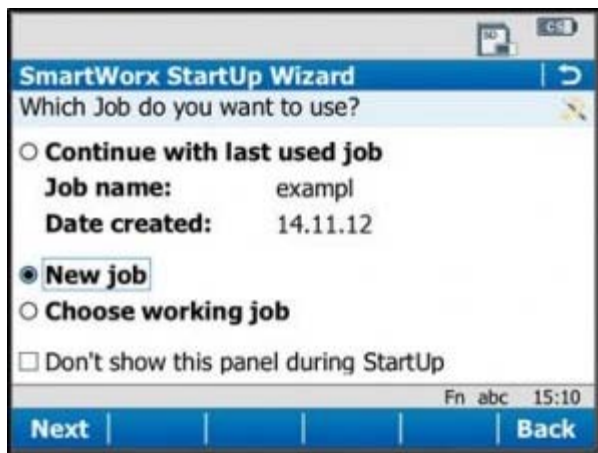
Note that you can also use the "F" key below each entry. So pressing F1 which is below "Next" is the same as using the stylus and clicking on the touch screen. Pressing F6 is the same as pressing the stylus on Back.

Set Job Description

On the General Tab, enter a name for the job, a description, and the name of the person who is creating the job. Be sure to choose "SD Card" for the Device option, as this will result in all the data generated within the job to be saved only to the SD Card.
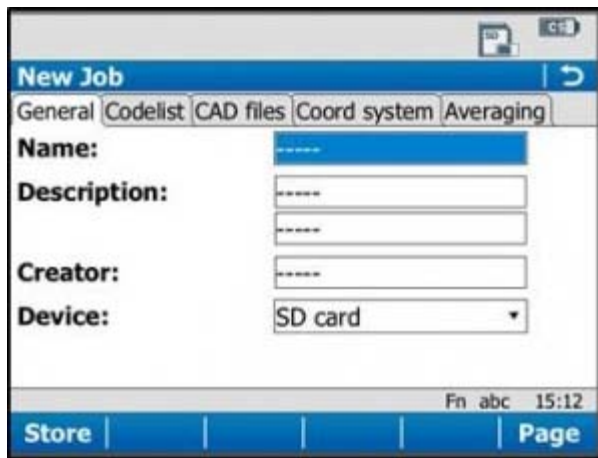
Set Coordinate System

On the "Coord system" tab, be sure the coordinate system is set to "WGS84basic." If it needs to be changed to this, just tap on the drop down menu, select "WGS84basic," and tap OK in the lower left corner. You have the ability to create a custom coordinate system if needed (more information can be found in the Leica Technical Manual).

Tap "Store" in the lower left corner to save the job and go to the main menu.

Note: It is beneficial to learn what the icons along the top of the screen represent. For detailed information, see the Leica "Getting Started Guide" section 2.1.2, pages 51-54. Additionally, a brief and simple presentation of the main menu options can be found in the Leica "Getting Started Guide" section 2.1.3, pages 55-57.

Continue To...

Continue to Part 3 of the series, "Leica GS15 RTK: Configuring a GS15 Receiver as a Base."

]]> http://gmv.cast.uark.edu/gps/leica-gs15-rtk-configuring-the-cs15-field-controller/feed/ 0
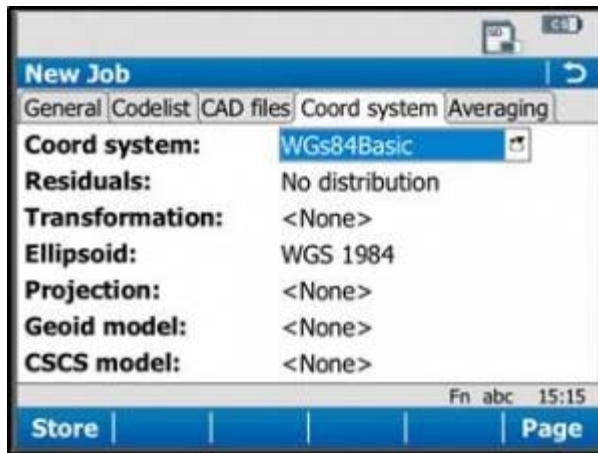http://gmv.cast.uark.edu/uncategorized/leica-gs15-rtk-preliminary-setup-before-going-into-the-field/
http://gmv.cast.uark.edu/uncategorized/leica-gs15-rtk-preliminary-setup-before-going-into-the-field/#comments Wed, 06 Mar 2013 18:11:20 +0000 steph http://gmv.cast.uark.edu/?p=12438

This page will show you the basic instrument components needed for a Leica GS15 RTK GPS survey and will review memory card maintenance.
Hint: You can click on any image to see a larger version.

Instrument Components
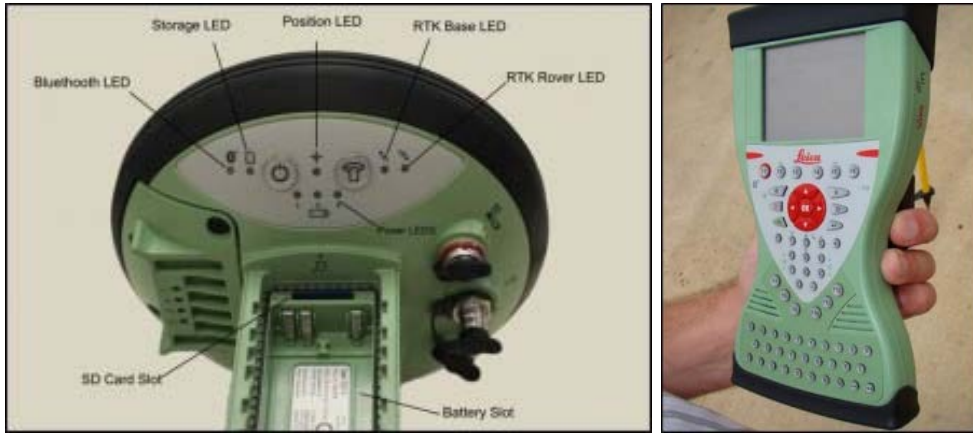
GS15 GNSS receiver (left) and CS15 field controller (right)

Equipment Check List

Minimum equipment and accessories needed (contents of instrument kit):

- • GS15 receiver (2)
- • CS15 field controller (1)
- • Antennas (2 – one for each GS15)
- • Holder for CS15 (1)
- • Base for telescopic rod (1)
- • Batteries
  - ○ 5 or more (two for each GS15 and one for the CS15, more depending on length of survey)
  - ○ Confirm that batteries are charged
- • SD cards
  - ○ Enough for each instrument (GS15 and CS15)
  - ○ Leica recommends 1GB
  - ○ Confirm that cards are not locked via the mechanical locks
- • Manuals
  - ○ Leica Viva GNSS Getting Started Guide
  - ○ Leica GS10/GS15 User Manual
  - ○

Memory Card and Data Maintenance

Make sure memory cards have adequate space for your data needs. The GS15 receivers hold one memory card, which can be accessed in the battery compartment beneath the power button. The CS15 controller also holds a memory card, which can be accessed by using the Phillips screwdriver end of the stylus to loosen the screws on top of the unit. These screws are spring loaded and only take about a half turn to loosen.

If you are recording Leica data (for example Leica MDX), the files will be found on the SD card in the DBX directory. If you are recording RINEX, the data will be found in DATA> GPS > RINEX.
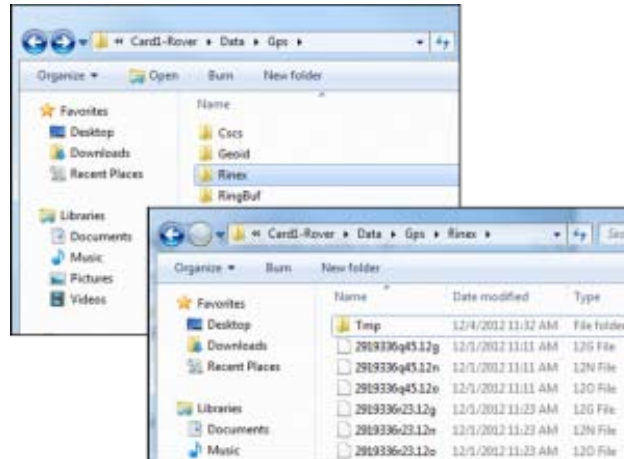
- Note: The raw data files have the following format AAAA_BBBB_CCCCCC with the suffix .m00 for raw Leica data (the suffix .12o is for RINEX). The letters are AAAA = last four numbers of the unit's serial number BBBB is the date in month and day so 0405 is the fourth month (April) and fifth day. CCCCCC is the hour (two digit 24 hour clock) minute and second. So 5:34 and 21 seconds PM is 173421. This is then followed by .m00 if it is RAW. Note that OPUS will now take Leica RAW as well as RINEX.
-
- *Only delete data from the SD card if it is your own work, or if the original owner has backed up the data. *

Inserting Memory Cards and Batteries

If you plan to record to the controller, place one SD card into the CS15 and secure the top back in place by tightening the screws about a half turn until they lock with the Phillips screwdriver end of the stylus. You do not NEED to record to the controller but it may provide redundancy. Place the other SD card into one of the GS15 receivers. The GS15 that has the memory card will be used as the base station (you may set the rover to write to the controller).
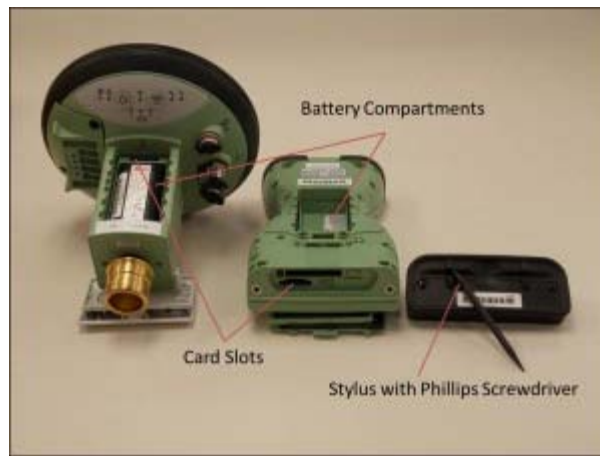
Insert fully charged Lithium Ion batteries into all devices. The GS15 receivers can hold 2 batteries, which are stored below the antenna portion of the unit in the compartments on either side. The battery for the CS15 is located in a compartment on the back. To access this compartment, you will likely have to remove the mounting base first. To do this, slide the red bar to the right in order to unlock the mount. Gently wiggle the mount and pull away from the CS15 to detach it. The battery compartment is now accessible. Replace the mount by popping it back into place and slide the red bar all the way back to left, which locks the mount to the CS15 controller.

Continue To…

Continue to Part 2 of the Series, "Leica GS15 RTK: Configuring the CS15 Field Controller."

]]> http://gmv.cast.uark.edu/uncategorized/leica-gs15-rtk-preliminary-setup-before-going-into-the-field/feed/ 0 http://gmv.cast.uark.edu/gps/hardware-gps/leica-cs-15-controller/setup-operations-leica-cs-15-controller/using-cs15-data-logger-to-set-up-gs15-as-base-for-opus-2-3/ http://gmv.cast.uark.edu/gps/hardware-gps/leica-cs-15-controller/setup-operations-leica-cs-15-controller/using-cs15-data-logger-to-set-up-gs15-as-base-for-opus-2-3/#comments Fri, 08 Apr 2011 16:20:55 +0000 Fred http://gmv.cast.uark.edu/692/using-cs15-data-logger-to-set-up-gs15-as-base-for-opus-2/ Continue reading →]]>

While the GPS unit can be used without the data logger it is normally the case that you will use the data logger to configure the system. This is **required** if you are creating a new job.

You can "connect" the data logger to the GPS via cable or Bluetooth. When using Bluetooth check to make sure you are connecting to the proper GS15 – especially when they are close to each other. The steps to configure the base are quite different than those for the rover and you can accidentally convert the base into the rover (or vice versa) if you are not careful. Be sure to check the arrows to the right of the FUNCTION key (one with antenna symbol on it) on the side of the GS15 to insure that the base has an outgoing arrow.

There are a number of "paths" through the menus and you can use both/either the keys on the data logger and/or the touch screen. After a bit the keys may be easiest since you don't have to have one hand on the stylus – and you don't risk losing the stylus – which is docked in the top of the data logger. The instructions below focus on the use of the keys but do switch back and forth when the stylus option is easier. You can use a fingernail instead of the stylus.

Step1. Start GPS units (GS15)

1. Set up tripod (see **Setting up tripod workflow**)
2. On the GPS unit press and hold the power button (circle with vertical line) briefly till battery LEDs light up release.
3. It will take a while for the base to fully power up, acquire the almanac (if needed) and perform other actions. You can monitor the status with the GPS LEDs.
    1. When fully operational the outgoing LED ("e" in figure) will flash and the position LED ("c" in figure) will be solid yellow.
    2. Depending on how the unit was previously used it may be configured as either a base or a rover. You can reconfigure using the FUNCTION key (press briefly to switch from base to rover mode or vice versa) and/or by using the data logger as described below. If the unit has not previously been configured to log raw data to the SD card you MUST use the data logger to set up this configuration. The Storage LED will flash slowly if the unit is logging data to the SD card.

    3. If the outgoing light is solid green the unit is NOT sending data. When sending data the outgoing LED will flash (sometimes slowly).

Step 2. Set up Job or select existing one on data logger

You will need to either set up a new job or use an existing one. You will need to turn on the data logger. Press and hold the power button (on left – with circle and vertical line) until the screen lights and then
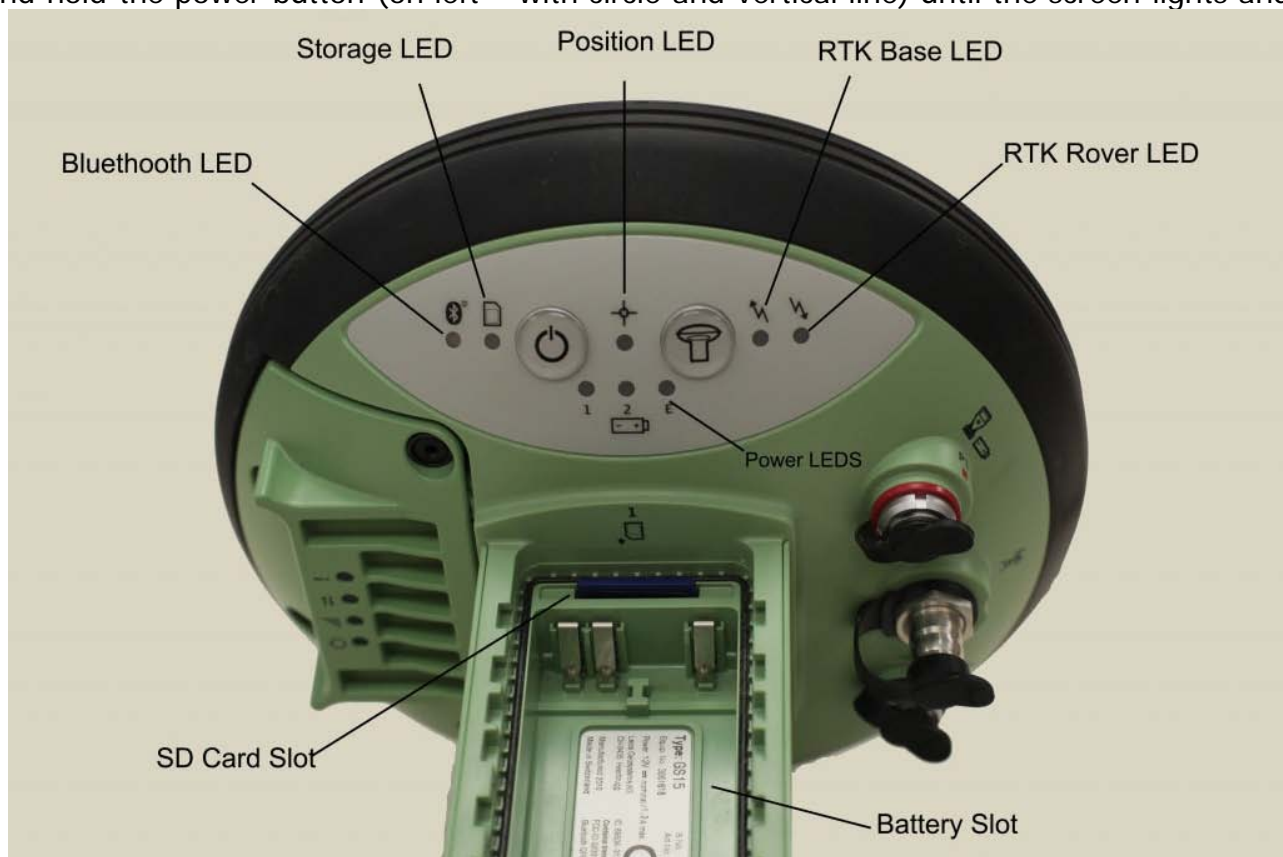
release.

1. The SmartWorx set up wizard will appear.
        1. Select "Use GPS Only"
        2. Press (F1) Next
        3. Check that GC10/15 is selected
        4. Press Next
        5. Then either
                1. Continue with last used job
                2. Or New job

2. To set up a new job:
    1. Press "Home" key (one with house symbol)
    2. Setting up a JOB
        1. Use red arrow key (in center) to move left to "Jobs and Data"
            1. Press 1 "New job"
            2. Enter
                1. Name
                2. Description
                3. Creator
                    1. Note: to move from data entry filed to the next press the "Return" key (right angle arrow pointing to left)
                4. When the last field is completed and you press the return arrow you will see the word "Store" (above the F1 key and "Page" above the F6 key. If you want to create a code list (e.g. a data dictionary) press F6 (or use stylus to click "Page" (or use stylus to click the tab at top of page "Code-list")
                5. If you are setting up a base station you won't have a code-list or need other options.
                6. You should page over to Coordinate System to confirm is it WGS84. It is possible to configure other coordinate systems. Those instructions are in Section 8 (pages 146ff of Viva Tech Manual)
                7. After checking everything press F1 for store.
    3. Press home again
3. Alternatively you may use an existing job.
    1. Press "home" key (one with house symbol)
        1. Use red keys to move right to Jobs and Data
            1. Press "4" or use down key to move to 4 – Chose working Job
            2. Use up/down arrow keys to move to desired job
            3. Press "OK"
                1. Note you may wish/need to edit the job properties
                2. To do so move to job and press the F3 "edit" key

(If needed – connect to GPS)

You may need to connect to the GPS. This can either be done via cable or Bluetooth.

1. To connect
2. Press Home key
3. Red arrow to "Instrument"
    1. Instrument Connections
        1. GPS Connection Wizard
        2. On next screens confirm
            1. GS Sensor is GS10/15
            2. Bluetooth (or) cable
    2. The unit will then display the current connected unit. If using Bluetooth, confirm that it is connected to the correct GS15 –
    3. if so press Next
        1. OTHERWISE – press Search
        2. After a bit review list and select the correct unit to connect to
        3. Press Next (F1)
        4. After a moment you should see "successfully connected"
    4. Press Finish
        1. The Bluetooth LED on the data logger will be blue and the Bluetooth on the GS15 will be blue as well.
    5. If you are unable to connect to the proper unit it may be necessary to step through the wizard again making sure that you have selected the correct unit. If this fails again it may be necessary

to power down both the GS15 and the data logger and start again. This usually fixes any connection issues.

Step 2. Set up base station parameters

For OPUS work you will be post-processing the base data and it is ESSENTIAL that the data be logged to the SD card. Be sure that the SD card has adequate memory for the work you plan. The SD card is any standard one (1) GB SD card. It is installed in the SD slot at the top inside of the battery cover.

1. Set/Check GPS Settings
2. Press "home" key
   1. If the unit is already in base mode you can proceed with settings. HOWEVER it may have been left in rover mode. As noted you can change this via the FUNCTION button on the GS15 or you can press 7 "Switch to Base Mode" on data logger
   2. This may cause a lost connection message to display/sound but usually it will then reconnect as a base. If it does not the cycle through the GPS connection wizard again.
      1. To cycle through connection wizard
         1. Press Home key again
         2. Right red arrow to "Instruments"
            1. Select "Instrument Connections"
               1. Select GPS Connection Wizard
                  1. Choose GS10/GS15
                  2. Press Next (F1)
                  3. Select Bluetooth (or cable if using a cable)
                  4. Press next
                  5. Confirm the correct unit is involved (SSN is on base of unit)
                  6. If correct
                     1. press NEXT
                        1. Dialogue should report "Connected to GS Sensor"
                  7. If Not
                     1. Press Search
                     2. Will identify different sensor
                     3. Press Next to connect
                  8. Press Finish
3. After re-running GPS Connection wizard – if needed.
4. Press Home key again
   1. Press red right arrow to move right to "Instrument"
      1. Select "1" GPS Settings (use down arrow or press "1")
         1. Check Satellite Tracking – indicate if you want GLONASS and L5 here
         2. Check Antenna Height
            1. This is usually 2 meters but should be set to the tripod height

Insure that you are logging raw data

1. Press "GO BACK" key (e.g. "U shaped arrow") as needed to get to "Base Menu" (at upper left of screen)
      1. You should see "Go to Work" and "Instruments" as options on Base Menu
      2. Select Instruments
         1. Select Base Settings
            1. Select Raw Data Settings
            2. Confirm or set "Log base data for post-processing" (normal method for most of Center's applications) check box is checked. If not checked use stylus (or finger nail) to check.
               1. Check that rate is 1.0s

1. It is possible to set rates from 0.05s to 300s. The one second (1.0s) seems to be the best option for our work.
        2. Data type "Leica Format (MDB)"
    2. Press "OK" (F1)

Confirm settings

1. Press "GO BACK" key "U shaped arrow" as needed to get to "Base Menu"
        1. You should see "Go to Work" and "Instruments"
        2. Select Instrument
            1. Select Base Status
            2. Under base status entries are:
                1. Battery and memory
                2. Satellite status
                3. Data Link Status
                4. Current Position
                5. Raw data logging
                6. Connections Status
            3. Go into each and check status – in particular
                1. Under battery and memory
                    1. The first tab is data logger memory and battery
                        1. Use Page (F6) to move to GPS base tab
                        2. Confirm adequate battery and memory
                2. Under Raw Data Logging
                    1. Confirm data logging
                        1. Note at least 20 minutes of RAW data needed for OPUS Rapid-Static solution
                            1. At one obs per second this is some 1,200 observations.
                            2. The data logger reports the number of observations logged. Under Base Status, Raw data Logging

Setting up over any point

You will probably usually use the "set up over any point" option when locating the base. "Any point" means that you do not, initially, know the point's locations, though you can determine this very precisely after the OPUS system after data are acquired.

1. From the base screen select "Go to work"
    1. Select "over any point"
    2. Confirm (or set)
        1. "Antenna height" to proper value (usually 2.0 m when using standard tripod)
        2. RTK Base Antenna : GS15 Pole
        3. Point ID: enter a value that you note for future reference.
    3. Base set up is complete
2. You will be directed to the Rover Connection
    1. You will NOT need to configure the rover for a single system OPUS process.

Setting up over a known point

1. It may be the case that you can set up the base station over a known point.
2. One way to accomplish this is to set up the base alone and acquire adequate data for an OPUS solution. Submit the data to OPUS and then use the results. Reset the base over the same point and enter the OPUS coordinates.

1. In this case you would
    1. Press "go back" arrow until you get to Base Menu screen
    2. Select "Go to work"
        1. Select "Over known point"
            1. Confirm antenna height and press" Next"
        2. You will be given the select known point
            1. Clicking in the "Point ID" field will take you to the Data screen when all currently known points are displayed and you can use these.
            2. However – you will Not have the OPUS solution in the list and will need to enter it to be able to choose it as a Known Point
        3. To enter a new point press F2 "New" at the bottom of the "Data: Points" tab screen
            1. Press F2 "coordinates" to shift from lat/lon, Cartesian etc. coordinate types.
            2. ENTER the OPUS solution here.
        4. IMPORTANT: If you are using the WGS84 coordinates be SURE to enter the ITRF 2002 OPUS solution not the NAD83(CORS) ones.
        5. When complete press STORE (F1)
    3. Use return arrow (sideways "U") to move back to the Select Know Point screen.
        1. Confirm that the OPUS solution is correct
    4. Press NEXT and you will then be at the "Base set up complete"
2. If the base mode LED (outgoing arrow) is
    1. OFF – the unit is not in base mode but in RTK rover – press FUNCTION to switch to base mode – check LEDs again
    2. The base mode LED should be either
        1. **Green** – the unit IS in base mode but NO DATA is being sent to radio
        2. Transmission is not needed for single point work but you do need to insure that the unit is NOT in rover mode.
        3. **Or Flashing green**
            – unit in base mode AND data is being sent.
            1. WARNING – the unit may flash very slowly!
            2. Again – this is not necessary – as there is no rover.
3. If the Position LED is
    1. OFF – no satellites are being tracked and/or unit is off
    2. **Flashing yellow**
        – less than four (4) satellites are tracked, no position available
        1. It may take a bit after you power up the unit for tracking to begin. This is especially true if the unit has been off for a while or if it is being restarted in an entirely new location. The delay is because the almanac has to be downloaded/updated.
    3. **Yellow** – a navigated position is available
        1. If you are setting up over "any point," that is you don't know the coordinates of the base from some outside source(s) (e.g. NGS benchmark, then only a navigated position.
        2. Typical readings for a base in navigation mode are in the order of 0.5 to 2 meters for 2nd order while the rover using the base will have values of 10-30 millimeters!
        3. It is possible to set up a base over "any point" acquire at least 20 minutes of good data, process it via OPUS (see that work flow) and then locate the base over the same point bus as a KNOWN point, using the OPUS provided coordinates.
        4. BUT – the position LED will still be YELLOW!
    4. **Flashing green**
        - a code-only position is available
        1. You will NOT get either a flashing or a solid green one if you are stand-alone and over an unknown point.
    5. **Green** – a fixed RTK position is available
        1. You will NOT get either a flashing or solid green if you are stand-alone and over an unknown point

1. To calculate an OPUS rapid-static position you need to have between 20 minutes and 2 hours of data.
    1. Data longer than two hours needs to be submitted to the OPUS static system. Not

rapid-static
1. Generally rapid-static positions are more than adequate for most purposes. They commonly are +/- 10-30 millimeters.
2. When you have adequate data you need to power down the system
   1. Hold power button down until LEDs turn red and quickly remove finger.
      1. Continuing to hold will cause a reset or reformat operation!
3. Remove SD card from unit and place in SD card reader attached to a PC running LGO
4. Detailed directions are provided in **LGO data transfer to OPUS workflow**
5. Basic steps are as follows.
   1. Note that you do NOT need a licensed version of LGO for this task
   2. Create or select a project
   3. Import data from SD card to LGO
   4. Export data from LGO to a RINEX file
   5. Upload the RINEX file to OPUS
      1. OPUS is found at http://www.ngs.noaa.gov/OPUS/
      2. The antenna type of the GS15 is **LEIGS15**
      3. Enter **2.0 m** for antenna height if using normal tripod setup
      4. Wait for e-mail