HORUS VIEW & EXPLORE

TECHNICAL DOCUMENTATION

Citymapper Manual

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Contents

1 Introduction

Thank you for using our Horus Citymapper system.
Equipped with a Ladybug 5 camera, and an Applanix GNSS/INS system, which, when used alongside our software suite, provides users with a powerful all-in-one mobile mapping system.

This document will describe the process of assembly and installation, the initial configuration, recording, post-processing, and viewing the recorded data.

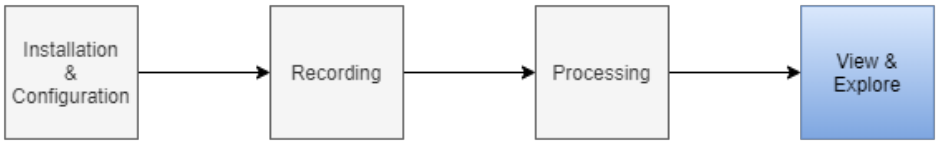


Figure 1: Citymapper manual process

The goal of this manual is to provide you with the information required to use the Citymapper system.
If you run into issues or require further assistance, contact Horus for support.

For more information on the software applications used, see their specific manuals.

2 The Citymapper System

2.1 What is the Citymapper?

The Citymapper is a turn key solution from Horus for mapping your surroundings with 360 degrees streetlevel imagery.
The system can be employed on different platforms such as: cars, boats, trains.

The system uses a FLIR Ladybug 5 camera, and an Applanix GNSS/INS system, which is mounted on an all-in-one system, additional sensors can easily be mounted and integrated into the system.
The system runs on our proven Horus Geosuite, which is easy to learn and use, and requires minimal setup time.

Figure 2: The Citymapper System

See Appendix 7.1 for the spec sheet of the Horus Citymapper.

2.2 Citymapper Kit Contents

The Citymapper system contains the following components:

- 1x FLIR Ladybug 5
- 1x GNSS/INS system from Applanix
- 1 or 2 Trimble LV59 antennas
- 1x Triggerbox

- 1x Roof mount with required hardware

- 1x USB 3 type A to micro USB 3.0 cable
- 1x USB type A to B cable
- 1x XLR to IO cable
- 1x XLR to Serial cable
- 1x IO to 3 Serial connectors cable
- 1x USB to Serial cable
- 1x Serial to Serial loopback cable
- COAX to COAX cable (1 for each antenna)
- 1x Ethernet cable
- 1x power cable (Triggerbox)
- 1x power cable (Applanix)

- Computer system

Included components may differ.

Figure 3: Citymapper Case

By default the Applanix can be used to measure the distance and determine when to take an image. If you wish to more accurately determine when to trigger the system, then an OBD Reader can be used.

OBD Reader

- 1x OBD Trigger unit
- XLR to XLR cable

The system can be integrated with extra sensors, such as high resolution cameras, and LIDAR. Adding an HR camera to the system will add the following components:

HR Camera

- HR camera
- USB 3 type A to micro USB 3.0 cable
- XLR to IO cable

2.3 Included Software

The Citymapper comes included with Horus software, allowing you to record and view data.
This includes:

- Horus Data Grabber *
- Horus Recorder Builder *
- Horus Movie Recorder *
- Horus Movie Player * #
- Horus Position Fixer #

Due to using off-the-shelf components from FLIR and Applanix, their software is also required.
These are:

- LV POSView *
- POSPac MMS #
- FLIR LadybugCapPro *
- FLIR Flycapture SDK (For FLIR Grasshoper HR cameras) *

We also recommend installing the following applications on your system.

- FileZilla (FTP client) *
- Realterm: Serial Terminal *
- OSMtiledownloader *

In cases where you have a dedicated recording and post-processing PC, we recommend installing the applications with an '*' to the recording system, and the software with an '#' to be installed on the processing system.

2.4 System Requirements

Power Requirements
The Citymapper system requires **19 V DC** power.
If your vehicle does not output 19 V, then a converter is required.

In cases where a 12 V car battery is your power source, a 12-19 V converter with at least 12 amps is needed.
Horus recommends a 12-220 V Victron converter, but it is important to have clean power delivery for a stable system.

PC System Requirements
The minimum requirements for the PC system are:

- I7 or equivalent CPU
- GTX 10X0 GPU
- 8 GB RAM
- Storage Drive with enough available space for recording
- 3+ USB 3.0 ports

3 Setting up the System

3.1 Assembling in the System

When you get the Horus Citymapper it requires some assembly. In appendix 7.2 you can see how the components are connected.

Applanix

Figure 4: Applanix Ports

- Plug the power cable into the 'PWR' port.
- If you have a wheel speed sensor, plug the cable into the 'DMI' port.
- the IO to 3x serial connectors cable can be plugged into the 'IO1' port.
- The antennas are plugged into the 'A1' & 'A2' port of the Applanix with the COAX to COAX cables. The antenna plugged into the A1 port will be the primary antenna.
- Plug the Ethernet cable into the 'LAN' port.

We recommend placing the IMU in a solid mount close to the camera with X axis pointing forwards.

Note: The number and location of the ports may differ between the different models.

Triggerbox

Figure 5: Triggerbox Ports

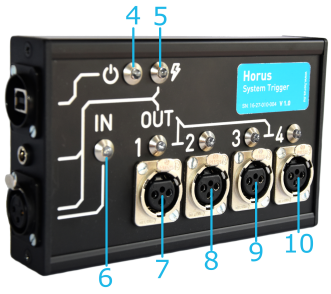


Figure 6: Triggerbox ports

1. Plug the USB type A to B cable into this port. This is used for the connection to the PC.
2. Optional power throughput, 5-24 Volt DC. This will prove additional power to the hardware that are plugged into 'TRG Out' ports.
3. 'TRG In', The Triggerbox receives trigger pulses via this port from either the Applanix or an OBD Reader Unit.
4. Power LED
5. Power throughput LED, Turns on when power is received through port 2 or 3.
6. trigger input LED, it will blink when a pulse is received through port 3.
7. Port 7 through 10 are all 'TRG Out' ports.

Once the system is assembled, turn on the Computer and Applanix, and check that all components are powered. With the system up and running, continue to the next chapter in which the initial configuration process is described.

4 Initial Setup of the System

4.1 Configuring the Software

With the system assembled and the software installed, you may continue with the initial configuration.

Step 1
Ensure that the system has power, and start the recording computer, and the Applanix.

Step 2
Start LV POSView.
This application is used to monitor and log the incoming data from the Applanix.

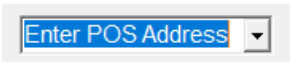


Figure 7: POS Address Field

Wait for the IP address to show up in the 'Enter POS Address' input field, or select it manually.

The default IP adress of the Applanix is:

192.168.53.100

Once the Applanix has been found, connect to it.
Check that the status at the bottom left of the window states 'Connected'.

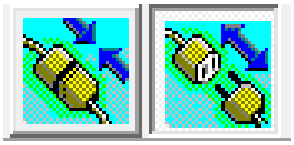


Figure 8: Connect Button

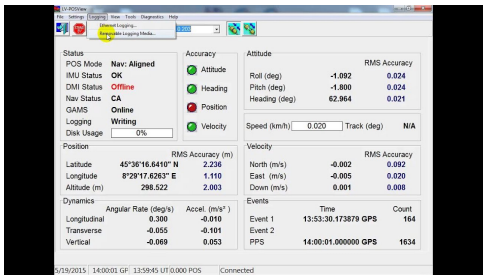


Figure 9: LV POSview

Once Applanix's address is entered in the application, the live data from the IMU will be shown.

Step 3
The next step is to set the 'Input/Output Ports...'.

Go to the 'Settings' tab at the top bas, to open the Settings menu, and then click on 'Input/Output Ports...'.

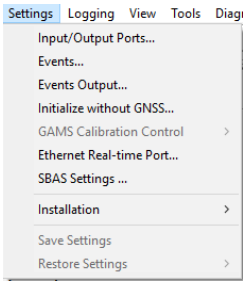


Figure 10: Settings Menu

This will then open a window as seen in figure

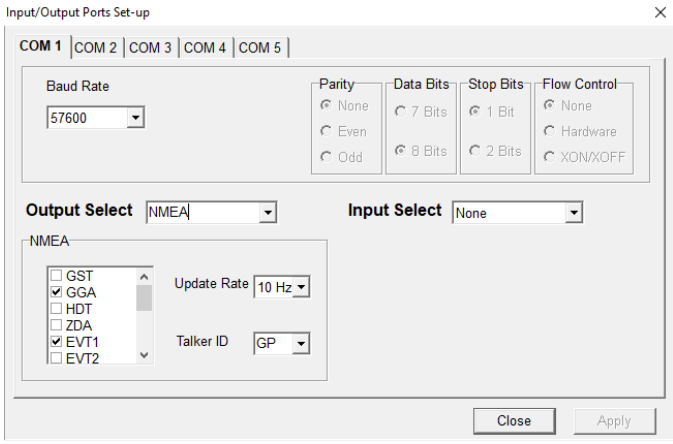


Figure 11: Input/Output Settings Menu

At the top of the window, there are 5 comport tabs, these correspond to the comports of your PC. You want to configure the settings for the used comport devices.

- **Baud Rate**, The Baud Rate defines the rate at which information is transferred. Set the rate to the same as set in the 'Baud Rate' property of the Recorder Builder pipeline. If the system drops frames, increase the Baud Rate.
- **Output Select**, Set the output to NMEA.
- Check the boxes for: 'GGA', 'EVT1', and 'PASHR'.
- **Update Rate**, Set the update rate to be about double of the frames per second, this will ensure that there is always data available when an image is made.
- **Talker ID**, Change this to 'GP'.

The Input/Output Settings are now set.

Step 4
Next, click on the Settings tab, and open the 'Events' window.

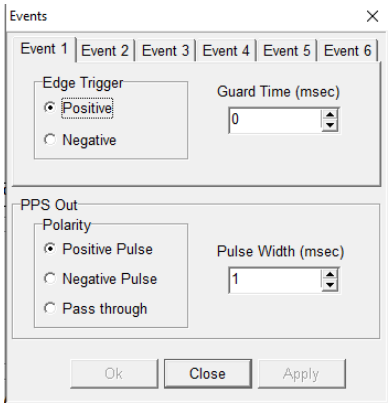


Figure 12: Events Menu

In this window set the 'Edge Trigger' option to either 'Positive', or 'Negative'. It does not matter which one you choose, as long as the trigger polarity of the camera is the same.
Open LadybugCapPro and check the 'Trigger Polarity', and ensure that both are set the same.

Step 5
Whilst oyu're in the Ladybug software, enable the 'Trigger Control' setting.

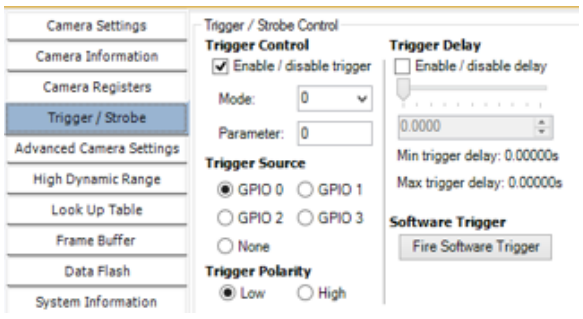


Figure 13: Trigger Settings in Ladybug Software

Step 6
Next, open the 'Events Output' menu.

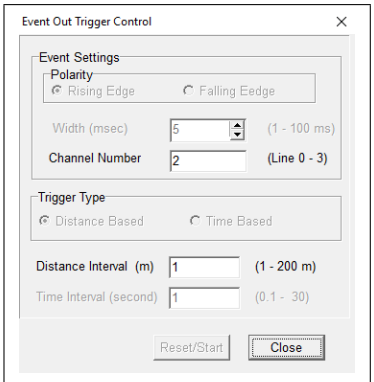


Figure 14: Events Output Menu

- **Channel Number**, Set this to 0.
- **Distance Interval**, Set the interval between each image. a value of 1 equals an interval of 0.5 meter.

Note that these properties do not get saved, so during each startup these two will need to be set again.

Step 7
This step involves setting the lever arms of the IMU.

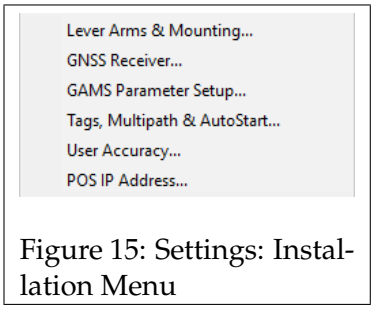


Figure 15: Settings: Installation Menu

Go back to the Settings menu, and then click on 'Installation', additional options will appear, click on Lever Arms & Mounting.

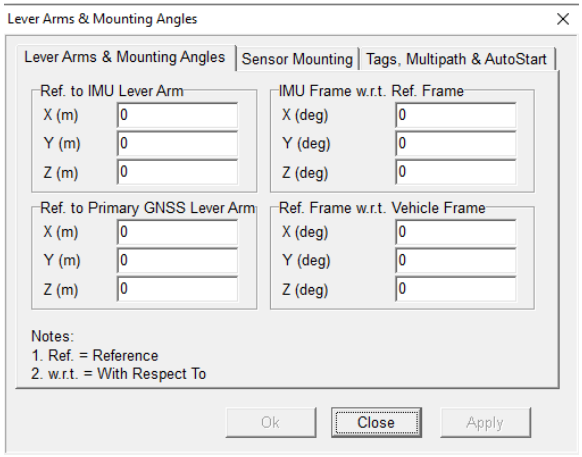


Figure 16: Enter Position of Lever Arms

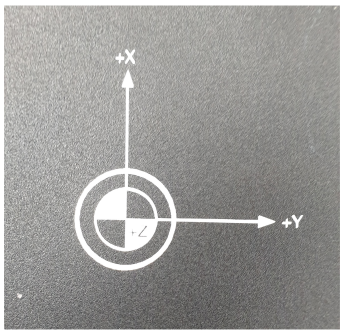


Figure 17: XYZ axis

Measure the distances, and rotation of the IMU to the reference point, and the primary antenna to the reference point. The Ladybug camera is generally the reference point.

- **X** Longitudional axis, forward is positive.
- **Y** Lateral axis, right is positive.
- **Z** Vertical axis, down is positive.

- **Ref. to IMU Lever arm**
  The location of the IMU from the reference point.
- **Ref. to Primary GNSS Lever Arm**
  The location of the primary antenna from the reference point.
- **IMU Frame w.r.t. Ref Frame**
  The rotation of the IMU in relation to the reference point.
- **Ref. Frame w.r.t. Vehicle Frame** The rotation of the reference in relation to the vehicle.

The Lever arms values can be adjusted at a later point, so they do not have to be exact. After entering the values, click on 'Apply'.

Step 8
In the Installation menu click on 'GAMS Parameter Setup'.

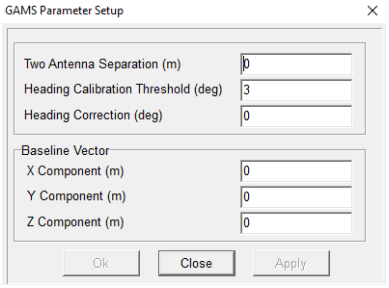


Figure 18: GAMS Parameters

The this window you can enter the location of the secondary antenna from the primary one. The second antenna is used to more accurately calculate heading.

Step 9
Go back to the Installation menu and open the 'User Parameter Accuracy' window.

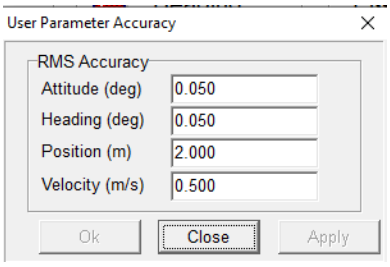


Figure 19: User Set Thresholds

In this window you can specify the threshold for when the 4 lights on the main panel turn green. The lower the value, the more accurate the solution needs to be, in order to turn green.

Step 10
At the top, click on 'Logging', two options should appear; one for logging via Ethernet, and the other for logging towards removable media. Choose your desired logging method.

Ethernet logging

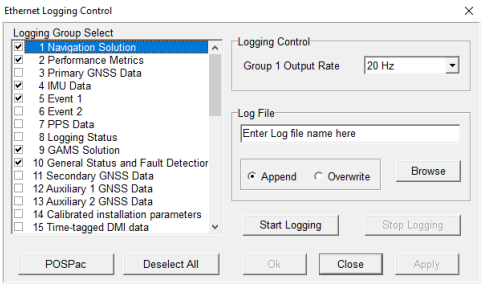


Figure 20: Ethernet Logging Window

- Set 'Group 1 Output Rate' to 20 Hz.
- Enter the 'Log File' name and save location.
- Check the following logging groups:
  1 Navigation Solution
  2 Performance Metrics
  4 IMU Data
  5 Event 1
  9 GAMS Solution
  10 General Status and Fault Detection

Removable Logging Media

- Ensure that the removable media has enough free space.
- Set 'Group 1 Output Rate' to 20 Hz.
- Enter the 'Log File' name.
- Check the following logging groups:
  1 Navigation Solution
  2 Performance Metrics
  4 IMU Data
  5 Event 1
  9 GAMS Solution
  10 General Status and Fault Detection

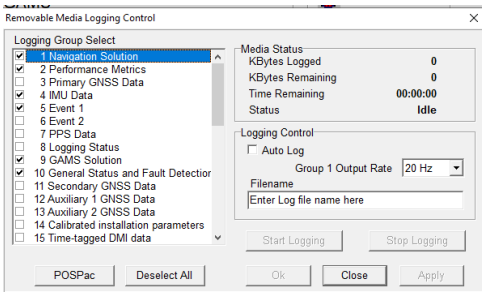


Figure 21: Removable Logging Media Window

Press 'Apply' and close the window

Step 11
Once you configured the settings, press 'Save Settings' in the Installation menu to save your adjustments.

Step 12
Start the Data Grabber and then the Recorder Builder.

Step 13
Click on 'Connect' at the top left, and load the pipeline.
The pipeline should then be displayed on the graph.

Step 14
The first step is to tell the system from which Comports it can grab the data for the 'Trigger' and 'NMEA' components.

Open Device Manager and expand the 'Ports' section. Find the entry for the Triggerbox and the Timerbox/NMEA and note down the Comport numbers.

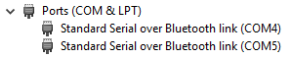


Figure 22: Device Manager

Go back to the Recorder Builder, click on either the 'Trigger' or 'NMEA' component and on the left, scroll all the way down till you find the property window, then set the correct Comport number. Do this for both components.

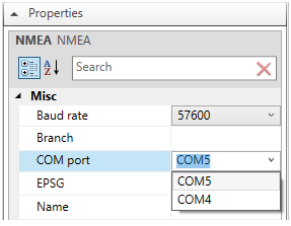


Figure 23: Component Properties

Once the Comports are set, use the same USB ports. If you plug the Applanix or Trigger into another USB port, the Comport will change.

Also check the properties of the camera grabbers, and that they are in 'Triggered' mode

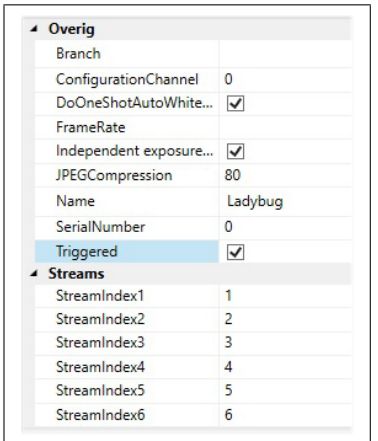


Figure 24: Camera Grabber Properties

Step 15
save the pipeline.

Step 16
Initialize the pipeline and then start it.
In the Data Grabber window, check that the system is running correctly.

Step 17
Start the Movie Recorder.
We want to add tabs such as the 'Arduino' to the interface, so they can be accessed.

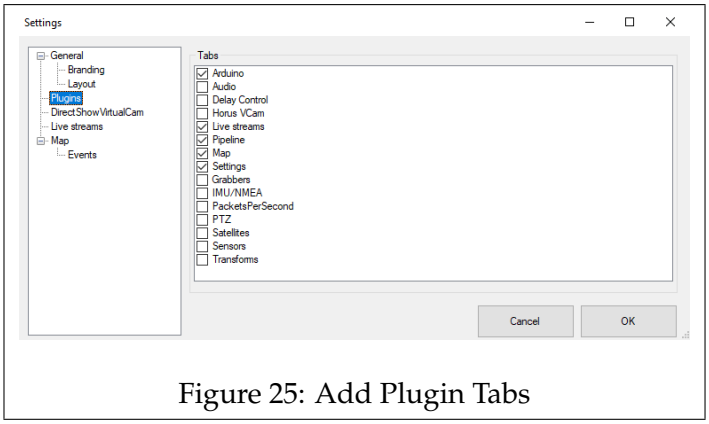


Figure 25: Add Plugin Tabs

We recommend to at least, enable the modules that are checked in figure 25.

Step 18
Open the 'Arduino' tab and set it to 'Free' mode, and set the 'Frequency' as desired. go to the 'Pipeline' tab and check that the data that is being transferred from the cameras/sensors is similar to the frequency set in the Arduino tab.

If a sensor does not transmit data, take the USB connector out, plug it back in, and restart the Pipeline. The device should now sent data.

Step 19
Set the Arduino to 'External' mode and set the 'Threshold'.

- If the Applanix is the trigger, set the threshold value to 1.
- If a CANbus Reader is the Trigger, the value will determine the interval. 1 = 0.5 meters.

Step 20
You may now check the system for proper functioning. Ensure that you have the Pipeline, Map and Livestream tab showing in the Movie Recorder, and also LV POSview on your screen.

Start driving around and monitor the system.

- In LV POSview the accuracy values should lower, and the lights should turn green.

- Check in the Movie Recorder that you're getting live video, and position updates in the Livestream, and Map tab respectively.
- Check the triggerbox for proper functioning, check in the Pipeline tab that you are getting data according to the set interval. The number of frames shown in the pipeline should correspond to the Trigger Count in LV POSview.

System is Ready
If the system functioned properly during step 19, then your system should now be ready for recording.
In the next chapter, you will learn, how to record from start to finish with the Citymapper system.

5 Recording with the Citymapper

5.1 How to Record

Now that the system is ready to go, you can start recording. This chapter will describe step by step the process of recording data with the Citymapper system.

Step 1. Starting and checking the System
Power on the system, start the computer and the Applanix.

Start the Data Grabber, followed by the Recorder Builder. then start the Movie Recorder and finally LV POSview.
In the Recorder Builder, press the connect button, and then load and run the pipeline.

Starting the pipeline can also be accomplished via the included .BAT file.

In LV POSview, connect to the Applanix, and check if you're receiving data.
In the Movie Recorder check that the pipeline is functioning correctly.
Once you're done checking, set the 'mode' to 'External'.

Step 2. Final Configuration
Each time you start the system, or recording, there are a few settings that you want to adjust.

Movie Recorder

- Set the 'Threshold' interval to the desired distance if you're using an OBD Reader Unit.
- In the 'Settings' tab, define the Recording name, and path of the recording.

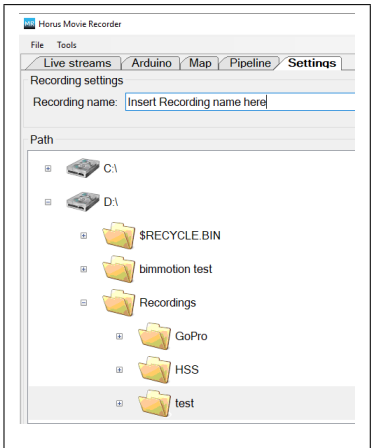


Figure 26: Settings tab

LV POSview

- In the 'Events Output' window, set the 'Channel Number' to 0.
- If the Applanix is used as the trigger, set the Distance Interval here.

Step 3. initializing the IMU
The IMU requires alignment, this can simply be done by driving in a straight line at a reasonable pace, you should see the 'accuracy' values drop once you are driving. Keep driving till you have 4 green lights, indicating that the alignment is good.
For this reason we recommend starting LS POSview prior to recording/logging, to give it time to initialize.

Step 4. Starting the Log
Drive to a clear, open area near the location where you wish to record. Go to 'Logging' and select your method of logging. In the window that opens, press 'Start Logging'.

Figure 27: Start Logging

Once the log starts, stand still for another minute before you start moving, this will ensure that the Applanix has a good GPS fix to start with.

If you're making multiple recordings, we recommend letting the log run for both recordings, otherwise you will have to find the correct log file for a specific recording, instead of being able to use a single log file for all the recordings made that day.
Whilst the log is running, refrain from stopping in a secluded area, instead park in a clear open area.

Step 5. Recording
Drive to the location where you wish to start the recording.

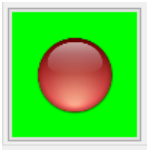


Figure 28: Record Button

Press the record button in the Movie Recorder to start recording data.

Whilst recording, monitor the accuracy and the trigger count in LV POSview. Also regularly check the pipeline and map to ensure that you are still getting data.
If you're recording in a city or otherwise secluded area, we advise you to move towards a clear area in between the recordings, this will ensure that each recording starts with a solid GPS fix.
We advise against recording for an hour or longer, instead stop, and restart the recording.

Figure 29: Pause and Stop Button

Once you are done recording, simply stop it by hitting the stop button.

Step 6. Stopping the Log
Once you have finished recording for the day, move to an open, and clear area and come to a standstill. Let the system log for another minute before

stopping the log, the log can be stopped by clicking on the 'Stop Logging' button as seen in figure 27.

Exporting the Recorded Data for post-processing
After recording the data, the recordings are stored on the device selected in the Movie Recorder, and the log file can be found on the PC, or on the USB stick of the Applanix depending on your logging method used in LV POSview.

The recorded data requires some post-processing before it is usable, this process is described in the following chapter. This can either be done on a dedicated processing PC, or on the Citymapper laptop, if the required software is installed. In either case, the computer should have access to both the Recording, and the Log data.

6 Processing

6.1 Introduction: Processing

After recording, you have the imagery from the cameras, and the log file from the Applanix.
The data from the Applanix requires some post-processing to improve the accuracy, and needs to be synchronized with the images.

The processing consists of the following main steps:

- Post-processing the GPS data in POSPac MMS
- re-attaching the processed data to the recorded imagery with the Position Fixer
- Configuring the video streams in the Movie Player

6.2 Processing: Importing Data

Before the post-processing process can start, the recorded data from the Applanix and the Movie Recorder needs to be moved to the system used for the post-processing.

Images from the Movie Recorder
The recorded images can be found in the folder that was selected in the Movie Recorder.
The recording folder are also given a date and sequence number after the given name.

Log file from the Applanix
Depending on what logging mode you used the log file can be found in the following two places:

- **Ethernet Logging...**
  The Log file can be found in the specified directory.
- **Removable Logging Media...**
  The log file can be found on the USB stick inserted into the Applanix.
  Note: the Applanix USB stick must only be formatted by a Linux system.

- **Back up**
  The Applanix also writes the log to its internal memory as a backup. This log can be accessed by connecting to it via an FTP client such as 'FileZilla'

Folder Structure
We recommend placing all data from same recording into a single directory.

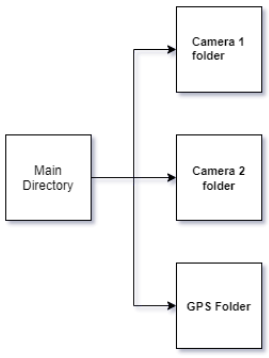


Figure 30: Recording Directory structure

- If you only have a single recording directory containing the data from all the cameras, then create a single 'recording' folder and copy the recording directory to it.
  If you have multiple recording directories for multiple cameras, then create folders for each camera. (Name the folders appropriately; Ladybug as '360', and LIDAR as 'LIDAR' for example.)
- Move the log file from the Applanix into the 'GPS' folder.

Now that your files are in the right place, you can start post-processing.

6.3 Processing: POSPac

The first step is to process the raw data from the Applanix in POSPac MMS.

Step 1
Start POSPac MMS.

Step 2

Click on 'New Default Project' to start a new project.

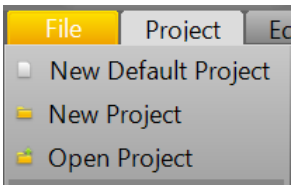
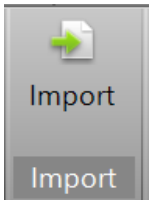


Figure 31: Start New Default Project

Step 3
Import the log file from the Applanix.



Click on the 'Import' to open the import menu.

Figure 32: Import Data

Enter the path to the directory containing the GPS data.

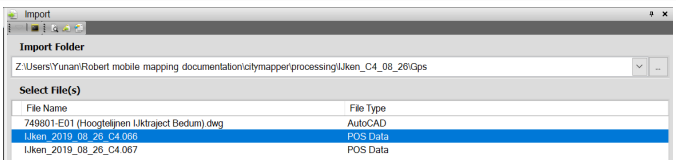


Figure 33: Import Menu

Select the log file, click on Import, and wait for the data to be imported. Once the data has been imported, the trajectory of the data will be shown on the graph.

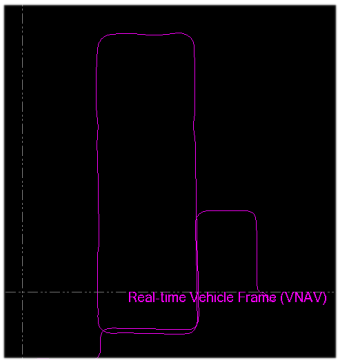
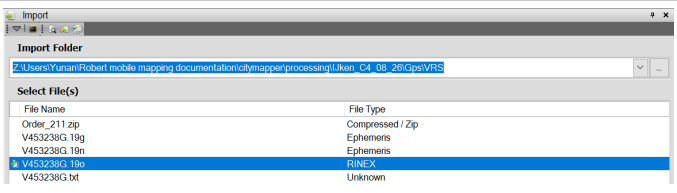


Figure 34: GPS Trajectory on the Graph

Step 4
The next step is to add a base station, it will be used to reference and compare the recorded data to. Using a base station will thus increase the accuracy of the processed data. It is not required to use a base station, but the accuracy of the data will be degraded.

Get VRS or CORS data from providers such as Trimble, ensure the data starts prior to the the start time of your recording and ends after you stopped your recording. Extract the downloaded data to a directory. (We recommend creating a folder inside the directory with the GPS data.)



Enter the path to the directory containing the base station data.

Figure 35: Import Base Station Data

Select the 'RINEX' file and import it. Once the data has been imported, you can find it on the graph.

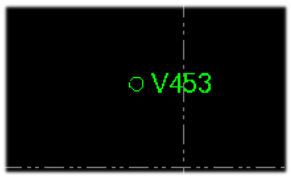


Figure 36: Base Station on the Graph

Step 5
Now that the base station has been added to the graph, we need to tell the system how to interpret the data from the base station data.

Right click on the base station to open a menu.

Select the 'Properties' at the bottom to get the base station its properties on the right side of the screen.
To continue with this step, click on 'Coordinate Manager'.

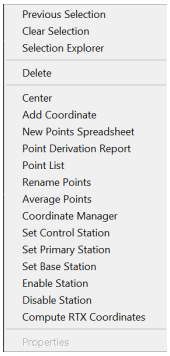
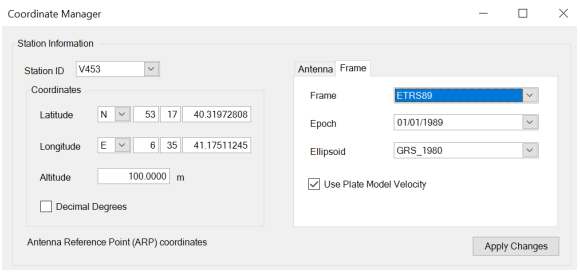


Figure 37: Import Menu



In the Coordinate Manager, select the 'Frame' tab. Set the 'Frame' property to the coordinate system/format that is used in the area of the recording/base station.

Figure 38: Coordinate Manager

Step 6
Right click on the base station icon and in the menu from figure 37 click on 'Set Base Station'.

Once the process has finished, a window will appear showing you the quality of the data.

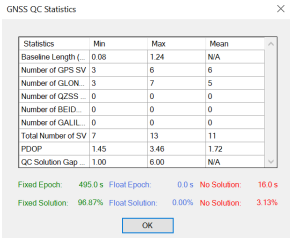


Figure 39: GNSS QC Statistics

The base station icon should now have a flag.

Figure 40: Base station icon after conversion

Step 7
The next step is to set the 'Project Settings'.
Click on 'Project Settings' to open the settings menu, in this menu you will configure the export settings, and set the 'Lever arms and Mounting angles' values.
First, we'll set the '*Export settings*', so go to 'Exports' -> 'Settings'. This will bring you to the menu as seen in figure 42.

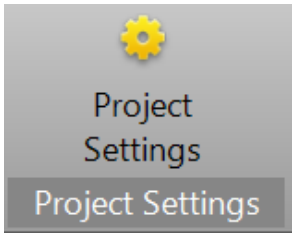


Figure 41: Project Settings

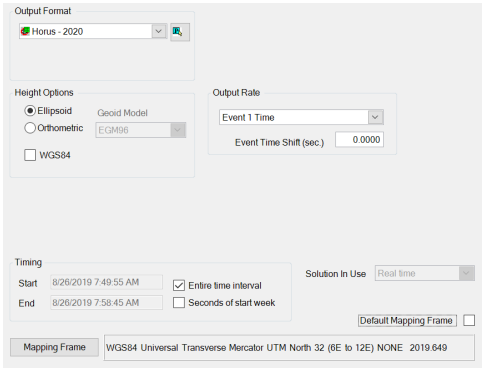


Figure 42: Export Settings

In the menu select the following settings:

1. Set the output format to our 'Horus Format'.
   If the format is not in the list, then you will need to add it.
   This can be done by placing the '<filename>.xsd' file in the following directory:

C:\ProgramData\Applanix\User Format Profiles

2. Set the 'Output Rate' to 'Event 1 Time'.

3. Uncheck the 'Default Mapping frame' box', and then click on the 'Mapping Frame Button'.

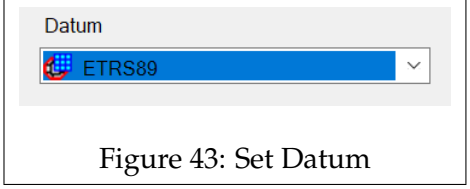


Figure 43: Set Datum

   In the window that opens, set the 'Datum' to the coordinate system of the area you recorded in.

The next step is to enter the *lever arm* values.
These values can be entered by going to: 'GNSS-Inertial Processor' -> 'Lever Arms and Mounting Angles'.

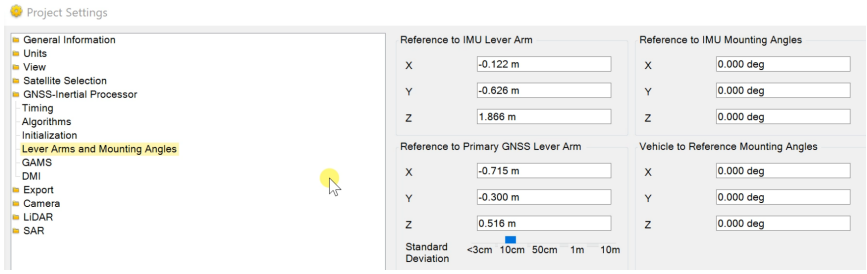


Figure 44: Enter Your Lever Arm Values

- **Reference to IMU Lever Arm**
  The position of the IMU in relation to the reference. (If the IMU is the reference; enter 0,0,0)

- **Reference to Primary GNSS Lever Arm**
  The position of the primary GNSS antenna in relation to the reference.

- **Reference to IMU Mounting Angles**
  The rotation of the IMU in relation to the reference.

- **Vehicle to Reference Mounting Angles**
  The rotation of the reference in relation to the vehicle.

If you have a second GNSS antenna, then you can also enter the GAMS values in the 'GAMS' menu. by comparing the position of the first and second antennas, the heading can be calculated.

The values from for the lever arms and GAMS, should be the same as the ones set in LV POSview. These can be adjusted later on.

Step 8
The system is now almost ready to start processing. Click on the 'GNSS-Inertial Processor' button to open the processing menu.

Figure 45: GNSS-Inertial Processor

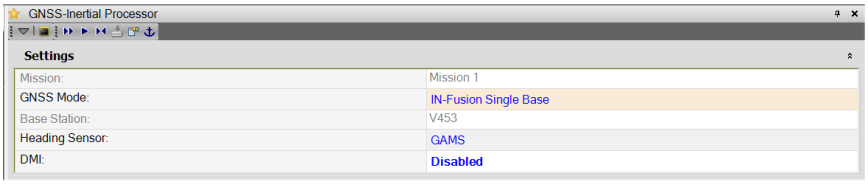


Figure 46: Processing Menu

The processing menu contains a number of settings, ensure that these are set correctly.

GNSS-Inertial Processor Settings

- **GNSS Mode**: Sets the processing mode.
  If using a single base station use: 'IN-Fusion Single Base'.
  When using no base stations use: 'IN-Fusion Autonomous'.
- **Heading Sensor**: Set to 'GAMS' if you have a second antenna.
- **DMI**: *Distance Measurement Indicator*. Enable if you have a wheel speed sensor.

Once the settings have been configured, press the desired processing button at the top of the menu.

The software will then start processing the data, wait till the process has finished. Once finished a green line should be drawn onto the graph, showing the difference between the raw and processed data.

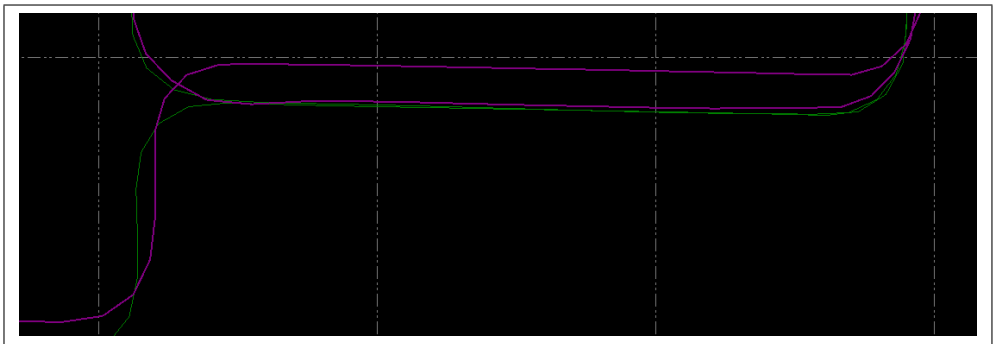


Figure 47: Processed trajectory on the graph

Step 9
The final step is to export the processed data.

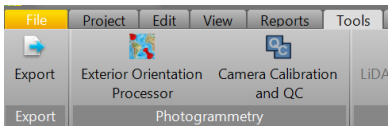


Figure 48: Export Button

Open the Export menu which can be found under 'Tools'.

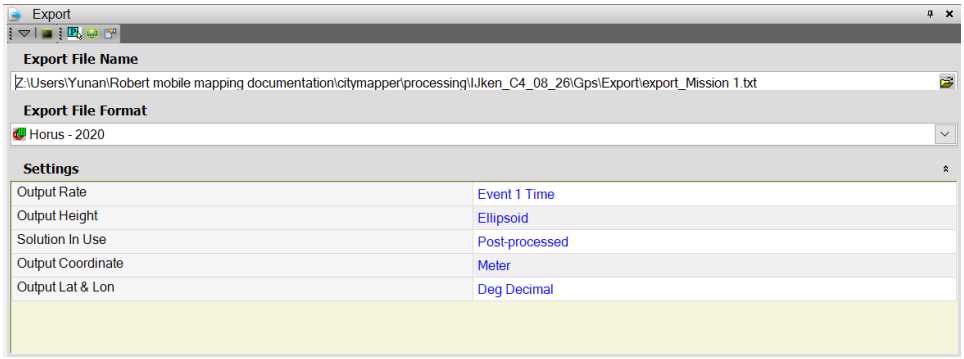


Figure 49: Export Menu

In the Export Menu you can define the directory where the data is exported to.
Ensure that the 'Export File Format' is set to the Horus format, and that the 'Output Rate' is set to 'Event 1 Time'.

Press 'Export' to start exporting the data.
The exported data will be stored in a '.txt' file. The first line of this file shows the coordinate system that is used, check that this is the correct format.

The positional data from the Applanix has now been processed, the next step is to link it to the imagery.

6.4 Processing: Position Fixer

The next step in the process is to attach the positional data from the Applanix to the recordings

- Start the Horus Position Fixer software.

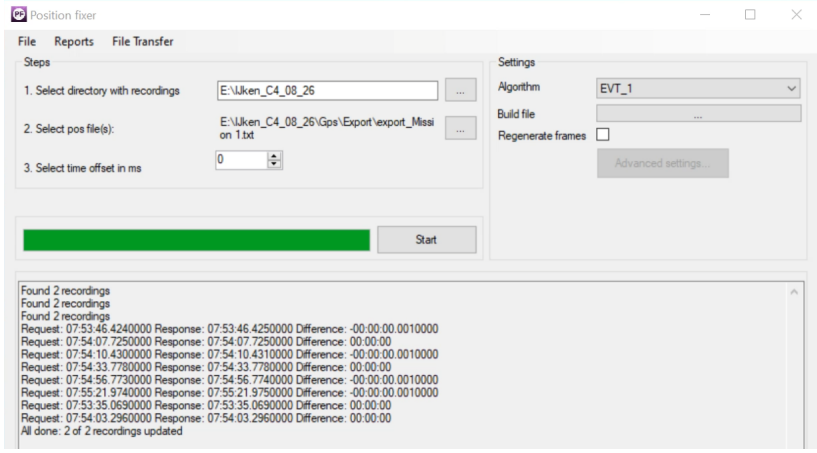


Figure 50: Position Fixer

- Add Paths

  Select directory with recordings: Enter the path to the directory containing the recordings.

  Select POS file(s): Select the pos file that you exported from POSPac MMS.

Regenerating Frames
In some cases, you may want to update your frames file, you can check the 'Regenerate frames' box to renew the frames file.
Alternatively you can also delete the 'frames.xml' file from the recording directory, upon starting the Movie Player a new one will be generated.

When you have added the paths to the recording and pos file, press 'Start', and wait for the process to finish. Once finished, the processed data from the Applanix is attached to the recordings.

6.5 Processing: Movie Player

The recorded data is now ready to be viewed in the Horus Movie Player.

Loading in Recordings
You can load recordings in two ways.

1. Click on one of the '.idx' files in your recording directory, this will start the Movie Player, and load the recordings from that folder.
2. Start the Movie Player and load any '.idx' file from the recording directory, by drag and dropping it on the Movie Player, or selecting it through the 'Open file...' option.

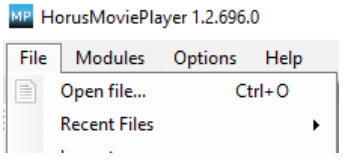


Figure 51: Load Recordings

It does not matter which '.idx' you load, the Movie Player will load in all the data from that folder, provided they are called for in the 'setup.hsf'.

Positioning the video streams
Now that we can view the images from all cameras, we may want to adjust the position, color, etc, of the video streams.
To position each individual video stream, we need the 'Immersive View Builder' module, which can be added to the GUI by going to the Modules tab as seen in figure 52.

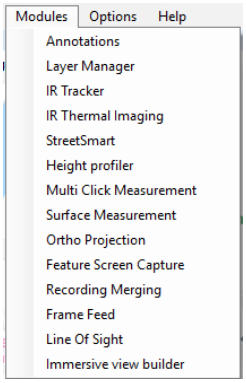


Figure 52: Movie Player Modules Menu

The 'Immersive View Builder' module should be added on the left side of the screen.

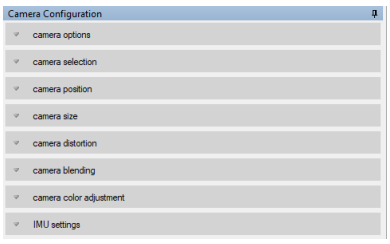


Figure 53: Immersive View Builder Module

Under the '*camera selection*' tab you can choose which video stream you want to edit.
In the '*Camera position/size*' tabs you will find controls to move and resize the image of the selected stream.
To crop and blend the image, use the settings in the 'camera blending' tab.
To correct the colors from the selected stream, use the '*camera color adjustment*' controls.

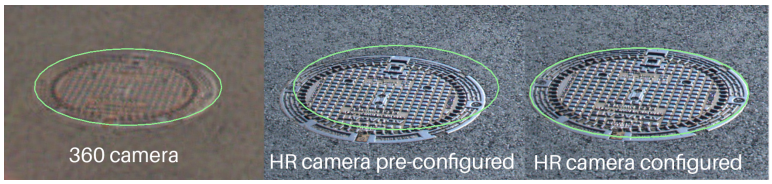


Figure 54: Correcting the camera position

Move the video streams in such a way that they are correctly overlapped, you can make the overlapping view transparent, by adjusting the opacity under the camera blending tab.
The exact position might change depending on the distance of the objects that you are viewing, so set it to the average distance that you wish to view.

Click on the gear icon at the top right to open the 'Settings' menu. Set the camera height, by adjusting the 'cam h' value to the height of the camera's center in meters.

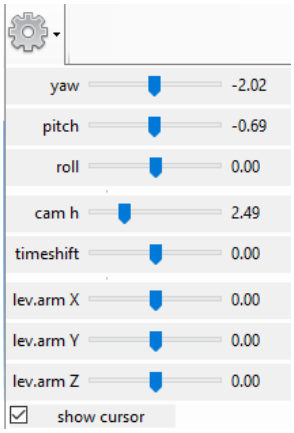


Figure 55: Camera Height

7 Appendix

7.1 Citymapper Spec Sheet

- Configuration & Training on site included
- First year of support Horus Software included
- High resolution camera inserts can be added

Learn more: www.horus.nu

Horus Citymapper

CAMERA	
Spherical camera	FLIR Ladybug 5+
Chip	32 MP CCD
Resolution	8000 x 4000 pixels

RECORDING LAPTOP	
Operating System	Windows 10 (64 bit)
Storage	2 TB internal SSD

ELECTRONICAL DATA	
Power supply input voltage	19 V DC

PHYSICAL CHARACTERISTICS	
Dimensions Set	1655 mm x 208 mm x 558 mm (L xB xH)
Weight Set	22 kg
Transportcase	800 mm x 500 mm x 300 mm (L xB xH)
Total weight incl.case	34 kg

POSITIONING SYSTEM		
POS Type	Professional (e.g Rural) LV125	Advanced (e.g City) LV220
	Accuracy	
X, Y Position (m)	0,050	0,020
Z Position (m)	0,080	0,050
Roll and Pitch (°)	0,025	0,020
True Heading (°)	0,060	0,025

https://www.applanix.com/products/poslv.htm

Software included

CAPTURE

The Horus Movie Recorder
Easy and stable way of capturing hundreds of kilometers a day

VIEW

The Horus Movie Player
View your data with the free Horus Movie Player

EXPLORE

Modules

Layermanager: work with CAD/GIS

Orthotool: export orthophotos (GeoTiff)

Position Fixer: improve imagery with post processed GPS

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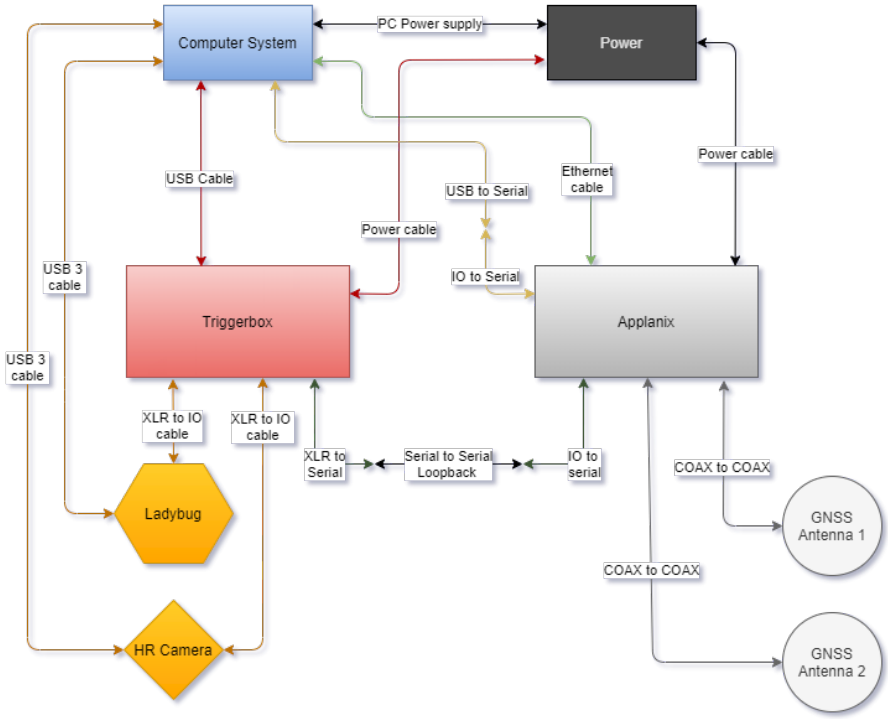
7.2 Citymapper Hardware Diagram

The diagram below shows a system where the Applanix is the trigger. The cable over which the pulses are sent is connected to the 'Trigger In' port of the Triggerbox and the cable has a loopback section in between.



The next graph shows a system with an OBD reader unit as the trigger. The OBD unit is connected to the 'Trigger In' port, whilst the Applanix is now connected via the 'Trigger Out' port and is missing the loopback section.