



User Manual – AS5013 Eval Software

AS5013

Two-dimensional Magnetic Position Sensor with Digital Angle (Interface) output



Table of Contents

- 1. General Description 2
- 2. How to get the software running 2
- 3. Evaluation Software GUI 3
- 4. Mouse Control Tab 4
- 5. Advanced Tab..... 6
- 6. Plugins Tab..... 11
- 7. Joystick Calibration..... 15
- 8. Ordering Information..... 16
- Copyright..... 17
- Disclaimer 17

1. General Description

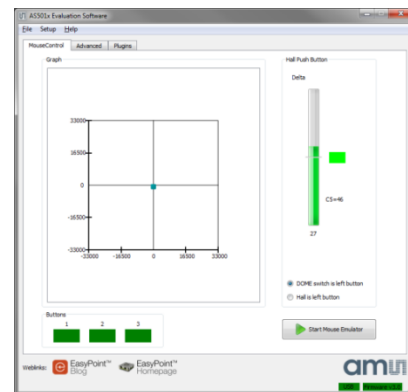
This document describes the features of the AS501X Eval Software. The Software is used to demonstrate the benefits of the EasyPoint™ using an AS5013 demo board (Figure 1).

The Software (Figure 2) comes with lots of different settings and options to evaluate the features EasyPoint™ on different use-cases and setups.

Figure 1:
AS5013-DB-2



Figure 2:
AS5013 Eval Software 4.2.2



The AS5013 is a Two-dimensional Magnetic Position Sensor with Digital Angle (Interface) output for smart navigation key applications.

Due to the on chip processing engine, system designers are not tasked with integrating complex software algorithms on their host processor thus leading to rapid development cycles.

The Two-dimensional Position Sensor includes 5 integrated Hall sensing elements for detecting up to $\pm 2\text{mm}$ lateral displacement, high resolution ADC, XY coordinate and motion detection engine combined with a smart power management controller.

2. How to get the software running

This section explains the required steps to set up the Evaluation Software.

Requirements

As the AS5013 Demo board works like a standard HID joystick, no software is needed to test it. But for more flexibility and in order to become familiar with the principle of the AS5013 sensor,

the AS5013 Evaluation Software allows to modify the device registers, read the magnet coordinates and change different settings of the mouse emulator.

In order to get started, you need:

- The **AS501x Evaluation Software GUI installer**
- **Windows XP® or Windows 7®** operating system
- **One free USB slot** on your PC to connect the demo board

The *AS501x Evaluation Software* is available on the following link:

<https://www.ams.com/eng/Support/Design-Resources/Demoboards/Magnetic-Encoders/EasyPoint-Linear-Encoder/AS5013-DK-ST>

First Time Installation

Before plugging the demo board on the PC, execute the AS501x Evaluation Software Installer, and follow the instructions. Once the installation is complete, plug the AS5013 demo board into the PC using the USB cable and start the software.

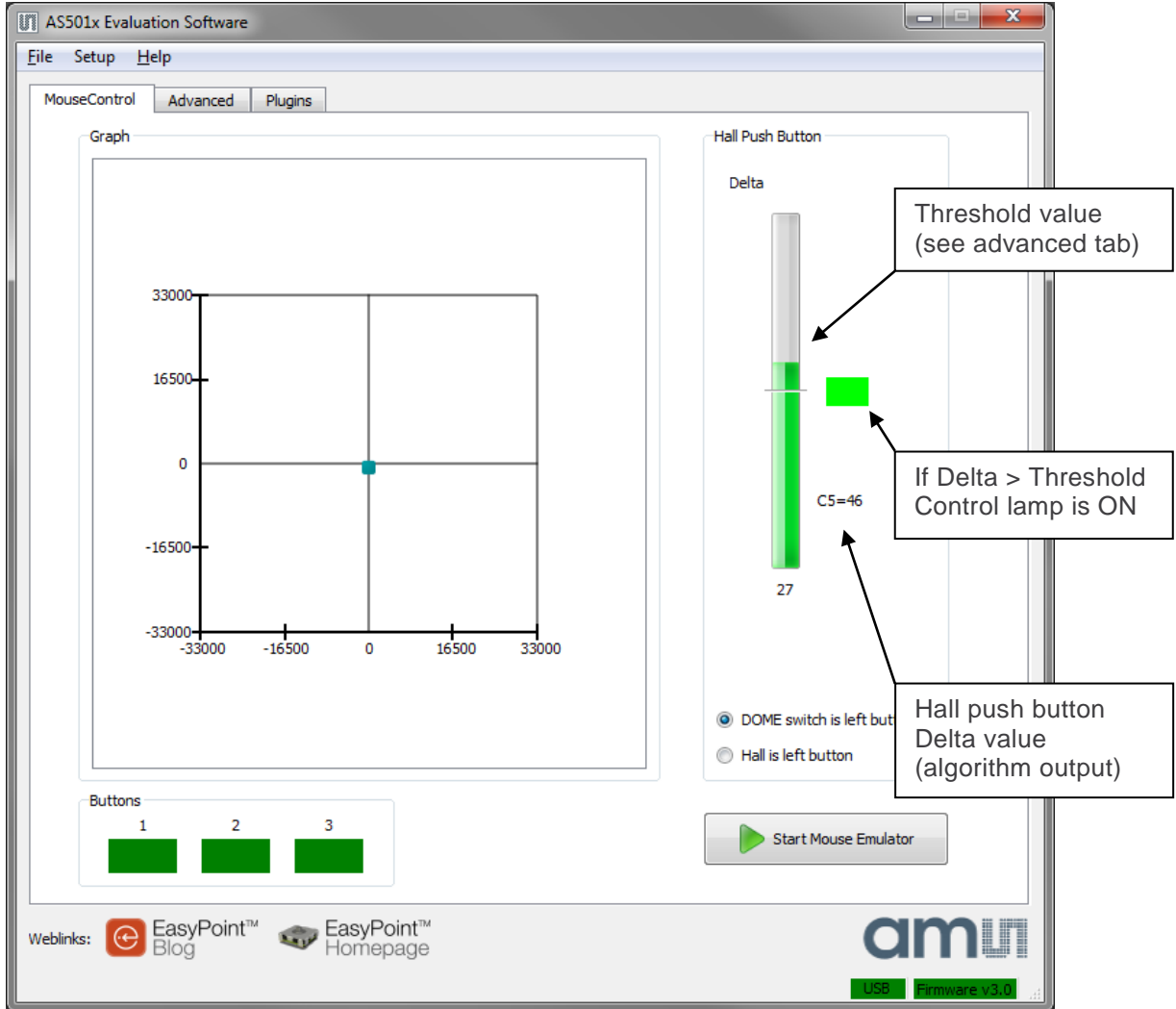
If this is the first time it has been installed, you will be asked to start the calibration (standard Windows procedure). To start the calibration manually, follow the instructions for joystick calibration explained in Section7: Joystick Calibration.

3. Evaluation Software GUI

Once the AS5013-DB demo board has been correctly calibrated, the evaluation can start. The software has three tabs (see Figure 3):

- Mouse Control
- Advanced
- Plugins

Figure 3:
Evaluation Software GUI: Mouse Control Tab



4. Mouse Control Tab

The AS5013 Evaluation Software includes a mouse emulator which is disabled by default. To enable the Mouse Emulator click on “Start Mouse Emulator” (see Figure 3).

Moving the knob on the demo board will control the mouse with progressive speed per default: small knob movements will move the mouse slowly; large mouse movements will move the mouse with a high speed velocity. The left mouse click is emulated by Button 1, and right mouse click by Button 2.

Graph:

Shows the position of the knob graphically from the HID XY data (standard joystick coordinates). The range -33,000 ~ +33,000 is the translation from EasyPoint™ coordinates (8-bit) to Windows HID driver (16-bit).

Start Mouse Emulator:

This Button will enable or disable the mouse emulator.

Note 1: If you are **using two or more monitors**, it is possible that the mouse emulator doesn't work correctly. In this case close the Evaluation Software by pressing "Alt + F4" and start the Evaluation Software again using one monitor.

Hall Push Button:

Two click detection modes are available: Dome Switch and Hall Push. When using the Dome Switch, the signal of the internal dome switch is read and processed. By activating the Hall Push function, the magnetic field is processed and generates a click as it reaches the Hall Push Threshold. The Hall Push Threshold is set up in the advanced tab (see section 5: Advanced Tab).

The software reads the hall elements C1..C5 and converts them to a "Delta" value by an algorithm. When pressing the EP button, the magnetic field increases, and thus increases the Delta value. Delta is compared to a Threshold value (details are explained in section 5: Advanced Tab).

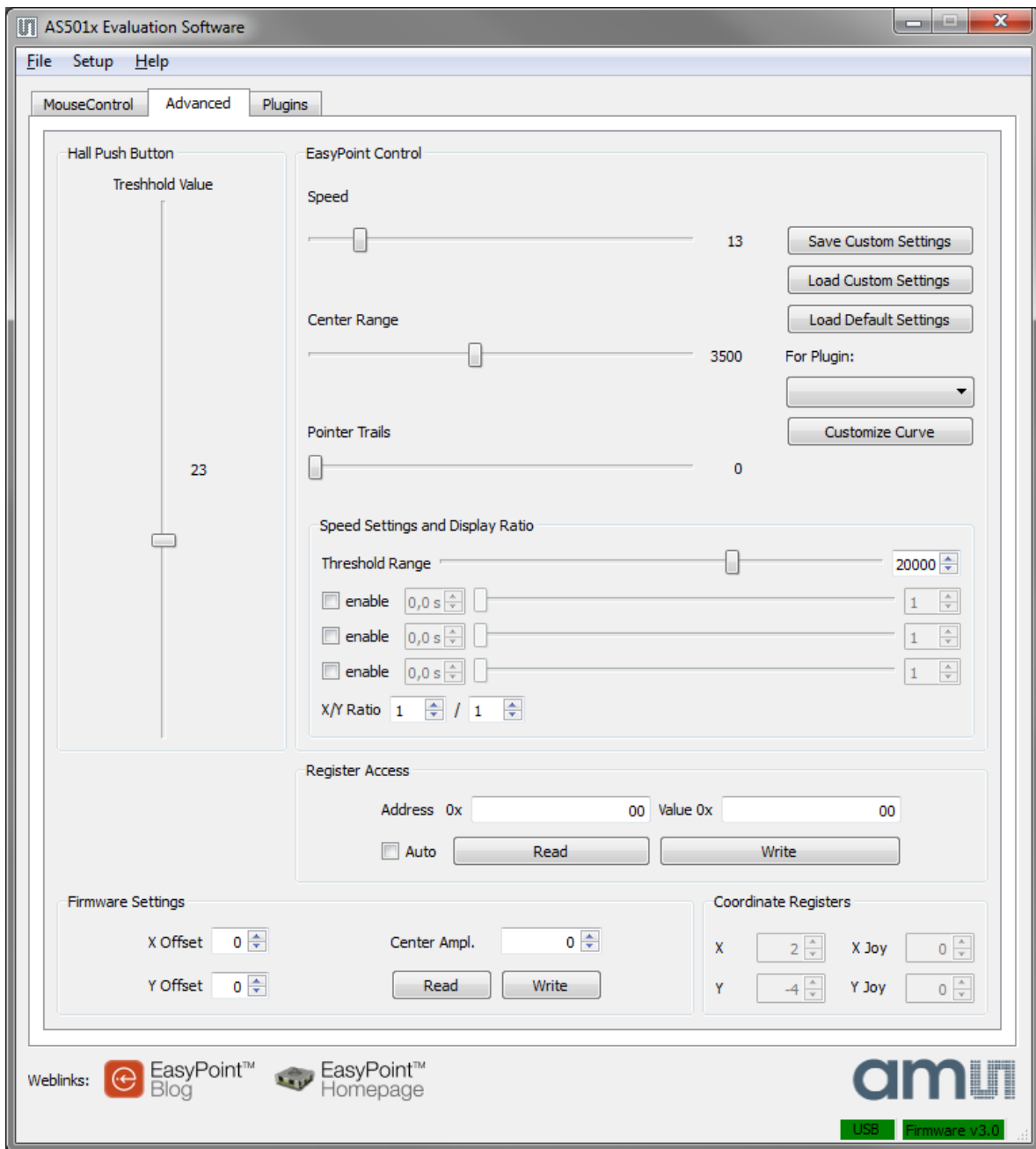
When $\Delta > \text{Threshold}$, it is considered as a push state. The PC software can be configured to use the standard EP button or the Hall Push button as HID button 1.

The Hall push function is active only when the XY coordinate registers are in the "Active area", defined by the values y pos, y neg, x pos, x neg. When XY coordinate is outside the active area, the Hall push function is always off.

5. Advanced Tab

The Advanced Tab is divided into four parts giving many options to modify the EasyPoint™ user experience. These are the Hall Push Setup, the EasyPoint™ Control, the Register Access and the Firmware Setting (see Figure 4).

Figure 4:
Advanced Tab



Hall Push Setup

The slider “Threshold Value” changes the threshold value for the hall push button detection which can be enabled or disabled in the Mouse Control tab (see Figure 3). A typical value is 23. The dynamic range of the bar graph in the Mouse Control tab is adjusted automatically.

EasyPoint™ Control

The EasyPoint™ Control is used to apply advanced functions to the mouse emulator. This is used to improve the user experience when using EasyPoint™.

For gaming, the user experience is usually controlled by the game itself. Therefore the EasyPoint™ Control affects only the plugins and applications that are available in the Evaluation Software. The AS501X EasyPoint™ game controller outputs, shown in the hardware section of the PC is not changed.

Note 2: If the EasyPoint™ device is connected the first time, a joystick calibration is necessary. Refer to section 7: Joystick Calibration.

- **Speed:** The speed slider controls the pointer speed of the mouse emulator.
- **Center Range:** Controls the radius around the center position, where the mouse does not move (dead zone).
- **Pointer Trails:** Adds shading pointers following the main mouse pointer.
- **Save Custom Settings:** Save the actual mouse setting into a .ini file.
- **Load Custom Settings:** Load any mouse setting (.ini file), and sets automatically the Speed, Center Range and Pointer Trails with those saved settings.
- **Load Default Settings:** Different mouse settings can be assigned independently to each plugin (see next chapter “Plugin Tab”). Select a plugin in the “For Plugin” field, before clicking on this button. Blank is for the default mouse settings.
- **Customize Curve:** The mouse response can be fully parameterized with a look-up table. X-axis is the module knob displacement (range 0 to 10). Y-axis is the translated value sent to the mouse emulator.

A curve is created independently for each plugin and can be modified to optimize the user’s experience (see Figure 4):

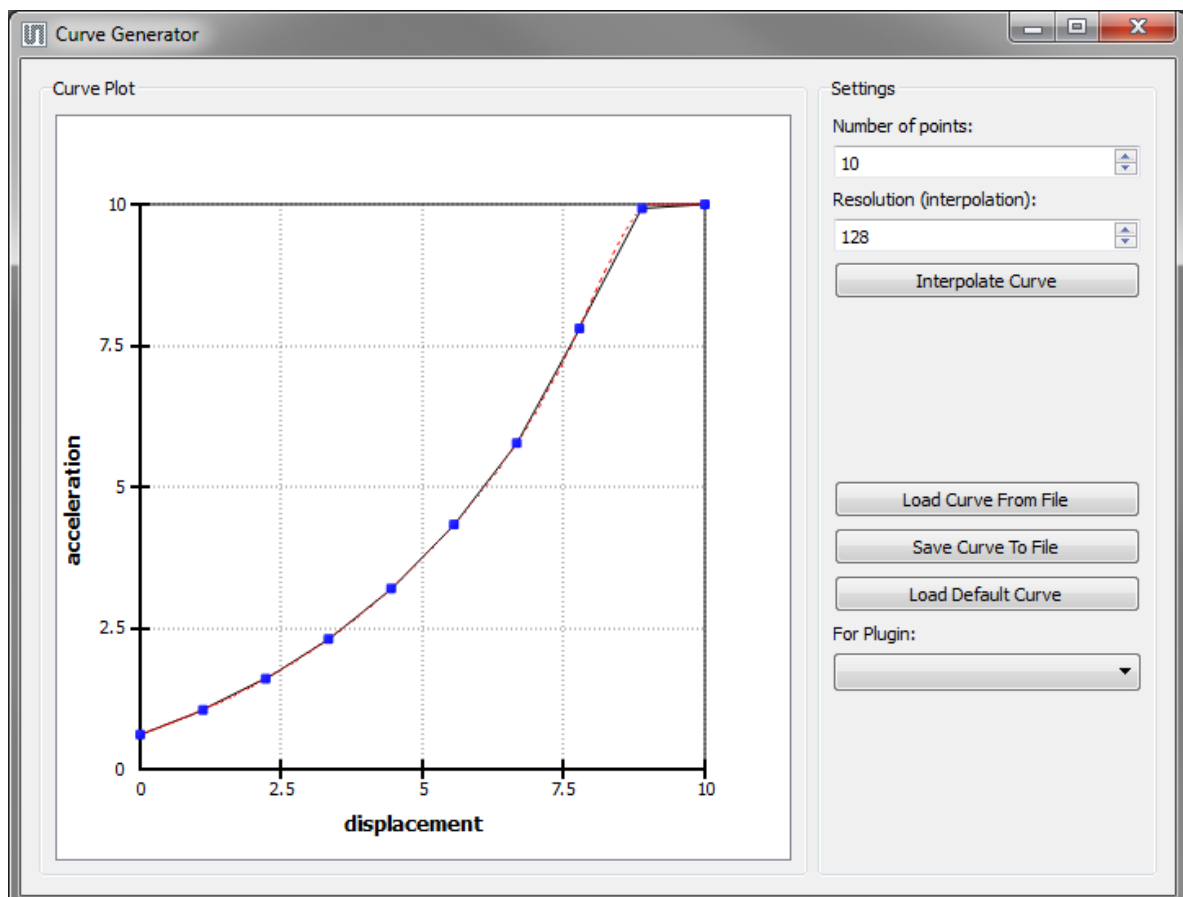
1. Select the plugin for which the response has to be displayed or modified. Blank plugin is the default mouse curve.
2. Click on Load Default Curve
3. A new curve corresponding to the plugin has been loaded
4. Drag the blue points vertically on the curve to modify its shape

5. Once finished, click on Interpolate Curve
6. Save the final curve into a .ini file. This file can be recalled anytime when executing a plugin.

The number of blue points on the curve can be increased in order to get a more precise control curve.

Interpolate curve smoothest and validates the curve after modification with the blue points, before saving it. The number of interpolation points can be changed.

Figure 4:
Advanced Tab: Customize Curve



Speed Settings and Ratio

For better user experience, it can improve user experience to add additional speed after a fixed amount of time. Generally it is recommended for mouse pointer control to use a slower pointer speed and increase speed after some time if the knob deflection reaches a certain threshold. (See Figure 5)

Threshold Range: Defines the threshold for the speed settings. If the knob deflection reaches this threshold, the delay timer starts to count. If the knob deflection is below, the timer is cleared.

Delay Time: Is used to set up the time delay for the new speed.

New Speed: The new speed value defines the speed applied to the cursor after the time delay.

X/Y Ratio: For different screen size ratios, it is possible to set up a speed ratio. This can be used to adjust a different cursor speed for X and for Y direction. If a wide screen is used, the setting 16/9 will effect that the mouse cursor will need the same time to go from the left to the right corner as from the top to the bottom of the screen.

Figure 5:
Advanced Tab: Speed Settings and Ratio

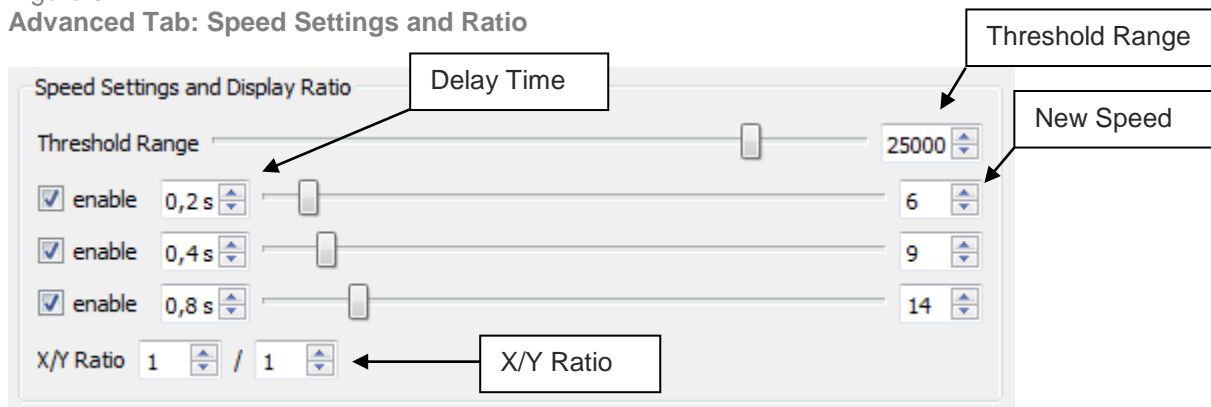


Table 1:
Advanced Tab: Recommended Settings

Setting	Slow	Convenient	Fast
Speed:	4	4	4
Center Range:	7000	7000	3500
Threshold Range:	25000	25000	25000
1 st speed:	0.2s / speed=6	0.2s / speed=6	0.2s / speed=6
2 nd speed:	0.4s / speed=8	0.4s / speed=8	0.4s / speed=8
3 rd speed:		0.8s / speed=10	0.8s / speed=14
X/Y Ratio:	1/1	1/1	1/1

Register Access

The AS5013 I²C registers can be read and written from this box, by entering hex address of the register and the hex value to write. The Auto checkbox enables the automatic periodic readout of the register pointed in the address box.

Coordinate Registers

X, Y (signed byte): Direct X and Y register values (Registers 10h and 11h).

X Joy, Y Joy (signed byte): Corrected (zero position offset added) XY coordinates sent to the Windows HID driver before calibration. The zero position offset values are described in “Mouse Adjustments” below.

Firmware Setting

X Offset / Y Offset (signed byte): Is the offset added to the X and Y registers to obtain X Joy / Y Joy. The offset values are computed when the demo board is powered up, to compensate an eventual mechanical misalignment of the knob at the zero position.

The calculation of X Joy (the same is applied for Y Joy): $X\ Joy = (X + X\ Offset)$

Center Amplitude: Controls the dead zone area width around the zero position. Used only for the LED control on the demo board.

The values of X Offset / Y Offset and Center Amplitude. Can be read and written by clicking on the corresponding buttons.

6. Plugins Tab

Plugins are applications using the potential of EasyPoint™ modules and AS5013.

Each plugin has a personalized look-up-table (response curve), by clicking on the corresponding Customize button. See, “Customize Curve” for more information.

Three categories of plugins are available (see Figure 6):

1. Progressive speed applications

This plugin type shows the advantages of having an analog control on X and Y axis, to control progressively e.g. position cursors.

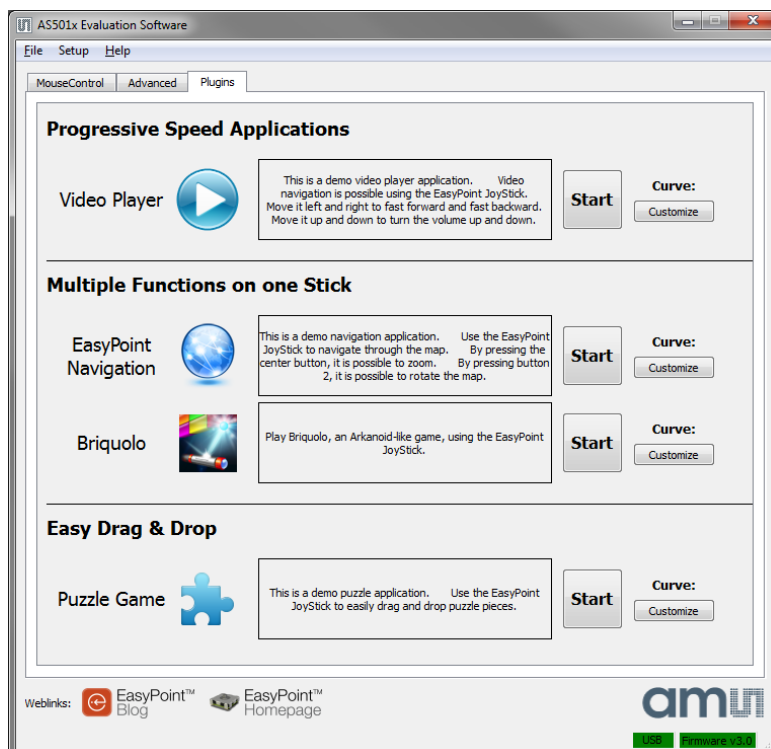
2. Multiple Functions on one Stick

This plugin type shows the advantage of the progressive speed applications combined with a push button. Those applications are typically games or navigation controls.

3. Easy Drag & Drop

This plugin type shows the possibility to use the drag & drop function with EasyPoint™ modules: Click and hold down the knob of the module, while moving an object, then drop it to another place by releasing the knob.

Figure 6:
Plugins Tab



Progressive Speed Applications: Video Player

This simple video player can open any .avi, .mpg, .mov, .wmv video file and play it.

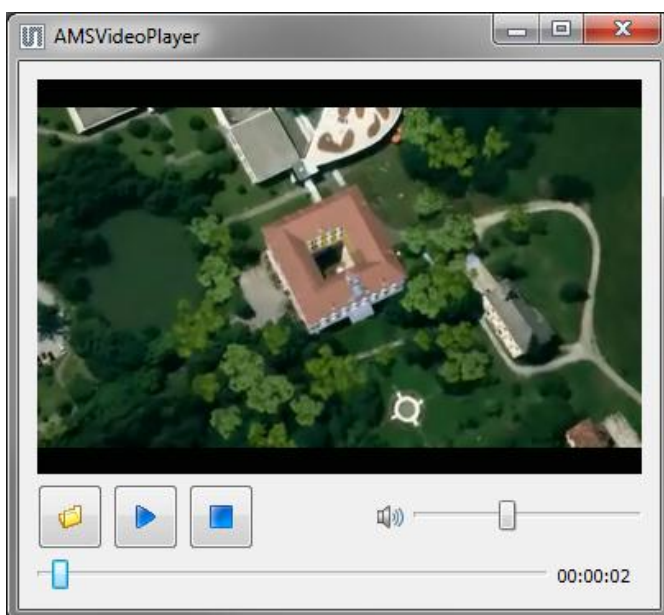
- **Progressive Video Speed control**

Moving the EasyPoint™ button to left or right, the movie will do a FFW or RWD with a speed of 2x to 64x, depending on the button horizontal position.

- **Progressive Volume control**

Moving the EasyPoint™ button to up or down, the volume will increase or decrease. The speed of the volume button is progressive with the EasyPoint™ knob's vertical position.

Figure 7:
Plugins: AMS Video Player



Multiple Functions on one Stick: Briquolo

Brick arcade game, using the progressive left-right movement of the module will move the racket progressively from slowly (low amplitude of the knob) to quickly (high amplitude of the knob)

EasyPoint Navigation:

Picture viewer with scrolling and zoom functions. This application shows the features of EasyPoint™ for applications such as GPS maps navigation.

The default picture can be changed anytime by clicking on the button Open Image

- **Progressive Multidirectional Scrolling:**

Progressive speed and smooth directions and angles are used to move the map to any direction.

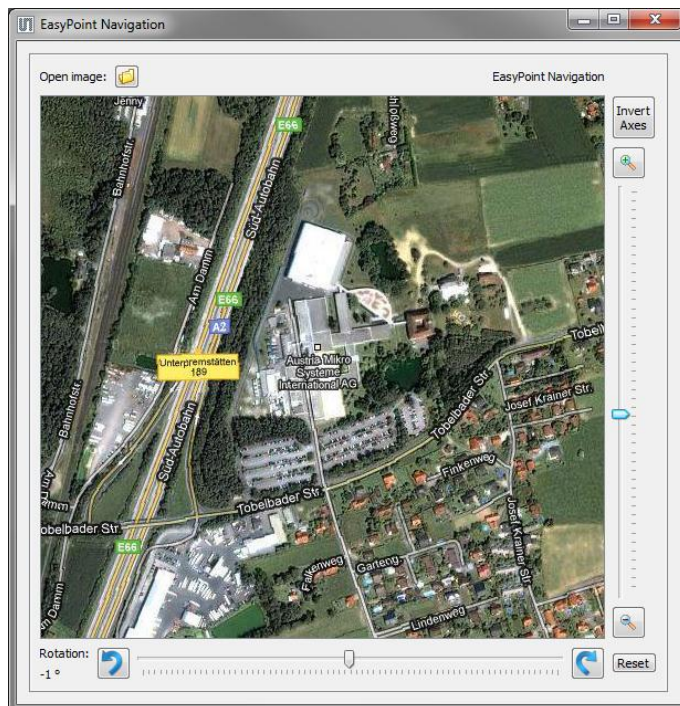
- **Progressive Zoom-in / Zoom-out**

Pushing the EasyPoint knob and SIMULTANEOUSLY moving it up or down will zoom-out/zoom-in the picture. The speed of the zoom is progressive, depending on the knob's amplitude.

- **Progressive Picture Rotation**

Pushing the Button II and SIMULTANEOUSLY moving it left or right will rotate the picture with a progressive speed depending on the knob's amplitude.

Figure 8:
Plugins: Navigation



Easy Drag & Drop: Puzzle Game

Drag and drop function: pick a part of the ams logo, push the knob, and move the part into the grid WITHOUT releasing the knob. To drop the item into the wanted place, release the knob.

To help the user in the game, a correct position of the puzzle tile is indicated by a green background, and a wrong position with a blue background.

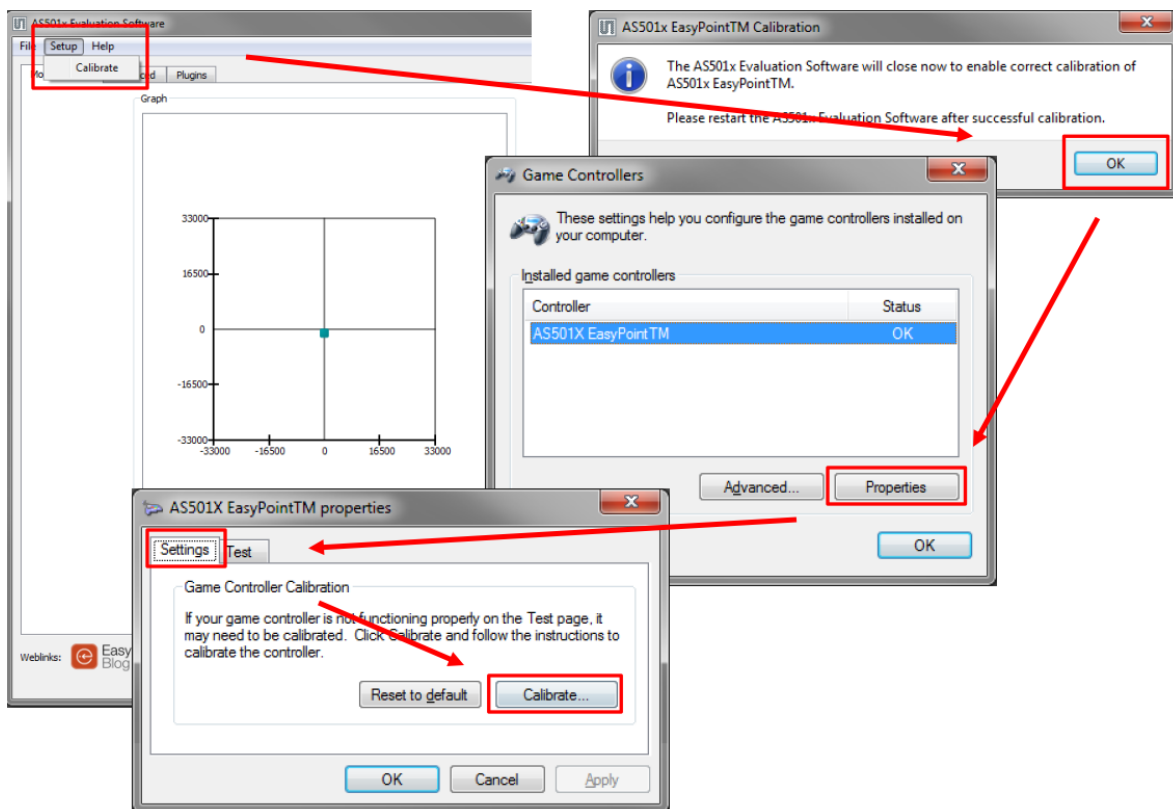
7. Joystick Calibration

To start the calibration manually, follow the instructions shown below in Figure 9.

1. Open the AS501X Evaluation Software, go to „Setup“-Menu and click on „Calibrate“
2. Read the information popup and accept.
3. Open „Properties“
4. Activate the „Settings Tab“.
5. Click on „Calibrate“ and follow the instructions of the wizard.
6. Restart the Evaluation Software

Note 3: The calibration has to be done only the first time the demo board is plugged into the PC. If a different demo board is used, a new calibration must be performed.

Figure 9:
Joystick Calibration



The calibration procedure

8. Ordering Information

Table 2:
Ordering Information

Ordering Code	Description	comments
AS5013-DB-2	AS5013 Demo Kit	AS5013 Demo board in gamepad-shape

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