



# EAN-Stabilization

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**CAUTION:** Alerts to a potential hazard that may result in personal injury, or an unsafe practice that causes damage to the equipment if not avoided.

**IMPORTANT:** Identifies crucial information that is important to setup and configuration procedures.

*Used to emphasize points or reminds the user of something. Supplementary information that aids in the use or understanding of the equipment or subject that is not critical to system use.*



## 1 Overview

This document describes an overview of how to use video stabilization to remove the jitter (shake) from a video source by its environment or by being on an unstable or moving platform. This vibration or movement can cause the video to appear blurry, specifically at high zoom. The SightLine firmware removes the blur caused by motion and provides a higher quality and stable video output for the operator.

### 1.1 Additional Support Documentation

Additional Engineering Application Notes (EANs) can be found on the [Documentation](#) page of the SightLine Applications website.

The [Panel Plus User Guide](#) provides a complete overview of settings and dialog windows located in the Help menu of the Panel Plus application.

The Interface Command and Control (IDD) describes the native communications protocol used by the SightLine Applications product line. The IDD is also available as a PDF download on the [Documentation](#) page under Software Support Documentation.

### 1.2 SightLine Software Requirements

**ⓘ IMPORTANT:** The Panel Plus software version should match the firmware version running on the board. Firmware and Panel Plus software versions are available on the [Software Download](#) page.

### 1.3 Application Bit Requirements

The functions described in this EAN require Application Bits (app bits) purchased from SightLine. App bits are enabled with a license file provided by SightLine at initial unit purchase or during a license upgrade process. License files use a hardware ID that is applicable to a specific hardware serial number. For questions and upgrade support contact [Sales](#).

**Table 1: Application Bits Requirement Table**

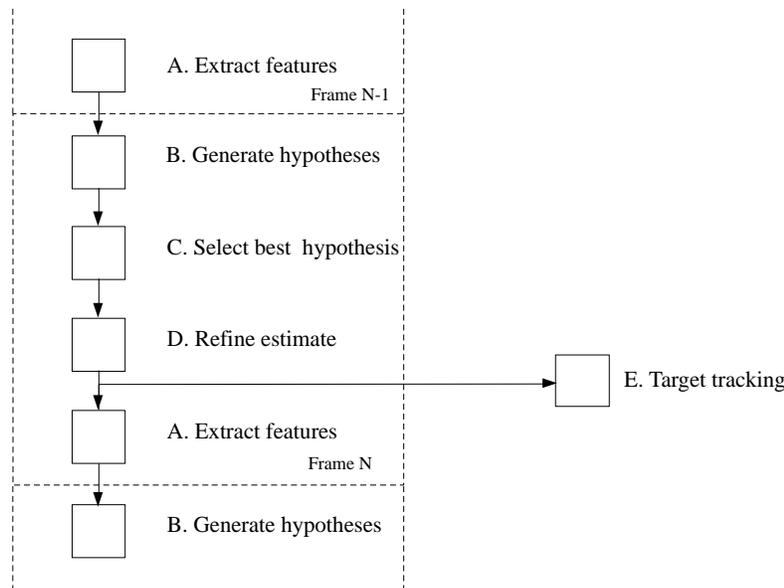
Function	Initial Software Release	Required Application Bit(s) v7 License
Stabilization	1.0.xx	Stabilization 0x0000 0002 Optional - Telemetry 0x000 00040 for frame-to-frame motion telemetry.

## 2 Video Stabilization

Video stabilization utilizes an estimate of frame-to-frame registration to calculate the adjustment of each frame of video necessary to closely match the previous frame, which compensates for rapid camera movements.

SightLine firmware is engineered for security, commercial and industrial applications for off-the-shelf camera systems that do not provide stabilization. Tunable parameters adjust how rapidly the stabilization adapts back to center, enabling an operator to trade off good stabilization with camera steering lag introduced by stabilization.

The video stabilization and object tracking algorithm is a two-step process consisting of frame-to-frame registration followed by target tracking. The registration and tracking algorithms are shown at a high level in [Figure 1](#) and [Figure 2](#).

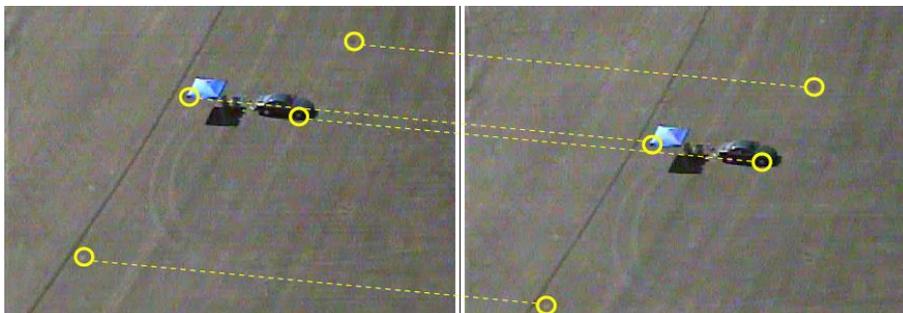


**Figure 1: Frame-to-Frame Registration and Tracking Steps**

Image registration estimates a frame-to-frame transformation between each video frame and the previous frame by maximizing correlation between control points.

To perform registration of one frame to the next:

- A) A set of features are identified and extracted from the current frame. These features are selected based on their local contrast to ensure that they will be robustly identified in the next frame.
- B) Using a subset of these features, the next frame is examined. A set of candidate hypotheses with quantized parameters (transformations in  $\Delta x$ ,  $\Delta y$ ,  $\Delta\theta$ , and  $\Delta\text{scale}$ ) are generated based on the degree of similarity (correlation) between the transformed subset of features and the image data in the next frame at the corresponding location.
- C) Each hypothesis is then evaluated using the complete set of extracted features to select the best matching transformation.
- D) The transformation parameters are interpolated to achieve a non-quantized estimate of the true transformation. The estimated transformation is used for several purposes including:
  - Scene Steering
  - Moving Target Detection
  - Video Stabilization
  - Denoising
  - Object Tracking



**Figure 2: Matching Features Between Frame N-1 and Frame N**



## 2.1 Stabilization Configuration

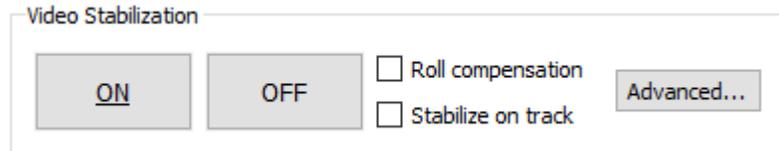


Figure 3: Video Tab - Panel Plus

*Roll compensation:* Helps achieve a steady video output by compensating for camera vibration in the roll axis.

*Stabilize on track:* Used when shifting the image during tracking so that the primary target is centered in the image.

More settings can be set in the [Advanced Registration and Stabilization](#) dialog that include disabling stabilization or saving registration telemetry to a local file.

## 2.2 Stabilization and Registration Configuration Examples

All parameters described in the set registration and set stabilization parameters packets in the [Command and Control Protocol \(IDD\)](#) are set from this dialog.

### 2.2.1 Airborne Camera Gimbal Example

The default settings shown in [Figure 4](#) are a good starting point for an airborne camera that can experience significant camera motion.

Uncheck *Stationary Camera Low Drift*.

Use the [StabilizationBias \(0x9F\)](#) command to feed forward user-controlled camera motion so that stabilization does not conflict with camera pan and tilt.

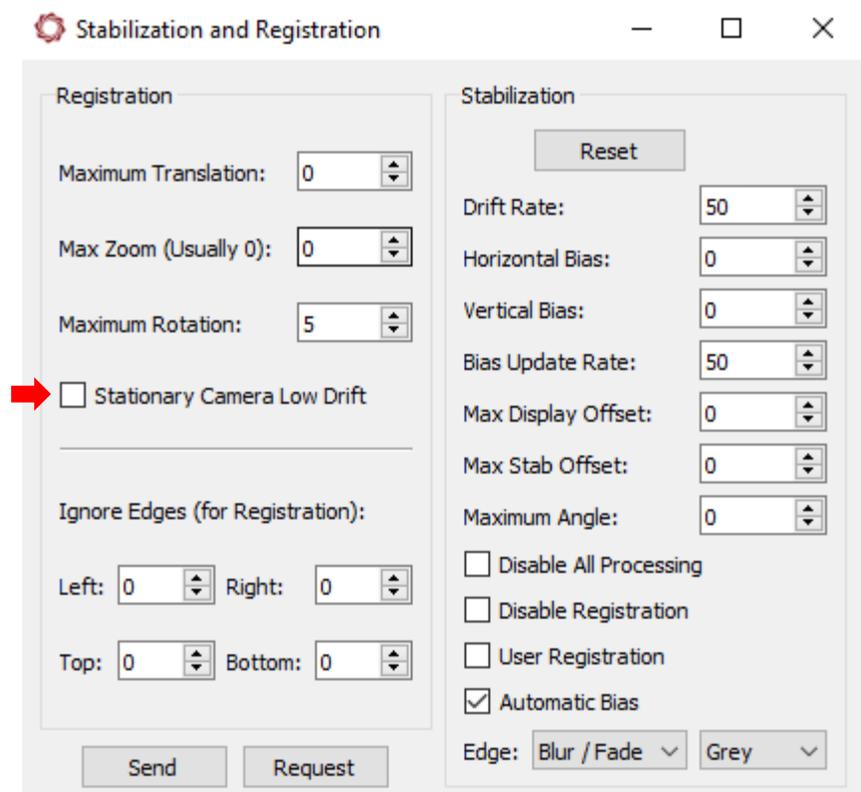
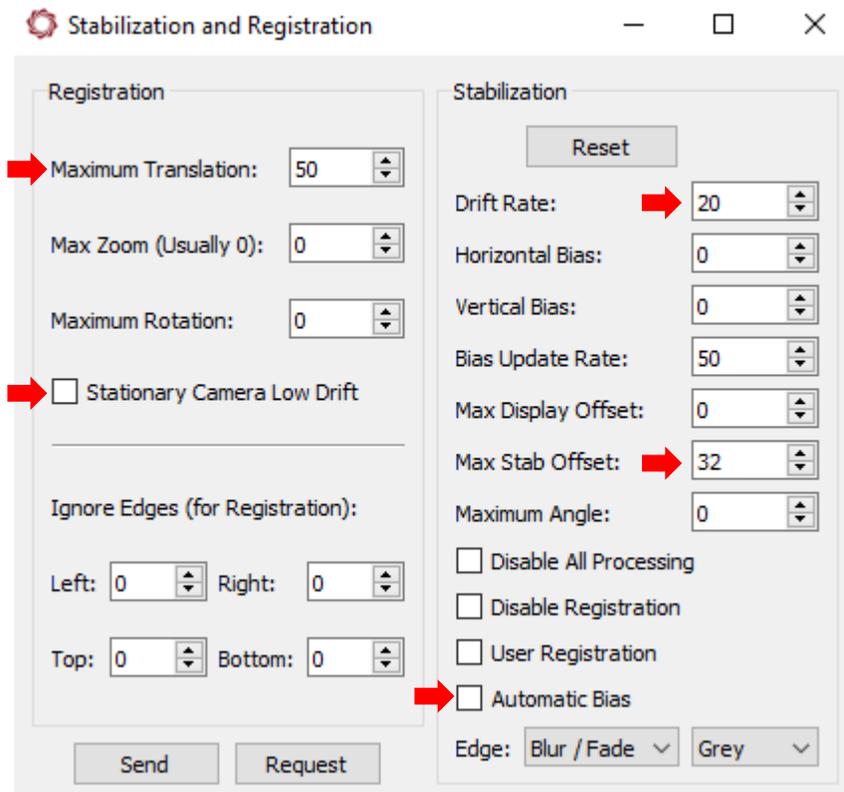


Figure 4: Airborne Moving Camera Stabilization Default Settings



## 2.2.2 Fixed or Ground Mounted PTZ Camera Example

A fixed mount camera or PTZ with a stable mount works best with additional changes to the default settings as shown in [Figure 5](#).



**Figure 5: Fixed Mount Camera Stabilization**

- *Maximum Translation:* (optional): Set to 50 - 100. Faster and more robust in a camera with small motion.
- *Maximum Rotation:* Set to 0. Faster and more robust in a non-rolling camera.
- *Stationary Camera Low Drift:* Uncheck this setting. If the camera is fixed and staring at the same scene for a long period of time and there is concern about scene drift, leave it checked.
- *Drift Rate:* Helps to stabilize the image.
- *Bias:*
  - If there is excessive camera pan and tilt motion, check *Automatic Bias* and *Horizontal Bias* and *Vertical Bias* controls.
  - If the camera mostly fixed and staring, uncheck *Automatic Bias*. Use the *Max Stab Offset* control to prevent large borders from forming during camera pan and tilt.



### 2.2.3 Moving Vehicle Mounted Camera Example

The default settings are generally a good starting point for an airborne camera which may experience significant camera motion.

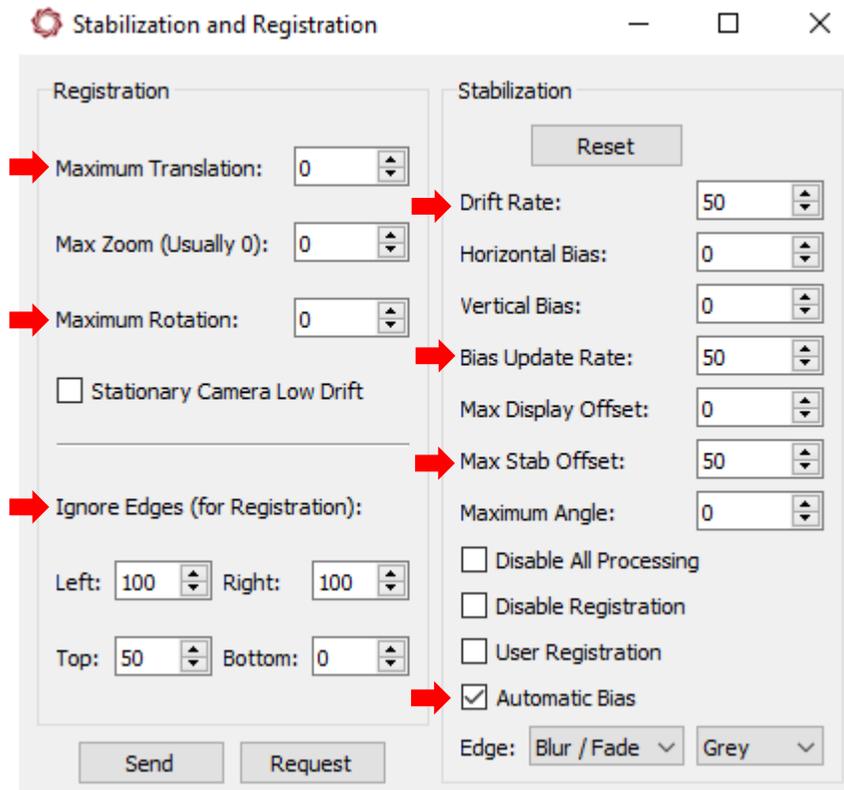


Figure 5: Moving Vehicle Stabilization Example

- *Maximum Translation*: Set to 0 to allow significant motion.
- *Maximum Rotation*: If there will be minimal camera roll set to 0. If there is roll instability, start with a value between 1 and 3.
- *Max Stab Offset*: Prevents large lags in stabilization with rapid change in direction.
- *Automatic Bias*: Keeps the image centered through turns.
- *Ignore Edges*: Focuses on the center of the screen. This is especially useful with a wide field of view on a front looking camera where the scene at the left and right edges may be moving in different directions.

To see the resulting registration region, go to the *Overlays* tab » *Advanced Overlay Settings* and check *Registration Ignored Edges* in the dialog window.

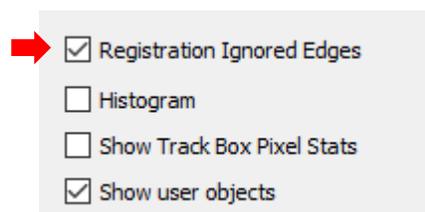


Figure 6: Advanced Overlay Settings Dialog - Show Registration Region

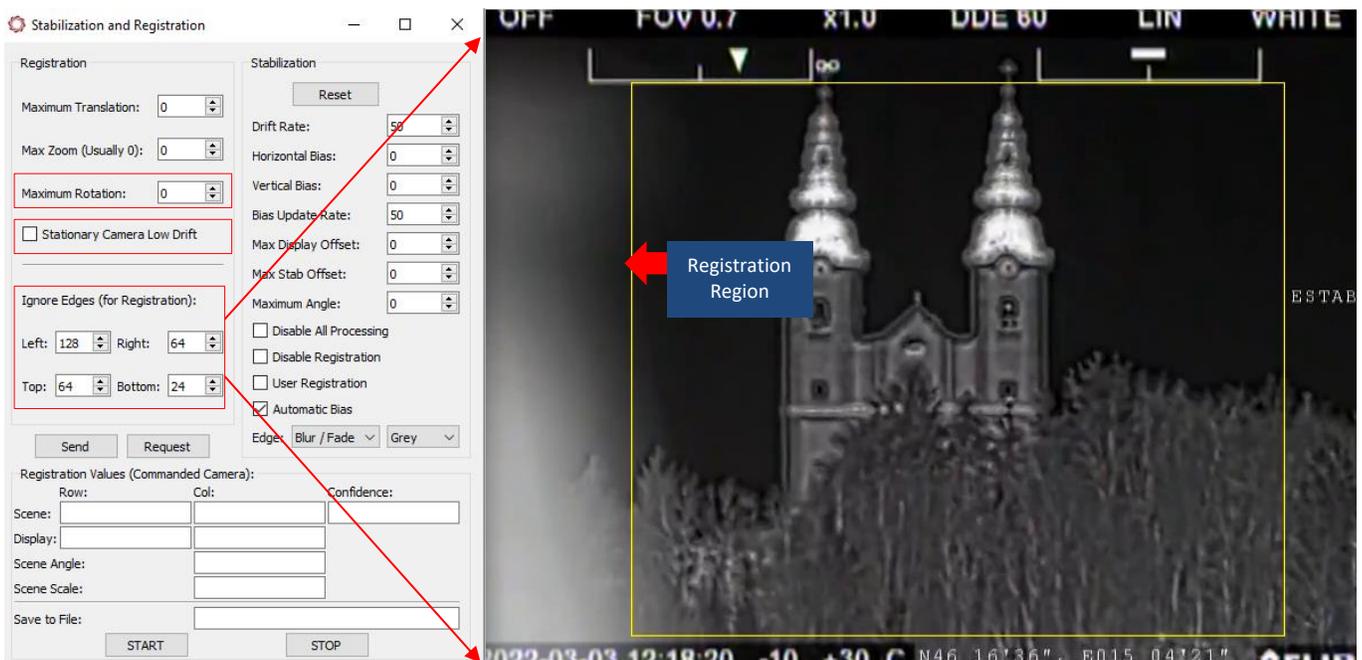


## 2.2.4 Camera Overlays and Obstructions

Image graphics in the camera will adversely affect stabilization. They often show up with strong edges that can confuse the frame-to-frame registration algorithm. If possible, turn these off and add graphics with the OEM board.

If it is not possible to turn these graphics off in the camera, use the settings in *Ignore Edges (for Registration)* section as shown in [Figure 7](#).

To show the yellow registration region, go to the *Overlays* tab » *Advanced Overlay Settings* and check *Registration Ignored Edges* in the dialog window. Similarly, to exclude obstructions from the area used for registration use the settings in the *Ignore Edges (for Registration)* section.



**Figure 7: Ignore Edges with Camera Produced Graphics**

## 2.2.5 Non-Image Edges

In some instances, the input video has a black frame around it as it comes out of the camera that can adversely affect stabilization. This frame may only be on some of the edges. In [Figure 8](#), the black frame around the video will need to be defined for the registration algorithm to ignore. Otherwise, this may cause false registration results and poor tracking performance.

To define the edges to ignore, go to the *Overlays* tab » *Advanced Overlay Settings* in Panel Plus and check *Registration Ignored Edges* in the dialog window.

In the *Stabilization and Registration* dialog window define the number of pixels per edge to ignore. The yellow frame overlay will help to confirm that no black edges are fed into the registration algorithm as shown in [Figure 8](#).

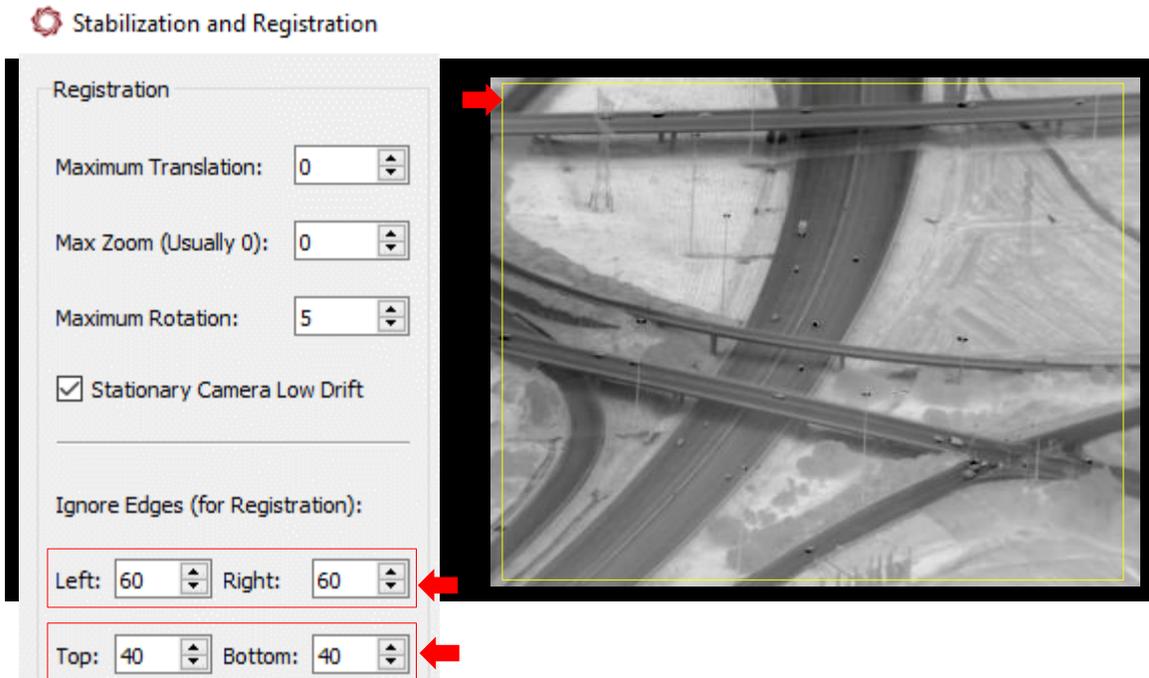


Figure 8: Defining Edges to Ignore

### 3 Questions and Additional Support

For questions and additional support, please contact [Support](#). Additional support documentation and Engineering Application Notes (EANs) can be found on the [Documentation](#) page of the SightLine Applications website.