STEVE-6D

User Manual

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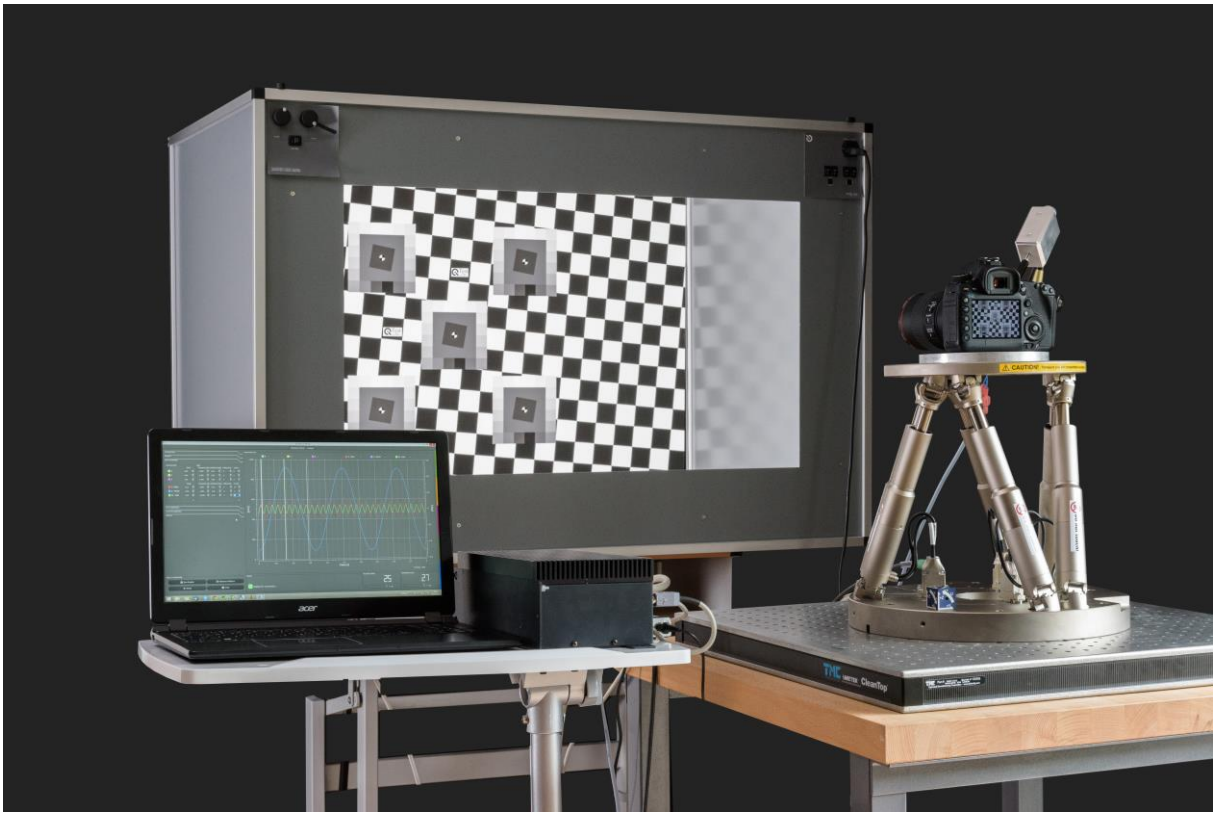
CONTENT

1 INTRODUCTION

The STEVE-6D software evaluates the image stabilization performance of digital cameras. The following example consists of an analyzation of low contrast slanted edges from the TE261 test chart. In order to capture enough images for evaluation, the camera is mounted to the STEVE-6D and is then vibrated while the image stabilization function of the camera is switched on and off for different exposure times. From here, the software analyzes the edge width of the blurred slanted edges and then calculates the stabilization performance in f-stops. This software is also able to control the iQ-Trigger and the STEVE-6D hardware itself with a sine wave generator, custom user waveforms, or the CIPA custom handshake.



STEVE-6D - Turnkey solution

2 GRAPHICAL USER INTERFACE

The STEVE-6D software is divided into two different major modules, one for communication to STEVE-6D hardware and the other for image stabilization performance calculation [1].

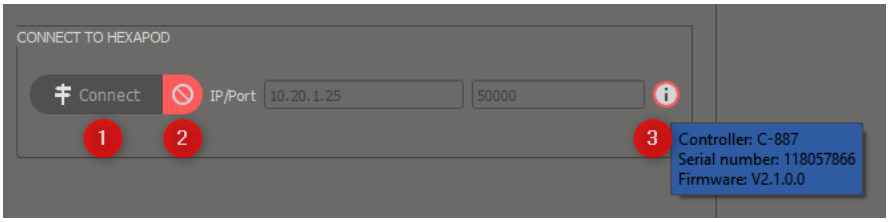
Module for vibration control of STEVE-6D

2.1 VIBRATION CONTROL MODULE

The “VIBRATION CONTROL” module sets up waveform data and manages the interface between the STEVE-6D and the iQ-Trigger. The “VIBRATION CONTROL” is divided in 4 different parts. The first part [2] switches amongst the following tabs.

2.1.1 CONNECTION TAB

To get a connection with STEVE-6D simply click the “Connect” button [1] and the STEVE-6D will automatically reference all six axes to position zero. For disconnecting, click the red button [2] to the right. Hovering the mouse cursor over the information item [3] will reveal some information about the connected controller, such as serial number and firmware version in the tooltip.



Connection tab

2.1.2 PRESETS TAB

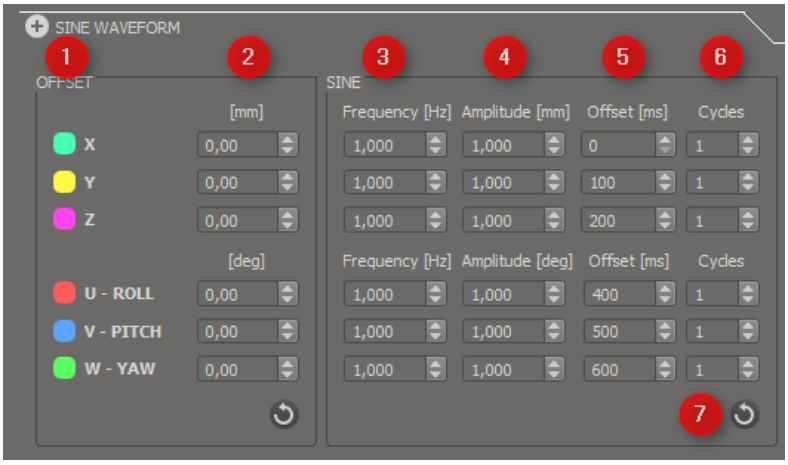
The camera system can be easily aligned by defining the rotation point, known as the pivot point [1], and the local home/zero position [2]. Every waveform data curve refers to this position.
The default pivot point (x=y=z=0) is located at the bottom center of the retaining plate. You can change its position to what is best for your application. For example, with a mobile phone it makes sense to set the pivot point to the center of the phone as this is usually the center of rotation when its hold by a user. However, an SLR camera probably has a different center of rotation due to its very different geometry.

Presets tab

After defining a new pivot point, it is necessary to click the "Set" button [3]

2.1.3 SINE WAVEFORM TAB

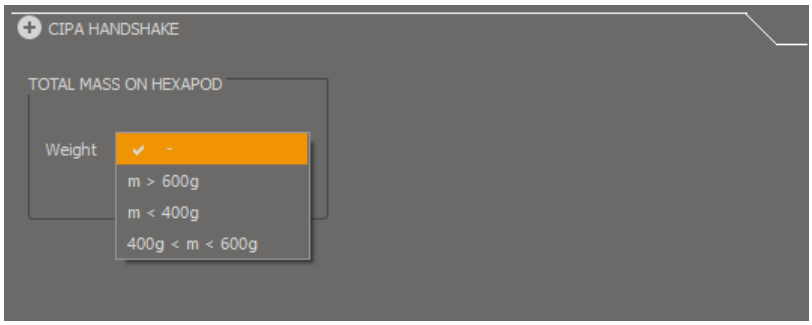
A sine wave generator for each axis creates a quick way to set up waveform data. To define a new waveform simply change the values of the offset in relation to position [2], frequency [3], amplitude [4] and time offset [5]. The "Cycles" [6] spin box defines how often the sine should repeat. To perform the waveform just click the "MOVE" button. To reset set values, click the button in the lower right-hand corner [7].



Sine waveform tab

2.1.4 CIPA HANDSHAKE TAB

To perform any of the three CIPA handshakes, first select the weight of the optical system. From there the waveform data is automatically uploaded to the STEVE-6D controller and movement begins when the MOVE button is clicked. Due to the CIPA nondisclosure agreement, the “WAVEFORM PLOT” is just an example.



CIPA handshake tab

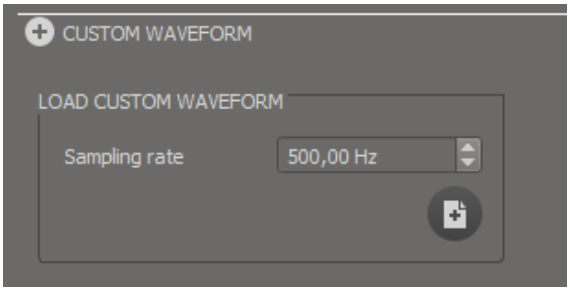
2.1.5 CUSTOM WAVEFORM TAB

2.1.5.1 BY STANDARD WAVEFORM

Upload a custom waveform to STEVE-6D by creating a simple .txt file with Cartesian coordinates. All values have to be separated with a tab stop. The axis sequence is X Y Z U V W. Set the sampling rate of the waveform in the STEVE-6D software and then load the .txt file to the software. All coordinates are irrespective of the pivot point and homing position. The waveform upload starts automatically after the .txt file is loaded into the STEVE-6D software.

File definition for standard waveform: (Use tab as separator)

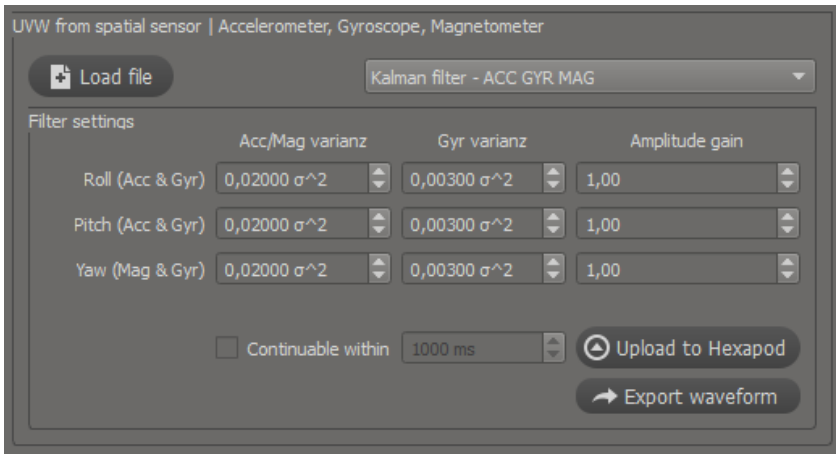
X[mm]	Y[mm]	Z[mm]]	U[deg]	V[deg]	W[deg]



Load .txt file and set sampling rate

2.1.5.2 BY SPATIAL DATA

Use the spatial sensor data when analyzing certain devices such as a smartphone (accelerometer, gyroscope, magnetometer). In order to get more precise rotation values, set the parameter for Acc/Mag & Gyr varianz. The amplitude gain is only for scaling the amplitude. After all parameters are set, click the upload to hexapod button to begin the movement. The continuable checkbox will allow the user to set a duration for the waveform to continue as long as the start position is different from the end position. There is also the option to use only the accelerometer or gyroscope data.
The export waveform button can be utilized to save the waveform as well as for the IS performace calculation. The data sampling rate is 1000Hz.



Spatial sensor settings

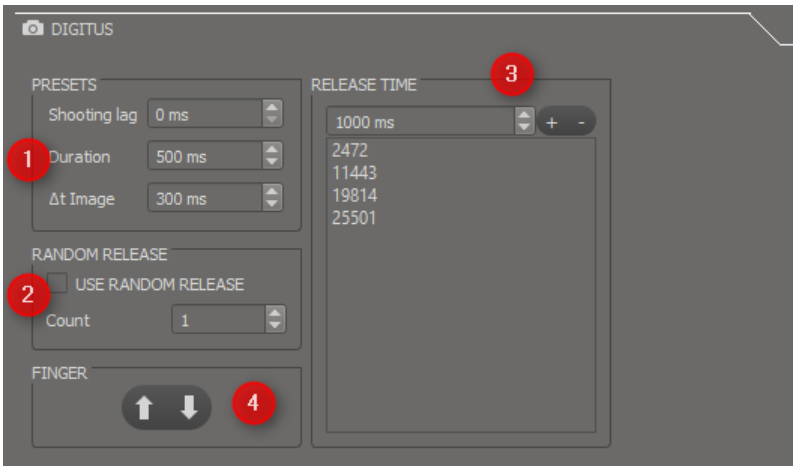
File definition for UVW from spatial sensor:

HH:MM:SS.ZZZZ	AccX[g]	AccY[g]	AccZ[g]	GyrX[rad/s]	GyrX[rad/s]	GyrX[rad/s]	Mag[µt]	Mag[µt]	Mag[µt]

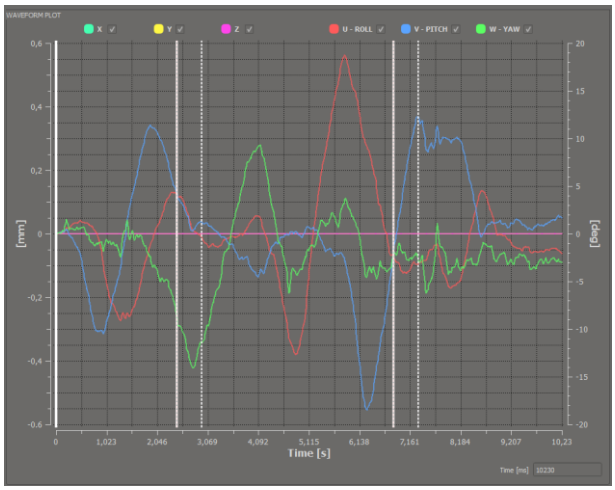
Use tab as separator.

2.1.6 IQ-TRIGGER TAB

Remote camera release can be performed with the iQ-Trigger. It is possible to define multiple release times by clicking in the “WAVEFORM PLOT” or by manually choosing the time in the iQ-Trigger tab [3]. If a random release time is needed, then simply define the count of releases per waveform [2]. Every iQ-Trigger release is defined by the shooting lag, the release duration and the delta time between two camera releases [1].



iQ-Trigger settings



Vertical lines indicate the Digitus release times

2.1.7 SEND TO HARDWARE, STATUS AND IMAGE/WAVEFORM COUNT

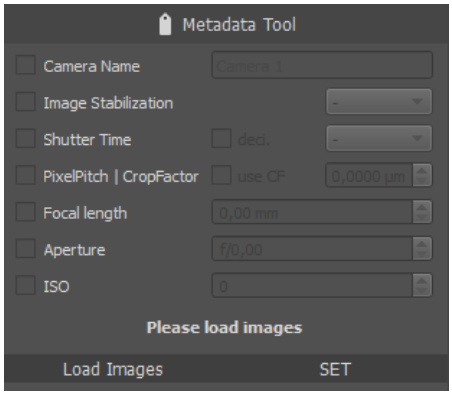
All information about the connection status or errors are displayed in the “STATUS” area. For starting a movement hit the “MOVE” button. By clicking the “Home Position” button, the STEVE-6D moves directly to the homing position, which was set previously in the “PRESETS” tab. If it is necessary to recalibrate the STEVE-6D, click the “Reference Platform” button. By defining a value for “PICTURE TAKEN” or “WAVEFORM CYCLE” it is possible to automatically stop the motion of STEVE-6D. Set the value to unlimited [2] or choose a value for the number of counts [1] the iQ-Trigger should trigger or the waveform should execute.

2.2 ANALYZE DATA

The Image Stabilization calculation is done by the “Analyze Data” module. This module has three major parts. The first part is the “Metadata Tool” [1], which sets the camera metadata. The second part is the image batch processing for the IS-Performance calculation [2]. The final part displays the results of the captured images.

2.2.1 METADATA

It’s important to have some camera metadata information for IS-Performance calculations such as pixel pitch and shutter time. If the camera doesn’t record this information in the image file, then load a batch of images and manually write it into the .jpg image. Simply load the images and set the parameters and then hit the “SET” button.



Only for JPEG images

2.2.2 LOAD IMAGES FOR IS-PERFORMANCE CALCULATION

Once the reference series is loaded, then choose a test series for IS-ON. At least one image series for IS-OFF is required. If the CIPA handshake waveform was used, the test series for IS-OFF is not needed and instead click the button for CIPA then select the camera weight. Images from custom waveform measurements may be loaded by clicking the custom motion data button. The “analyze image center only” checkbox is available for quicker but less precise data. When choosing this option, only the middle edge box is used during the calculation.

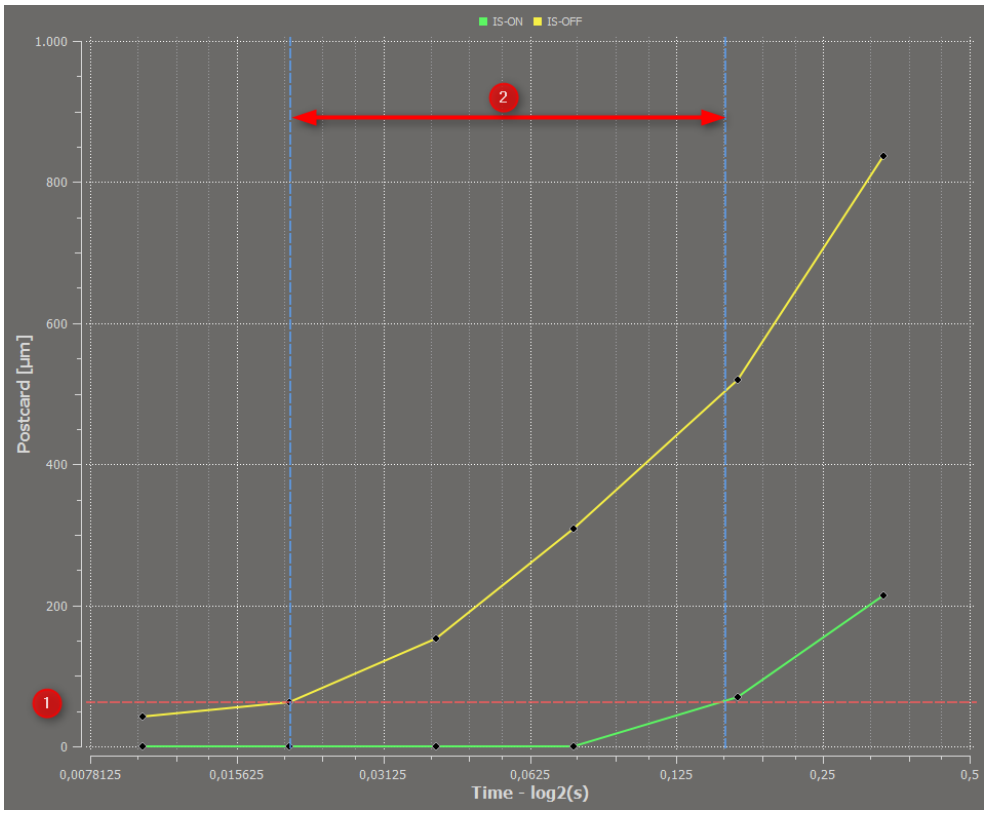
Once the options have been chosen, there is next a tree view of the different series, as seen below. If there is no image metadata available, then use the “Metadata Tool”, which is indicated by an error message after the images are loaded to the STEVE-6D software.

Now the image stabilization performance calculation can be started by clicking the “Process” button. A result file with single edge width calculations will be saved in the folder with the images.

	Exp.Time [s]	Pitch [pix]	Yaw [pix]	Sqrt(p^2+y^2)

2.2.3 IS-PERFORMANCE

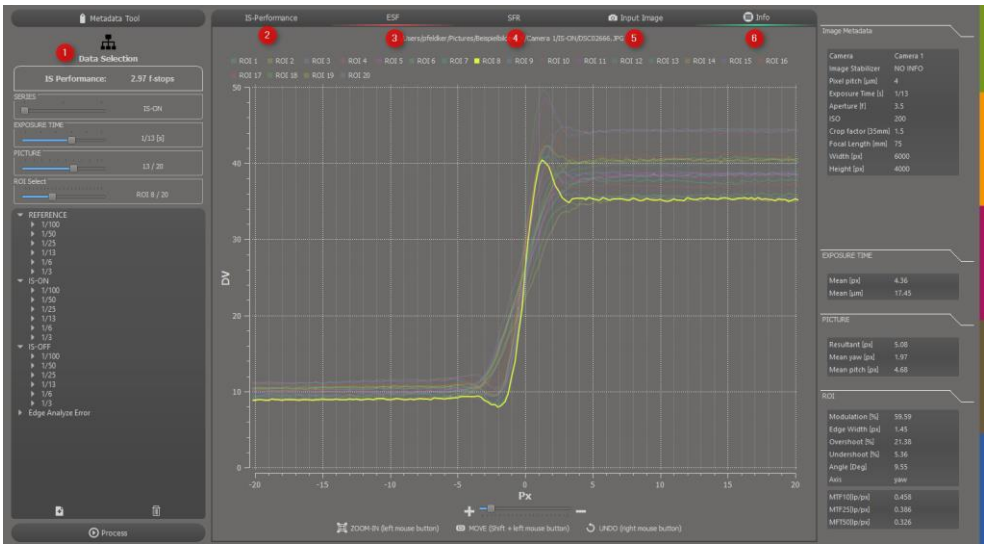
The IS-Performance is calculated by the edge width in µm vs. the exposure time. To accomplish this process, the edge widths of the IS-ON and IS-OFF (or by motiondata) series are converted to the size of a postcard with a viewing distance of 65-80cm. The image stabilization performance in f-stops [2] is located by the intersection points of the IS-ON and IS-OFF curve with a determination limit of 63µm [1]. The numerical value of the IS-Performance is displayed in f-stops.



IS-Performance

2.2.4 RESULT DATA SELECTION

To select single results of the IS-Performance calculation, just move one of the sliders [1] for “SERIES”, “EXPOSURE TIME”, “PICTURE” or “ROI” (region of interest). This will change the displayed results for the edge spread function (“ESF”) [3], spatial frequency response (“SFR”) [4], and the “INPUT IMAGE” [5] tab. Detailed information can be shown or hidden with the “INFO” button [6].



Data selection

2.2.5 EDGE SPREAD FUNCTION (ESF)

Every edge width is calculated by the ESF. Thus, an oversampled slanted edge of an image ROI is calculated from every image. Each image includes twenty slanted edges. Ten in the pitch and ten in the yaw direction.

2.2.6 SPATIAL FREQUENCY RESPONSE (SFR)

The SFR is not used for IS-Performance calculation. Instead it describes the modulation transfer function of every ROI.

2.2.7 INPUT IMAGE AND ROI SELECTION

It is entirely possible to change or display the region of interest for every single result. Simply click on the “Edit ROIs” button and change the location of the ROI. To set a new ROI, click the button, and use the “-“ button for deleting a ROI. For a zooming effect, click the “Zoom +” button and draw a rectangle on the image.

2.2.8 ERROR HANDLING

If the software does not detect all 20 ROI’s on one of the images, then an error occoured during the input image list view. If this happens please select the image and manually define the missing ROI’s for the image.

3 COPYRIGHT INFORMATION

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