



INTEGRATION GUIDE

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INTEGRATION GUIDE

STENCIL 2 WITH TRIMBLE GNSS

This guide provides instruction for connecting a Trimble GNSS unit to Kaarta Stencil 2® including:

- Physical connections
- Network settings and configuration
- Verifying receipt of GNSS data visually

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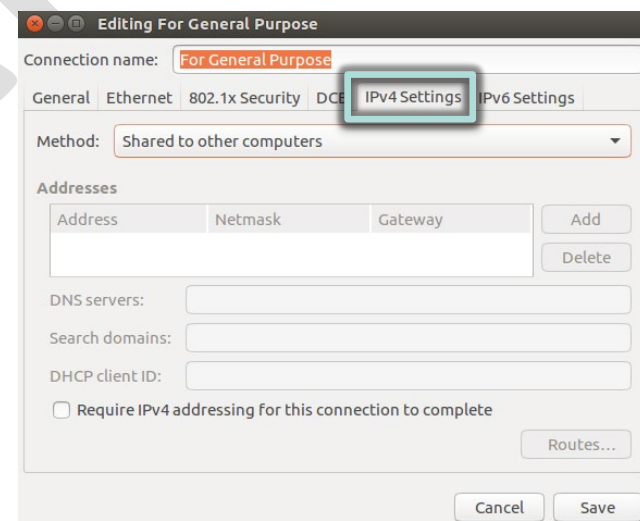
SETTING UP STENCIL 2 NETWORK FOR GNSS

Step 1 - Power on Stencil 2.

Step 2 - Update Stencil network settings **For General Purpose** connection.

- ✓ Right click on the network symbol  (if connected wirelessly) or  (if not connected to a wireless network) in the top right of the Stencil Ubuntu task bar and click **Edit Connections**.
- ✓ Select **For General Purpose** and click **Edit**.
- ✓ Navigate to IPv4 settings and change the Method to **Shared to other computers**.
- ✓ Click **Save**.

Step 3 - Plug the Trimble GNSS network connection into the network port on the back of Stencil.



Step 4 - Power on the Trimble GNSS equipment.

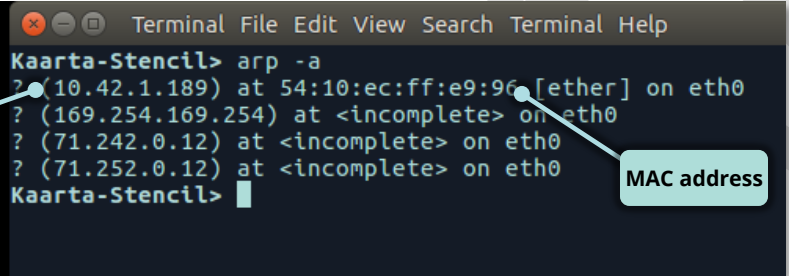
- ✓ You should see the message **Connection Established** on the Stencil 2 Desktop indicating that there has been a network link established between Stencil 2 and the Trimble unit.

IDENTIFYING TRIMBLE GNSS IP ADDRESS AND TCP PORTS

Step 1 - Open a command terminal (ctrl + t) on Stencil and run `arp -a` to identify the Trimble GNSS IP address.

- ✓ The result of the `arp -a` command will be structured as follows:

? (IP address) at MAC address [ether] on eth0



```

Kaarta-Stencil> arp -a
? (10.42.1.189) at 54:10:ec:ff:e9:96 [ether] on eth0
? (169.254.169.254) at <incomplete> on eth0
? (71.242.0.12) at <incomplete> on eth0
? (71.252.0.12) at <incomplete> on eth0
Kaarta-Stencil>
  
```

- ✓ The most likely IP address is 10.42.0.XXX or 10.42.1.XXX depending on whether Stencil's wifi adapter is plugged in.
For this example, the IP address is 10.42.1.189.
- ✓ If the `arp -a` command does not produce a similar response or format as above, verify that the Trimble unit is powered on and the Stencil 2 ethernet indicators are active (green and yellow LEDs on the ethernet port are lit).

Step 2 - Open a web browser on Stencil and enter the IP address you identified in the previous step (your IP address) in the browser web address and press Enter. You should connect to the Trimble GNSS webpage. When prompted, the username and password are the following:

- ✓ User Name: admin
- ✓ Password: password

Step 3 - From the Trimble GNSS webpage, identify the Trimble TCP communication ports.

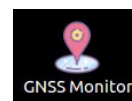
The screenshot shows the Trimble I/O Configuration webpage. The left sidebar contains a menu with options: Receiver Status, Satellites, Receiver Configuration, I/O Configuration (highlighted), MSS Corrections, Network Configuration, Security, Firmware, and Help. The main content area is titled 'I/O Configuration?' and contains a table with columns: Type, Port, Input, and Output. The table lists various communication configurations, including TCP/IP, NTRIP Client/Server/Caster, Serial, USB, and CAN. Two callouts are present: 'NMEA Port' pointing to port 5017 and 'BINEX Port' pointing to port 28001.

Type	Port	Input	Output
TCP/IP	5017	-	NMEA-GGA(10Hz), NMEA-ZDA(1Hz), NMEA-GSA(10Hz)
TCP/IP	5018	-	-
TCP/IP	28001	-	BINEX(1Hz)
TCP/IP	28002	-	-
NTRIP Client 1	-	-	-
NTRIP Client 2	-	-	-
NTRIP Client 3	-	-	-
NTRIP Server	-	-	-
NTRIP Caster 1	2101	-	-
NTRIP Caster 2	2102	-	-
NTRIP Caster 3	2103	-	-
Serial	COM1 (115K-8N1)	-	-
Serial	COM2 (115K-8N1)	-	NMEA-GGA(5Hz)
USB	-	-	-
CAN	CAN 1	-	-

- ✓ Click on the **I/O Configuration Screen**
- ✓ Identify the port for NMEA. *For this example, the NMEA port is 5017.*
- ✓ Identify the port for BINEX(1Hz). *For this example, the BINEX(1Hz) port is 28001.*

SETUP GNSS ON STENCIL 2

Step 1 - Double-click the **GNSS Monitor Icon** on Stencil 2 Desktop.



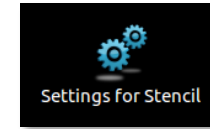
Step 2 - Select connection type as **TCP**.

Step 3 - Enter the IP address determined with the *arp -a* command.

Step 4 - Enter the NMEA Port you obtained from the Trimble GNSS webpage.

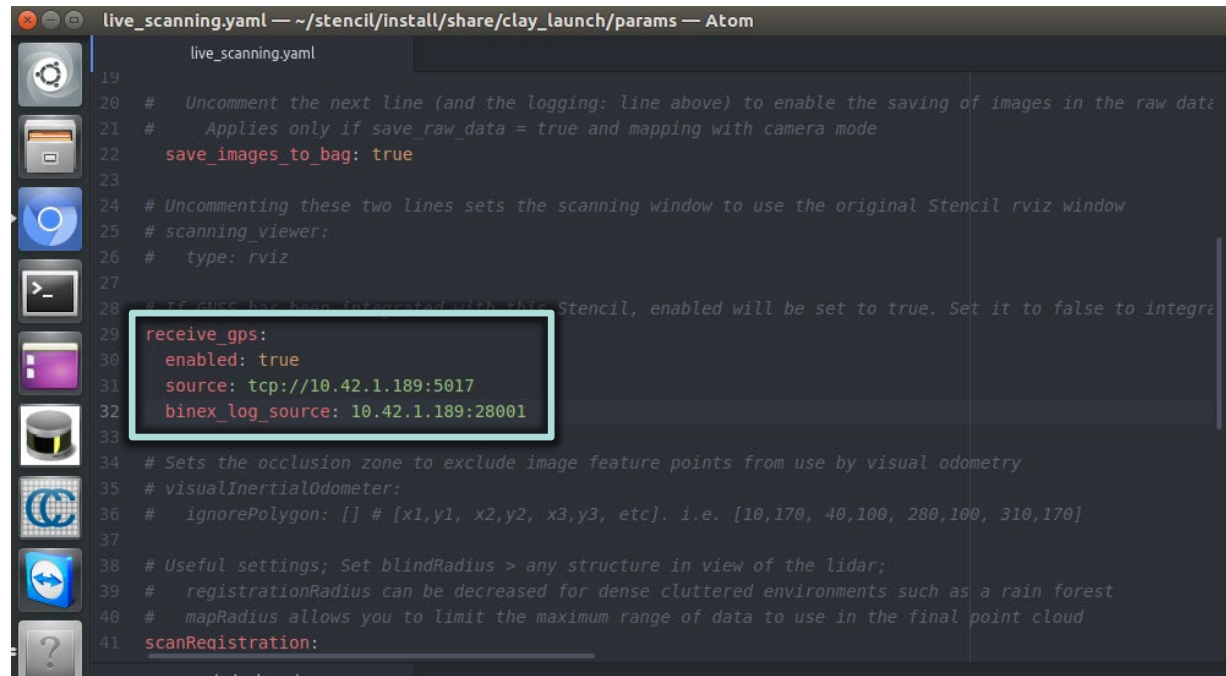
Step 5 - Double-click the **Settings for Stencil** on the Stencil 2 Desktop.

- ✓ Default settings configurations, as well as configuration settings for live scanning and playback, open in the Atom text editor.



Step 6 - In the **live_scanning.yaml** configuration file (the top left window of the Atom editor) scroll down to the **receive_gps** settings and add the line identified in **RED** below (which is a concatenation of your IP address and your BINEX port number).

```
receive_gps:
  enabled: true
  source: tcp://10.42.X.XXX:5017
  binex_log_source: 10.42.X.XXX:28001
```



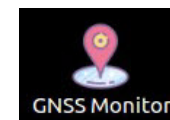
```
live_scanning.yaml
19
20 # Uncomment the next line (and the logging: line above) to enable the saving of images in the raw data
21 # Applies only if save_raw_data = true and mapping with camera mode
22 save_images_to_bag: true
23
24 # Uncommenting these two lines sets the scanning window to use the original Stencil rviz window
25 # scanning_viewer:
26 # type: rviz
27
28 # If this has been integrated with this Stencil, enabled will be set to true. Set it to false to integrate
29 receive_gps:
30   enabled: true
31   source: tcp://10.42.1.189:5017
32   binex_log_source: 10.42.1.189:28001
33
34 # Sets the occlusion zone to exclude image feature points from use by visual odometry
35 # visualInertialOdometer:
36 # ignorePolygon: [] # [x1,y1, x2,y2, x3,y3, etc]. i.e. [10,170, 40,100, 280,100, 310,170]
37
38 # Useful settings; Set blindRadius > any structure in view of the lidar;
39 # registrationRadius can be decreased for dense cluttered environments such as a rain forest
40 # mapRadius allows you to limit the maximum range of data to use in the final point cloud
41 scanRegistration:
```

- ✓ Note that the IP address and ports should match what was identified through previous steps in the *arp -a* command and the Trimble GNSS device webpage settings.

Step 7 - **Save** (ctrl + s) and close the settings file.

VERIFY GNSS DATA IS BEING RECEIVED ON STENCIL

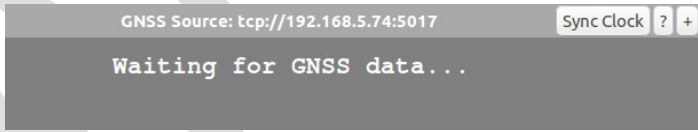
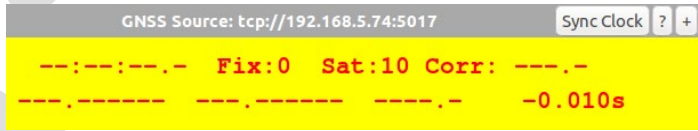
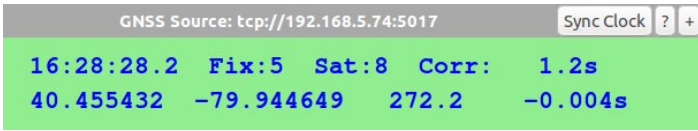
Step 1 - After Stencil 2 is configured correctly, double-click the **GNSS Monitor** once again on the Stencil Desktop.



Step 2 - A GNSS monitor status window appears on the Stencil Desktop with the following information:

- ✓ The GNSS Source IP address in the window header
- ✓ Connection Settings: IP address and port that Stencil is listening to for data
- ✓ Colorized Status: Monitor status window is color coded either gray, yellow, or green. The colors may change as GPS signal fluctuates.

GNSS MONITOR STATUS WINDOW

Status	Description	Window
Gray	Trying to connect	
Yellow	Data received if fix quality is 0	
Green	Fix quality if greater than 0	

TROUBLESHOOTING GRAY (NOT CONNECTED) GNSS MONITOR STATUS

Step 1 - Verify the Trimble unit is powered on and the network cable is connected.

Step 2 - Open a command terminal on Stencil 2 and run `arp -a` to verify that the IP address input into **live_scanning.yaml** is correct. If the IP address has changed (for example it could switch between 10.42.0.XXX and 10.42.1.XXX), update both instances in the **live_scanning.yaml** and restart Stencil 2.

PROCESSING PPK DATA

In the US

Step 1 - Once a scan is complete and a BINEX file has been produced, connect Stencil to the internet.

Step 2 - Open a terminal window and run the following command out of the scan folder:

```
rosrun receive_gps binex2GPS.sh <BINEX input file> <PLY output file>
```

✓ Note that the **<PLY output file>** should include a .ply extension.

From Your Own Base Station

Step 1 - Before scanning, be sure to turn on raw data logging on the rover and base units.

Step 2 - Once a scan is complete, transfer the GNSS raw log files (rover and base unit) to Stencil by copying the data into the folder that contains the .bag file from the associated scan.

Step 3 - Open a terminal window and run the following command from the scan folder to convert the GNSS raw data to a format that is compatible with Stencil:

```
convbin <input file>
```

- ✓ The **<input file>** format is dependent upon the base station receiver model. For example, an Emlid Reach produces a u-blox (.ubx) file. The following file formats can be converted for use on Stencil:

- RTCM 2 (*.rtcm2)
- RTCM 3 (*.rtcm3)
- NovAtel OEMV4/6, OEMStar (*.gps)
- U-blox LEA-4T/5T/6T/7TM8T (*.ubx)
- NovAtel Superstar II (*.log)
- Hemisphere Eclipse/Crescent (*.bin)
- SkyTraq S1315F (*.stq)
- Javad (*.jps)
- BINEX (*.bnx, *.binex)
- Trimble RT17 (*.rt17)
- Septentrio SBF (*.sbf)
- CMR/CMR+ (*.cmr)
- TERSUS (*.trs)
- Rinex OBS (*.obs, *.o)

- ✓ This should produce a base unit observation and base unit navigation files from the base station data.

Step 4 - Open a terminal window and run the following command out of the scan folder:

```
roslaunch receive_gps binex2GPS_local.sh <converted file> <base obs> <base nav> <PLY output file>
```

- ✓ The **<converted file>** is the converted raw log file produced in Step 3.
- ✓ The **<base obs>** file is the observation data from your fixed base station produced during the *convbin* conversion in Step 3.
- ✓ The **<base nav>** file is the navigation data from your fixed base station produced during the *convbin* conversion in Step 3.
- ✓ Note that the **<PLY output file>** should include a .ply extension.

For additional assistance with any Stencil 2 issue, please email stencilsupport@kaarta.com. With any support issue, be sure to have your Stencil Serial Number handy. Additional information on Kaarta Cloud, Contour, and Stencil can be found on our website www.kaarta.com.