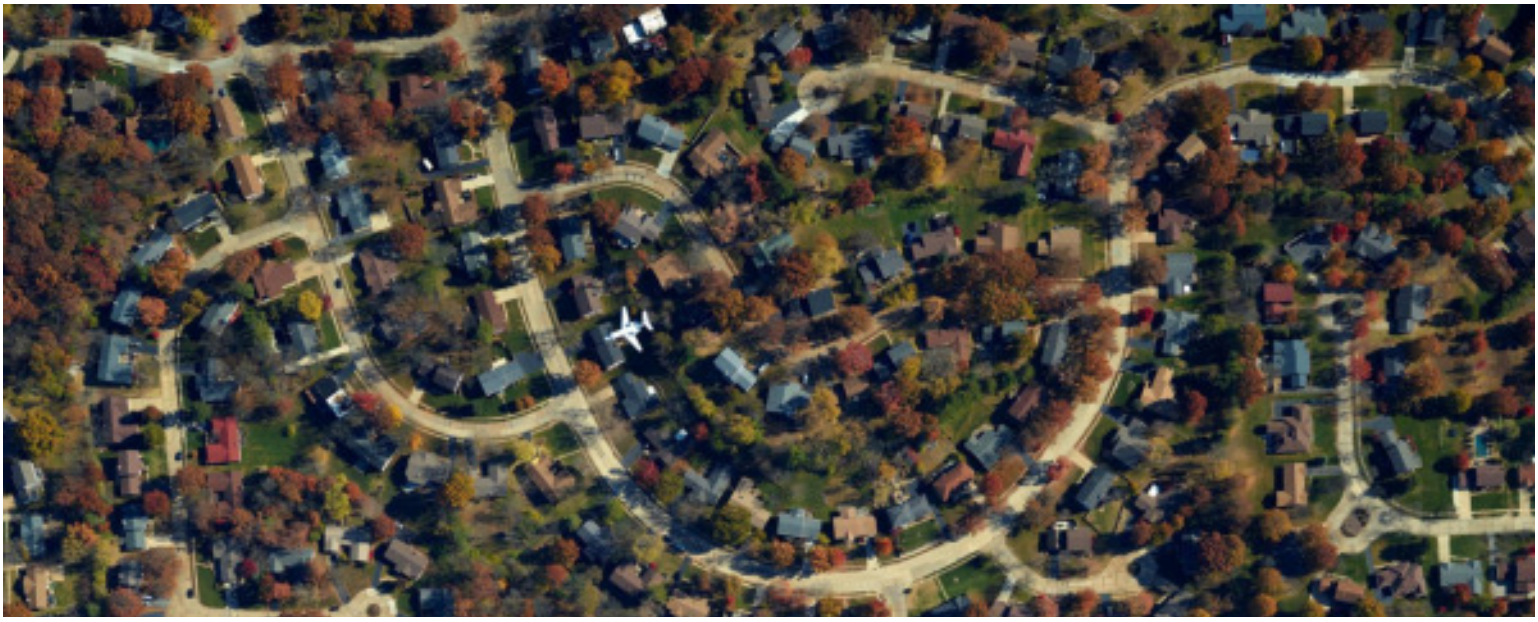
PHASEONE

IMAGING BEYOND IMAGINATION

Phase One Cameras And GNSS/IMU Systems

Installation Guide



1. Introduction

1.1. Phase One Aerial Cameras and GNSS/IMU

Phase One aerial cameras are easy to integrate into new or existing setups and offer compatibility with popular flight management systems, global navigation satellite systems and Inertial Measurement Unit.

This guide will assist you in connecting your Phase One iX Camera with a GNSS/IMU. To understand the exposure sequence, read the appropriate instructions in Phase One iX Camera Installation guides.

1.2. Getting Started

Connecting a Phase One iX Camera to a GNSS/IMU involves three steps:

- Physical connection of the camera to the GNSS receiver
- Configuring the camera
- Configuring the GNSS/IMU

To facilitate communication between your Phase One iX Camera and a GNSS receiver, the parameters in your GNSS receiver and camera must match.

Note: The GNSS receiver must use the same baud rate as the camera (9600, 19200, 38400, 57600 or 115200).

Ensure that your Phase One iX Camera is using the latest firmware. Current firmware is available from https://industrial.phaseone.com/Downloads.aspx.

1.3. Multi-Camera Setup

Phase One iX Cameras can be connected to form an array. Follow the instructions in the Installation Guide for a multi-camera setup to ensure that the cameras are synchronized and that the GNSS data is transferred to all cameras that are connected to each other.

In a multi-camera setup, configure each camera individually for GNSS use. All synchronized cameras share the GNSS data (written to each image).

2. Configuration of GNSS/IMU

2.1.About Communication Modes

A GNSS sends data to Phase One aerial cameras using one of these methods:

- Continuous mode

  The GNSS sends the data in a continuous asynchronous stream to the camera. The output frequency of the GNSS should not exceed 50 Hz. If the GNSS receiver fails to transmit information, the image file will not contain any GNSS data.

- Event driven

  Data is generated by the GNSS at the exact time of the mid-exposure pulse.

  Data output is automatically set to be event driven when you select:

  - ◊ Applanix when using an Applanix receiver
  - ◊ GGS when using a GGS receiver
  - ◊ VectorNav when using VectorNav receiver
  - ◊ IGI when using an IGI receiver
  - ◊ NovAtel when using a NovAtel receiver
  - ◊ OxTS when using an OxTS receiver

Data is automatically set to be Event driven or Continuous driven as follows:

Device Used	Selection in Camera or iX Capture	Communication Mode
NovAtel	NovAtel	Event Driven
Applanix	Applanix	Event Driven
IGI	IGI	Event Driven
GGS / OxTS	GGS or OxTS	Event Driven
VectorNav	VectorNav	Event Driven
Any NMEA device	NMEA Device	Continuous

When using Event driven data streams, the following data is written to the image file:

- NovAtel
  - MARKTIMEA sentence
    - Event ID
    - Time
    - Date
  - MARKPOSA sentence
    - Event ID
    - Position
  - MARK1PVAA sentence
    - Event ID
    - Time
    - Date
    - Position
    - Dynamics
    - Speed
- Applanix
  - EVT sentence
    - Event ID
    - Time
    - Position
- Dynamics IGI
  - ACEVT sentence
    - Event ID
    - Time
    - Date
    - Position
    - Dynamics
- VectrorNav (iXM only)
  - VNINS sentence
    - Date
    - Time
    - Dynamics
    - Position
    - Speed
- GGS or OxTS
  - GGA sentence
    - Time
    - Position
  - ZDA sentence
    - Time
    - Date
  - VTG sentence
    - Speed
  - GLL sentence
    - Time
    - Position
  - GST sentence
    - Time
  - PASHR sentence
    - Time
    - Dynamics

When using Continuous data streams, the following data is written to the image file:

- NMEA GGA sentence
  - Time
  - Position
- NMEA ZDA sentence
  - Time
  - Date
- NMEA VTG sentence
  - Speed
- NMEA GLL sentence
  - Time
  - Position
- NMEA GST sentence
  - Time
- NMEA PASHR sentence
  - Time
  - Dynamics

2.2.Configuring a Camera for GNSS/IMU Recording

iXU and iXA cameras can be configured for connectivity to a GNSS/IMU via the camera itself or via iX Capture. iXM cameras can only be configured via iX Capture (For more details, view the user guide on industrial.phaseone.com)

To configure your camera (with LCD) to work with your GNSS:

1. Open the Home screen and select Menu > GPS.
2. Select GPS Receiver dialog.
3. In the GPS Receiver dialog select the GNSS receiver to use:
   - NMEA device
   - NovAtel
   - Applanix
   - IGI
   - GGS or OxTS
   - VectorNav (iXM only)

   The GPS Settings dialog appears and displays the device that you selected.
4. Select GPS Settings Baud Rate.
5. In the GPS Baud Rate dialog select the GPS Baud Rate to use:
   - 9600
   - 19200
   - 38400
   - 57600
   - 115200

   The GPS Settings dialog displays and displays the baud rate.
6. Select GPS.
7. In the GPS dialog select operation mode:
   - On
   - Off

   The GPS Settings dialog displays and shows the selection.

2.3.Configuring a GNSS/IMU Device

To configure the serial port on your external device:

1. Set the external device as follows:
   - Baud rate: 9600, 19200, 38400, 57600 or 115200 bps
   - Data: 8 bits data
   - Parity: none
   - Stop: 1 bit
2. Set the appropriate sentences that you want written to the image according to the receiver you have selected.

   If you are using an Applanix receiver, select at least one of these:
   - PAPLEVT1 (Applanix)
   - EVNTPA (Applanix)

   If you are using a NovAtel receiver, select at least one of these:
   - MARKTIMEA (NovAtel)
   - MARKPOSA (NovAtel)
   - MARK1PVA (NovAtel)

   If you are using an IGI receiver, select this:
   - ACEVT (IGI) mandatory

   If you are using a GGS or OxTS receiver, select at least one of these:
   - NMEA GGA sentence
   - NMEA ZDA sentence
   - NMEA VTG sentence
   - NMEA GLL sentence
   - NMEA GST sentence
   - NMEA PASHR sentence

   If you are using a VectorNav receiver, select this:
   - VNINS (VectorNav) mandatory
3. Select at least one of the following (the following sentences are supported by the camera in NMEA devices):
   - NMEA GGA sentence
   - NMEA ZDA sentence
   - NMEA VTG sentence
   - NMEA GLL sentence
   - NMEA GST sentence
   - NMEA PASHR sentence

3. Wiring Camera Control Cable

Connect the GNSS/IMU to the camera with a Phase One iX Control cable (supplied with the camera kit). This cable has a LEMO-secured connector on one side for the camera and an open side with nine (28 AWG) wires for connection to your system.

The table below describes the functionality of the wires in the camera control cable for connection to a GNSS/IMU.

Connector Pin	Color	Name	Description		Level	Notes	Connect to:
4	Purple	Trigger in	Trigger the camera for a new exposure cycle.	In	VIH, min = 2.4 V VIL, max = 0.8 V tiF, tiR < 1uSec	Isolated, active low (for manual triggering; activate by short to common signal, otherwise leave floating.)	
5	Blue	RS232 RX	External system; can send specific information (GNSS) to camera.	In	RS232 input level ±15V (VIT+ max = 2.4V) (VIT- min = 0.8V)	Isolated. 9600, 19200, 38400, 57600 or 115200 Baud, 8 data bits, Parity: none, Stop bit: 1	
7	White	Mid Exposure	Midpoint of the exposure time.	Out	VOH, min = 4.0V (Io = –4mA)	Isolated 5 Volt Level	
8	Gray	Reserved					Short to pin 9*
9	Black	Common					

- VIL: Maximum voltage level is interpreted as a ‘0’ by an input
- VIH: Minimum voltage level is interpreted as a ‘1’ by an input
- VOL: Guaranteed maximum voltage level that appears on output to ‘0’
- VOH: Guaranteed minimum voltage level that appears on output set to ‘1’
- VIT-: Input threshold voltage when the input voltage is falling
- VIT+: Input threshold voltage when the input voltage is rising

* For iXM / iXU camera products, this connection is mandatory. This connection is not necessary for iXA camera products.

4. GPS Data in Image Files

The camera system extracts GPS data received from the GPS receiver and stores it in the image metadata section. Only the parameters provided by the GPS/IMU device and based on the selected sentences are stored. The GPS event ID is always stored (with value of 0) in case there is no GPS data at all or in case there was no synchronization event.

4.1 Viewing GPS Data in Image Files

You can use an XMP viewer to see the GPS data in processed files. Partial data is viewable in Capture One's Metadata tab.

The data is located in the image XMP block (XML packet containing XMP metadata). This is TIFF extension tag number 700 (0x2BC) with the name "XMP".

Parameters are stored in two sections:

- 'exif' (for parameters that comply with the Exif standard)
- 'aerialgps'

4.2 GPS data parameters

GPS data parameters are listed below; XML parameter tags are shown in brackets:

1. Event ID (*GPSEventID*) — a unique number for matching an image with GPS marked output sentences.
2. Position
    - ◊ Latitude (*GPSLatitude*) — degrees, minutes, decimal minutes, direction (N/S)
    - ◊ Longitude (*GPSLongitude*) — degrees, minutes, decimal minutes, direction (W/E)
    - ◊ Altitude (*GPSAltitude*) — numerator, '/' and denominator in meters
    - ◊ Altitude reference (*GPSAltitudeRef*), integer:
        - 0 = above sea level
        - 1 = below sea level
3. Speed
    - ◊ Speed (*GPSSpeed*) — numerator, '/ ' and denominator
    - ◊ Speed reference (*GPSSpeedRef*):
        - 'K' for km/h
        - 'M' for mph
        - 'N' for knots
    - ◊ Track (GPSTrack) — degrees in format of numerator, '/ ' and denominator
    - ◊ Track reference (*GPSTrackRef*):
        - 'M' for magnetic north,
        - 'T' for true north.
4. Date (*GPSDateStamp*) — format: yyyy-mm-dd
5. Time (*GPSTimeStamp*) — GPS time; format: hh:mm:ss.sss.

Note: If time is UTC time, rather than GPS time, an additional *UTC offset* is added.
The format is: ±hh:mm.

6. Dynamics

   ◊ Pitch (*GPSIMUPitch*) — numerator, '/' and denominator.
      - Positive = nose up
      - Negative = nose down

   ◊ Roll (*GPSIMURoll*) — numerator, '/' and denominator.
   Positive = right wing down; Negative = right wing up.

   ◊ Yaw (*GPSIMUYaw*) — degrees in format of numerator, '/' and denominator.

   ◊ Yaw reference (*GPSIMUYawRef*):
      - 'M' for magnetic north
      - 'T' for true north.

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