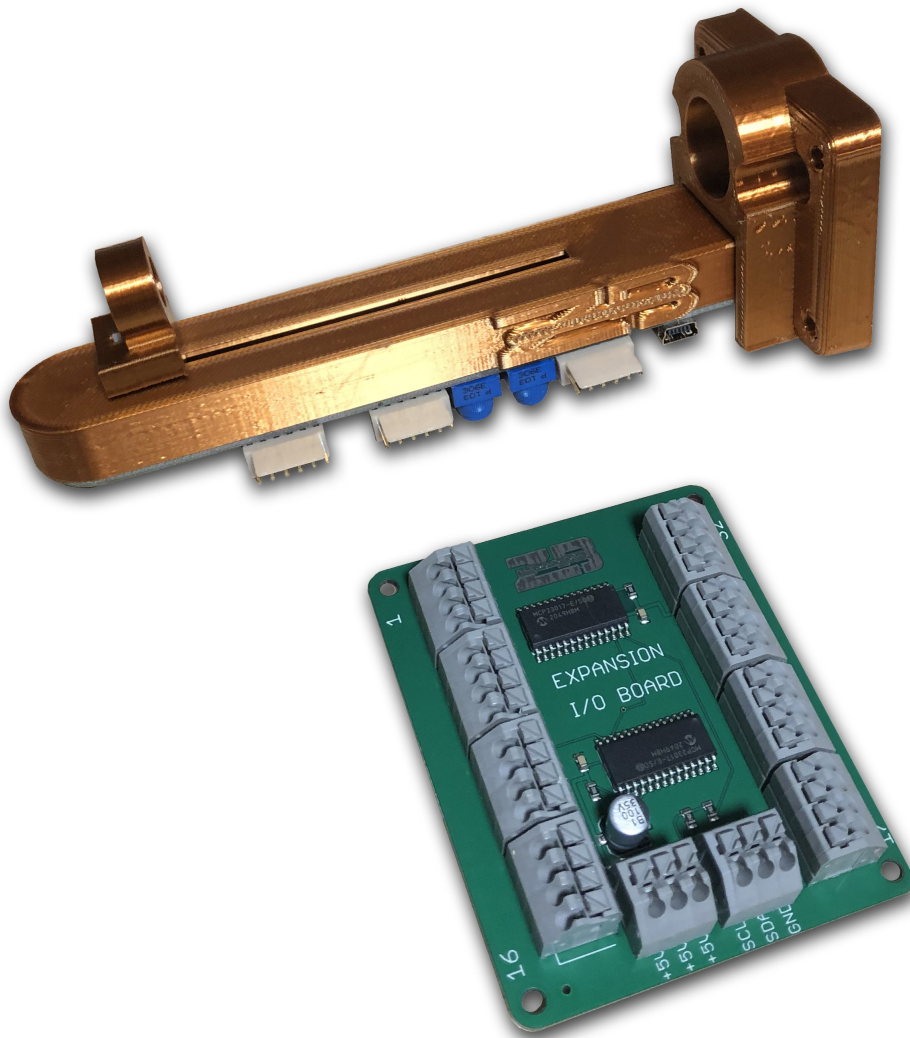




## **V5 Digital/Analog Plunger Installation**





## **BEFORE YOU BEGIN**

Working with electricity comes with huge risks that should never be taken lightly, safety should always come first.

To avoid personal injury, possible damage to equipment or danger of fire, all work on electronic equipment should be conducted following these safety procedures.

### **General Safety**

Before working on any electronics, consider following these basic safety precautions to help reduce any hazards.

- Remove any electronic equipment you're testing or working on from the power source.
- Never assume the power circuit is off. Test and test again with a voltmeter to confirm.
- Remove fuses and replace them only after the power to the circuit is disconnected.
- Don't connect power to a circuit until you're done working on it and rechecked the work.
- Always ensure that all electronics equipment is properly grounded
- If it's damaged, replace it. For instance, replace cables instead of repairing with insulating tape.
- Always use the right electronics repair and maintenance tools.
- Always return covers after removing them to reduce the risk of electric shock.
- Make sure your circuit is not overloaded.
- Always have safety equipment like a fire extinguisher, a basic first aid kit and a mobile phone nearby.

### **Personal Safety**

Here are some personal safety precautions to keep in mind:

- Always keep your work area dry.
- Always work in a well-ventilated area.
- Don't wear flapping or loose clothing when working.
- Don't work with metallic jewelry on your hands like watches, rings and bracelets.
- Always wear non-conductive shoes.
- Always remove power to a circuit before connecting alligator clips.
- Always wear safety goggles.
- Be careful when handling large capacitors as they can still hold high voltage even after you've disconnected the circuit from power.

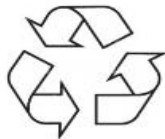
## Static Damage Prevention

Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective bags until you are ready to install them.

To reduce the possibility of electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its antistatic bag, touch it to an unpainted metal part of the system unit for at least 2 seconds. (This action removes static electricity from the package and from your body).
- Remove the device from its package and install it directly into your system, without putting it down. If it is necessary to put the device down, place it onto its static-protective bag. (If your device is an adapter, place it component-side up.) Do not place the device onto the cover of the system or onto a metal table.
- Take additional care when you handle devices during cold weather. Indoor humidity tends to decrease in cold weather, causing an increase in static electricity.

## Disposal



Observe the approved methods and ordinances of your locality with regard to proper disposal of used electronic appliances.

Ensure all parts are present :

1pc Plunger Assembly

1pc Plunger Slider Block

1pc I/O Expansion Board

1 pc USB A to mini-B Cable

3pcs 6pin Wire Harness Assembly

1pc plastic shim

3pcs #10 x 1/2" machine screw and star washer

1pc #10 flat washer

2pcs #6 x 1" panhead screw

Assemble screws and star washers



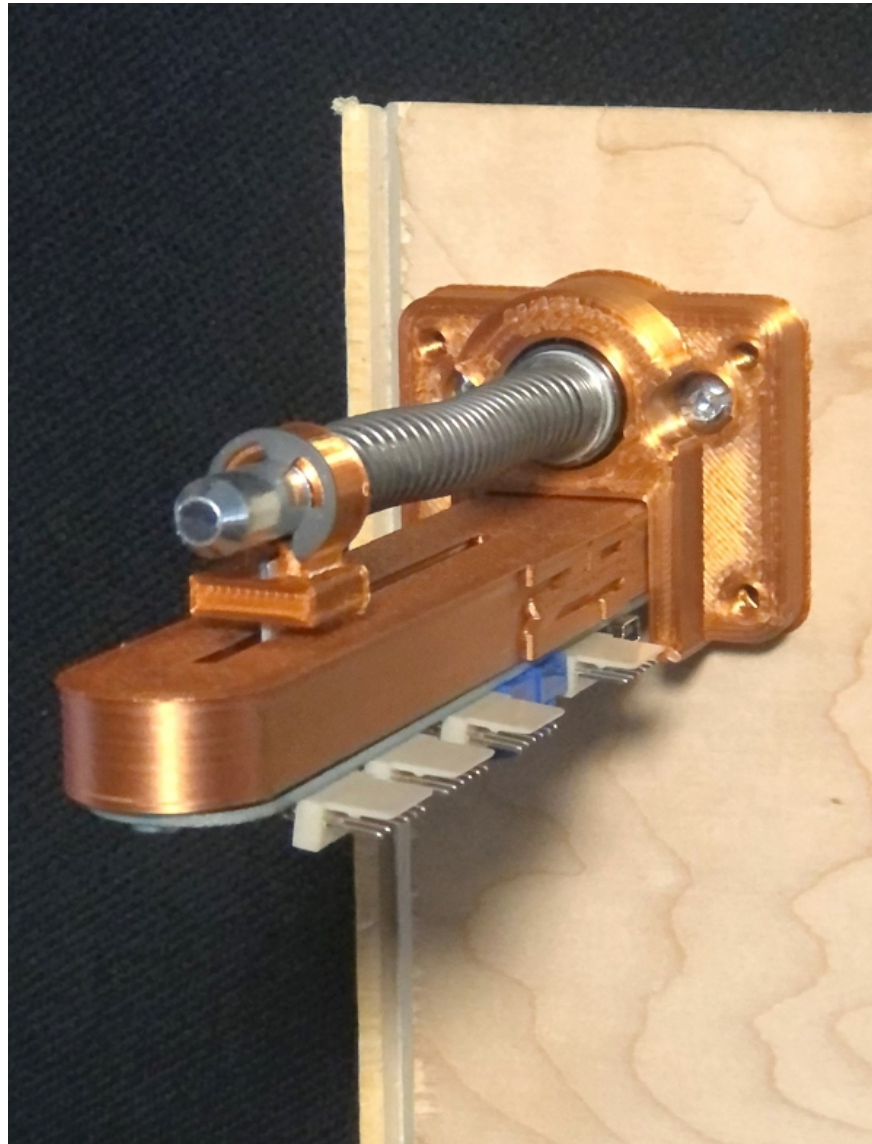
Mount ball shooter in opening



Use the large flat washer to hold the ball shooter in place securely.



Mount plunger using supplied machine screws and star washers  
(washers not really necessary).

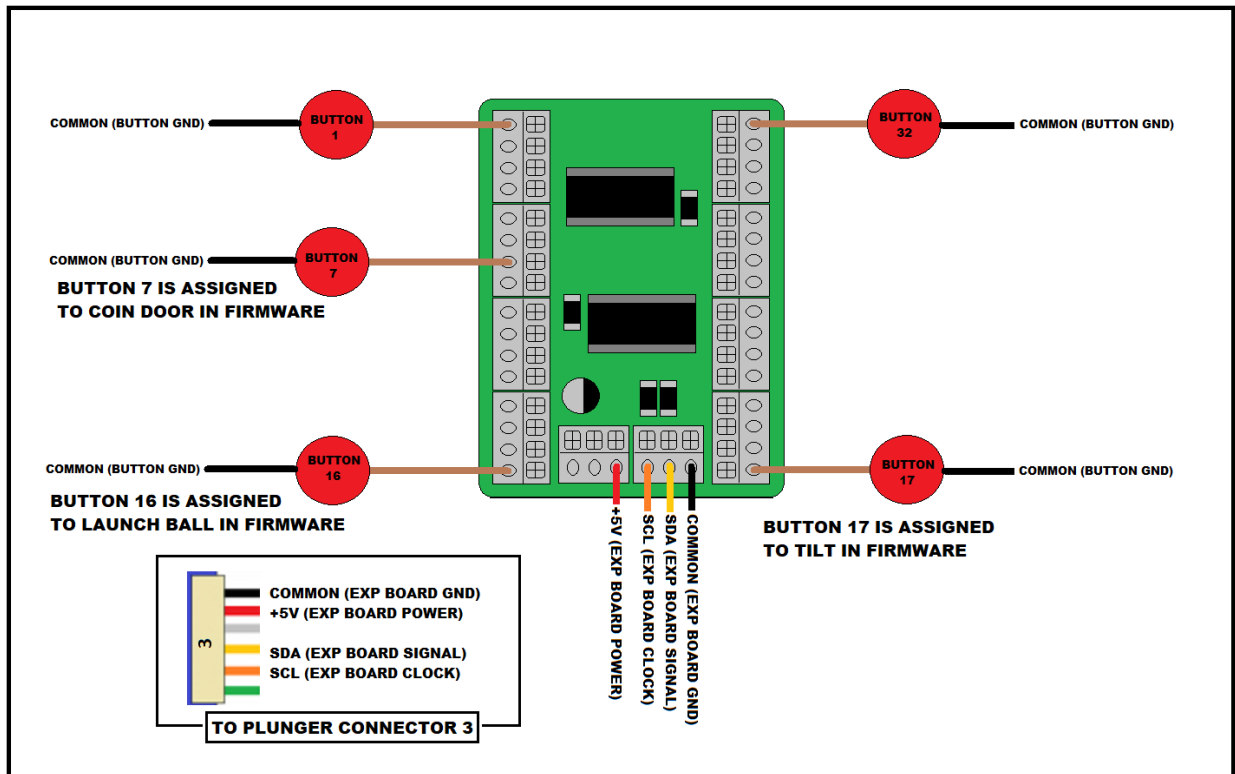
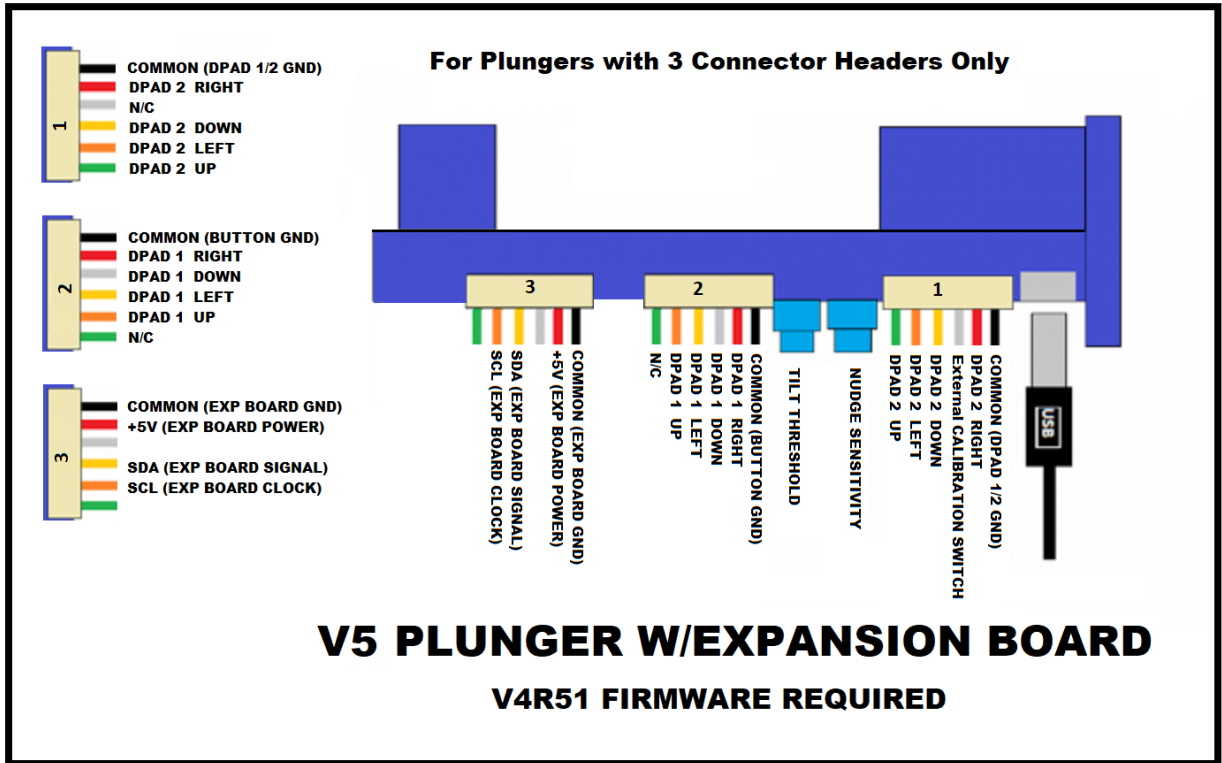


Make sure not to overtighten and damage the plunger housing plate. Screws should be tight enough to hold the ball shooter in place but not so tight as to split mounting plate. If the angle of the plunger is too high toward the front, put the supplied panhead wood screws into the bottom holes of the plunger and tighten to bring down the nose of the plunger. If the nose of the plunger is too low place the provided shim behind the bottom of the plunger to raise it up.

**Note that slider block is mounted between the c-clip and shooter rod spring.**



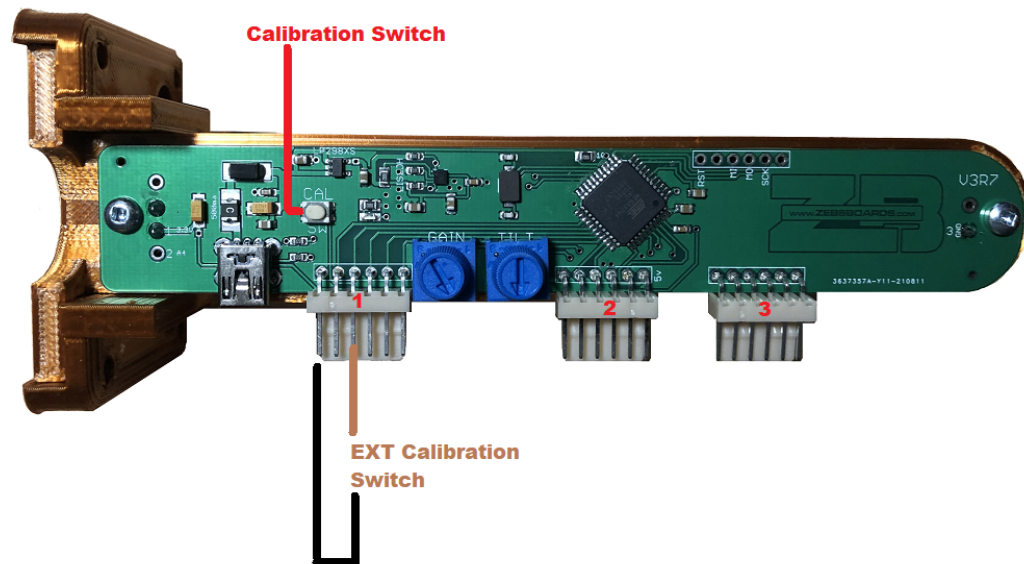
Connect inputs from buttons as shown in diagram





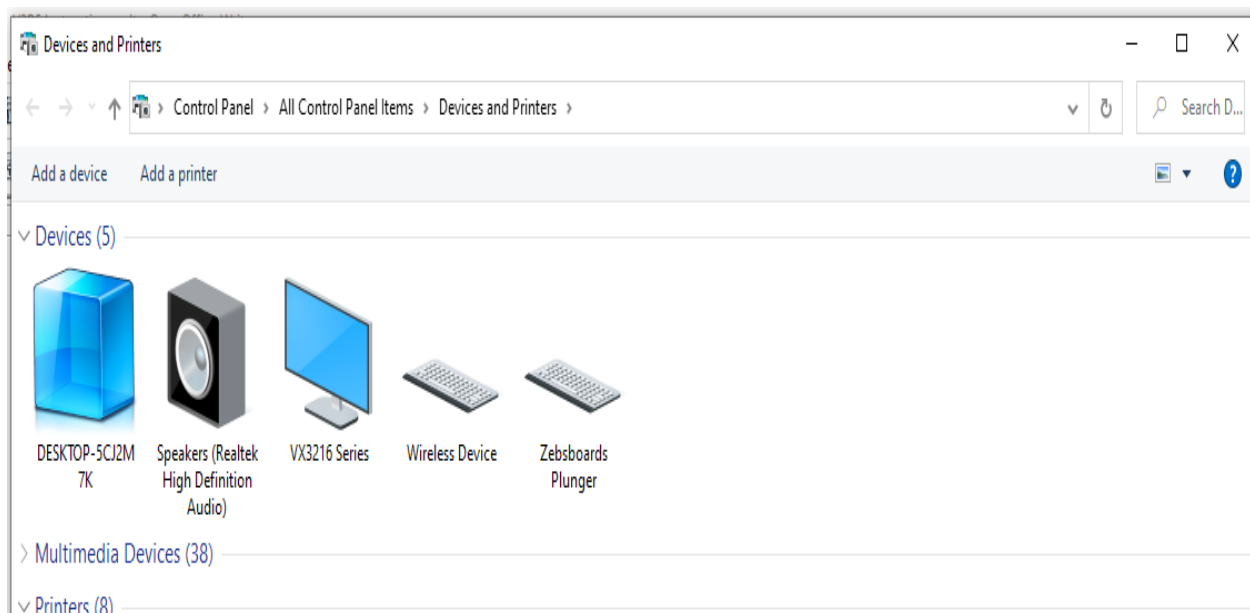
## Calibration

Firmware posted after and plungers sold December 14, 2020 now comes with a simple hardware calibration routine built in. It is recommended to run the calibration routine.

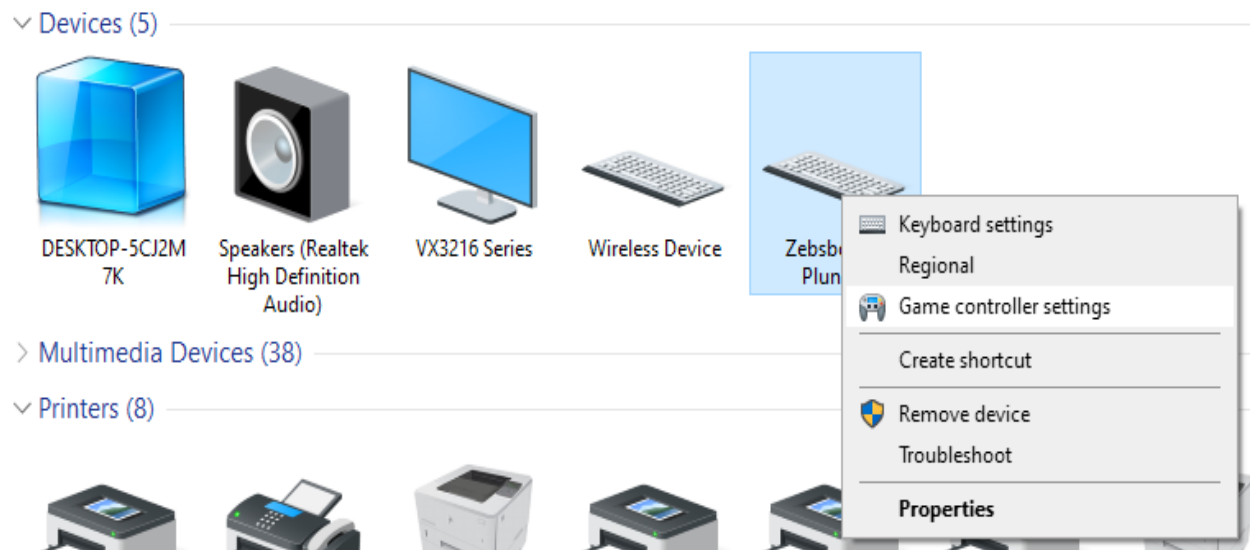


With the plunger mounted in your cabinet start your computer and switch to the Gamepad controller applet in windows ....

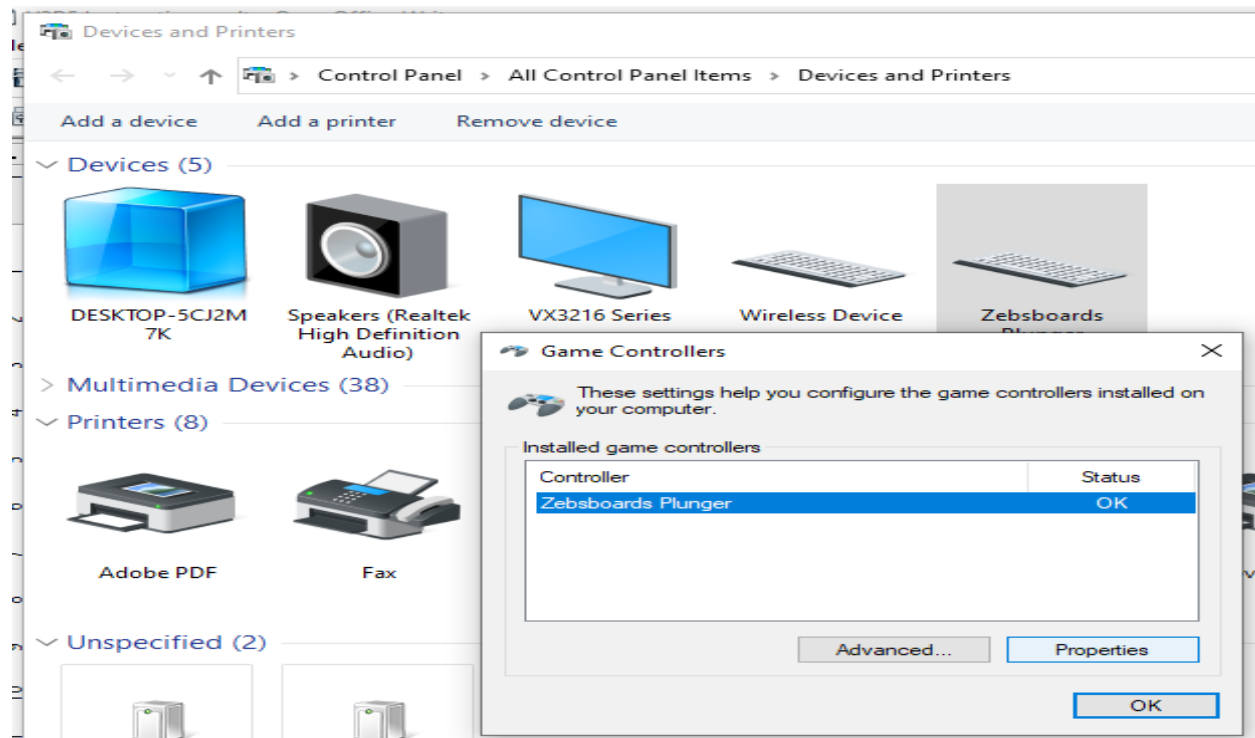
Open the deices and printers screen



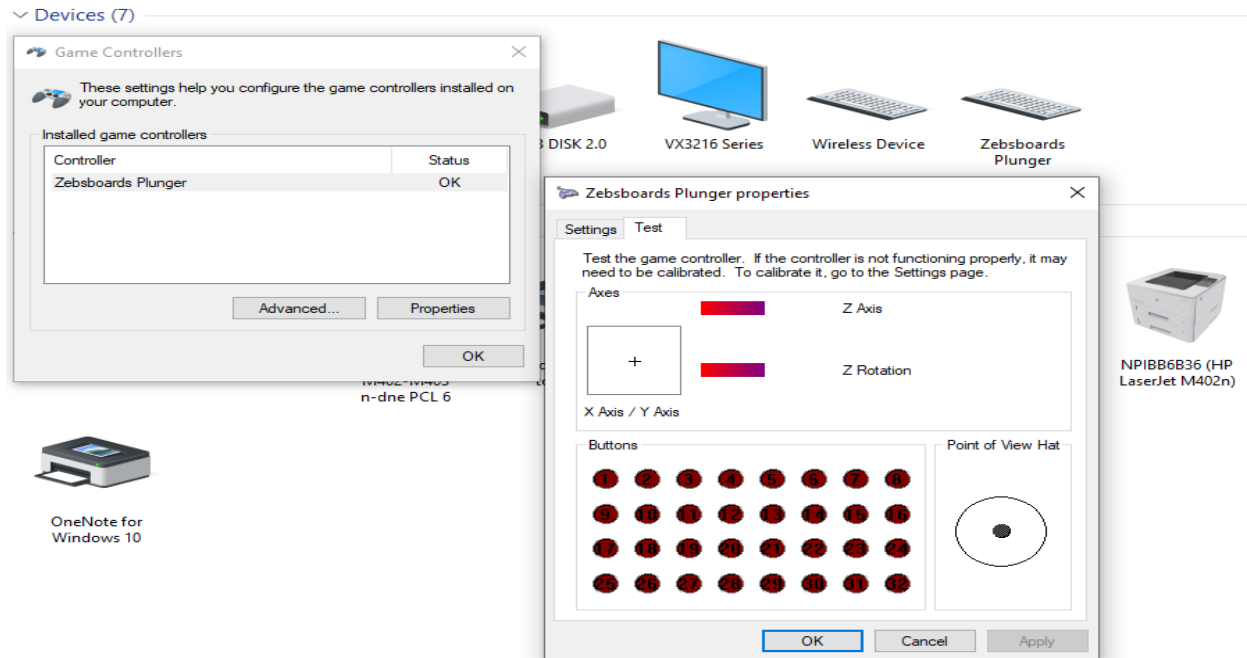
Right Click on the Zebsboards Plunger icon and select Game Controller Settings in the drop down menu that appears ...



Select Properties and click on 'OK' ...



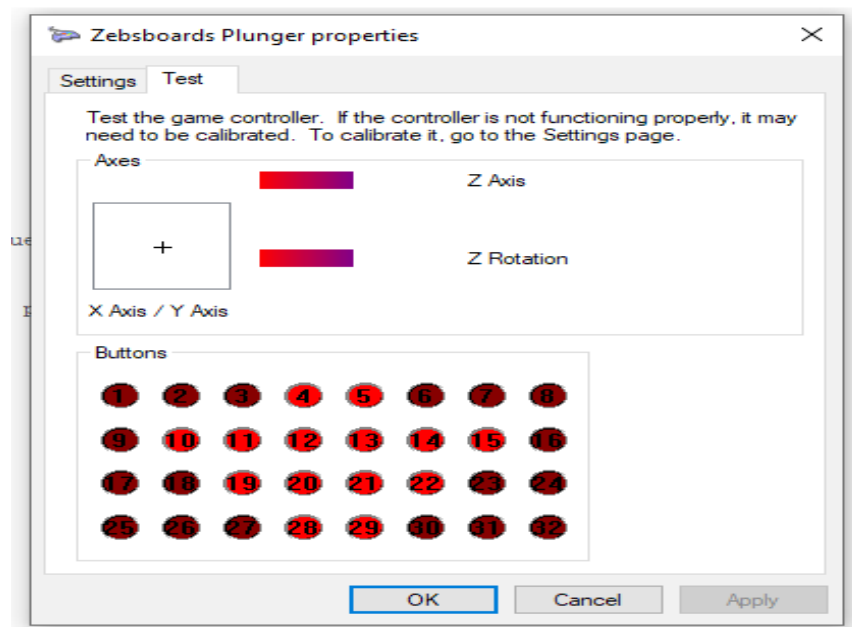
Which will bring you to the Test screen ...



With this screen open, **press and hold the CALIBRATION SWITCH for 2 seconds and then release it.**

The Button Display will display an DOWN ARROW in lighted buttons .....

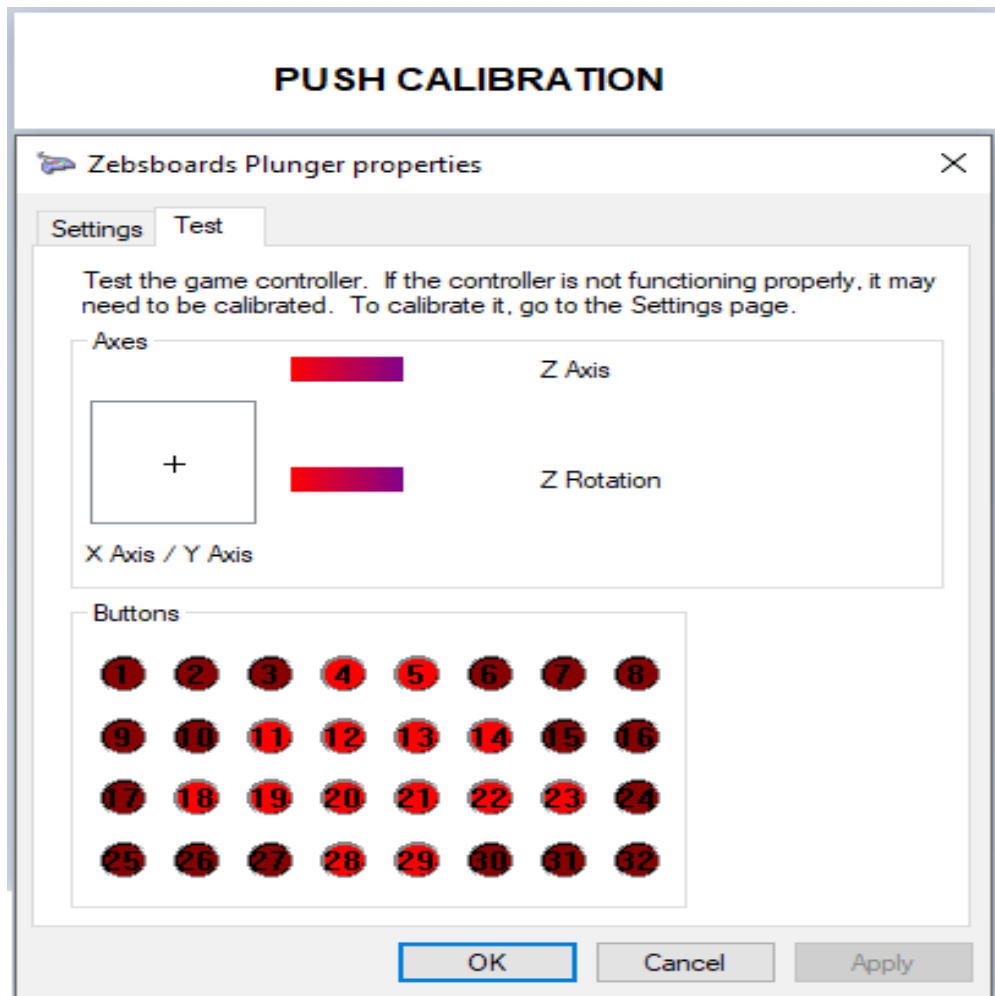
### PULL CALIBRATION



**Pull Back the plunger to the FULL LENGTH OF TRAVEL and release it.**

If you have pushed the plunger in by accident the button lights will flash several times and then light back up as the DOWN ARROW and you can try again.

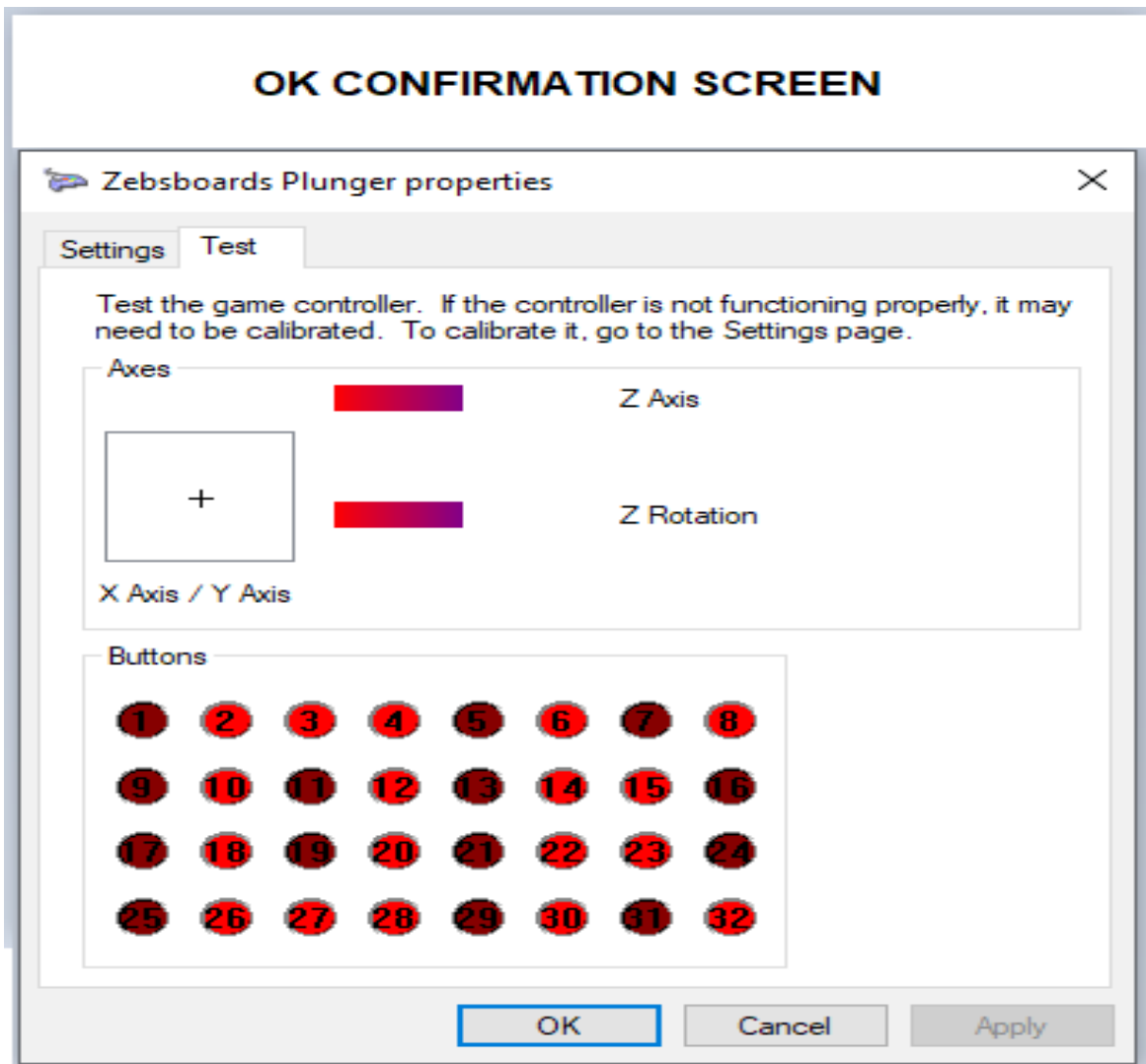
Upon successfully pulling and releasing the plunger the button display will change to an UP ARROW ...



**Press the plunger FORWARD to the full extent of travel and release it.**

If you have pulled the plunger in by accident the button lights will flash several times and then light back up as the UP ARROW and you can try again.

Upon successful completion of the routine the button lights will change to display OK.



After a few seconds the button lights will go back out and the normal screen will be displayed.

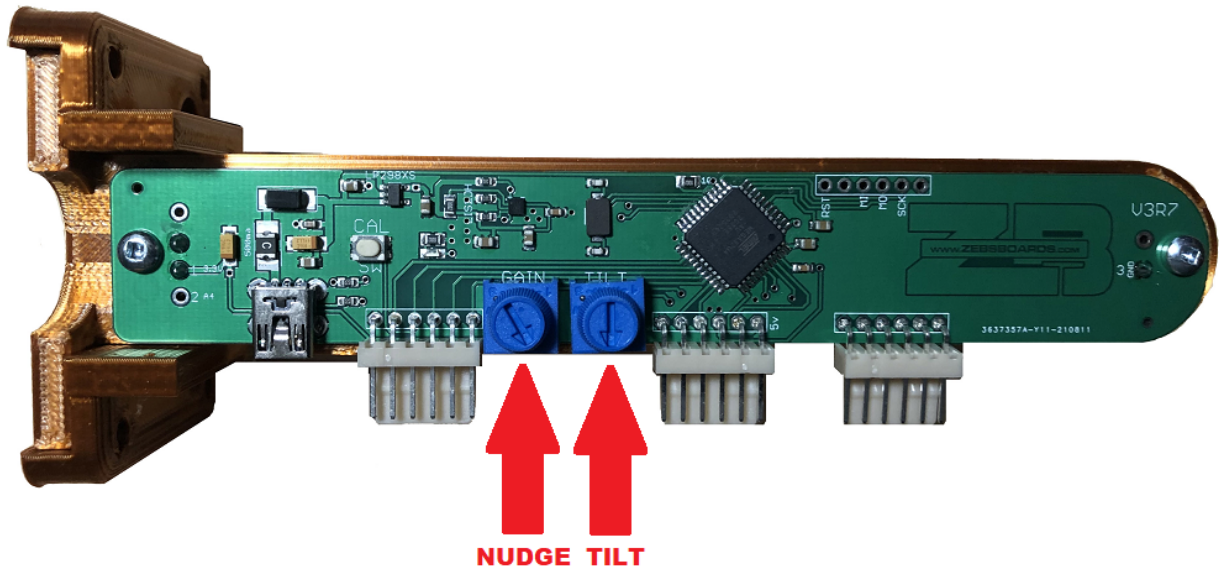
At this point pull the plunger and release it to reset the plunger and make use of the new values. **Pull and release and press and release the plunger several times** to verify proper operation. If the operation is erratic the plunger was not pulled completely back or pressed completely in during the routine, Press the LEFT SHIFT and START BUTTONS and repeat the above procedure.

When you are satisfied with the plunger behaviour you can exit the screens.

The values measured by the calibration routine are stored in the non-volatile memory of the plunger and will not change when the plunger is disconnected or the computer is powered off.



## Nudge and TILT adjustment



### Nudge Adjustment

The gain on the nudge signal from the accelerometer can be adjusted from 0% - 100% by turning the indicated knob as seen in the picture above. Best practice for adjusting is to open a table in Visual Pinball and adjust the knob until the desired response is found. Turning the knob clockwise increases the sensitivity and counter clockwise decreases the sensitivity.

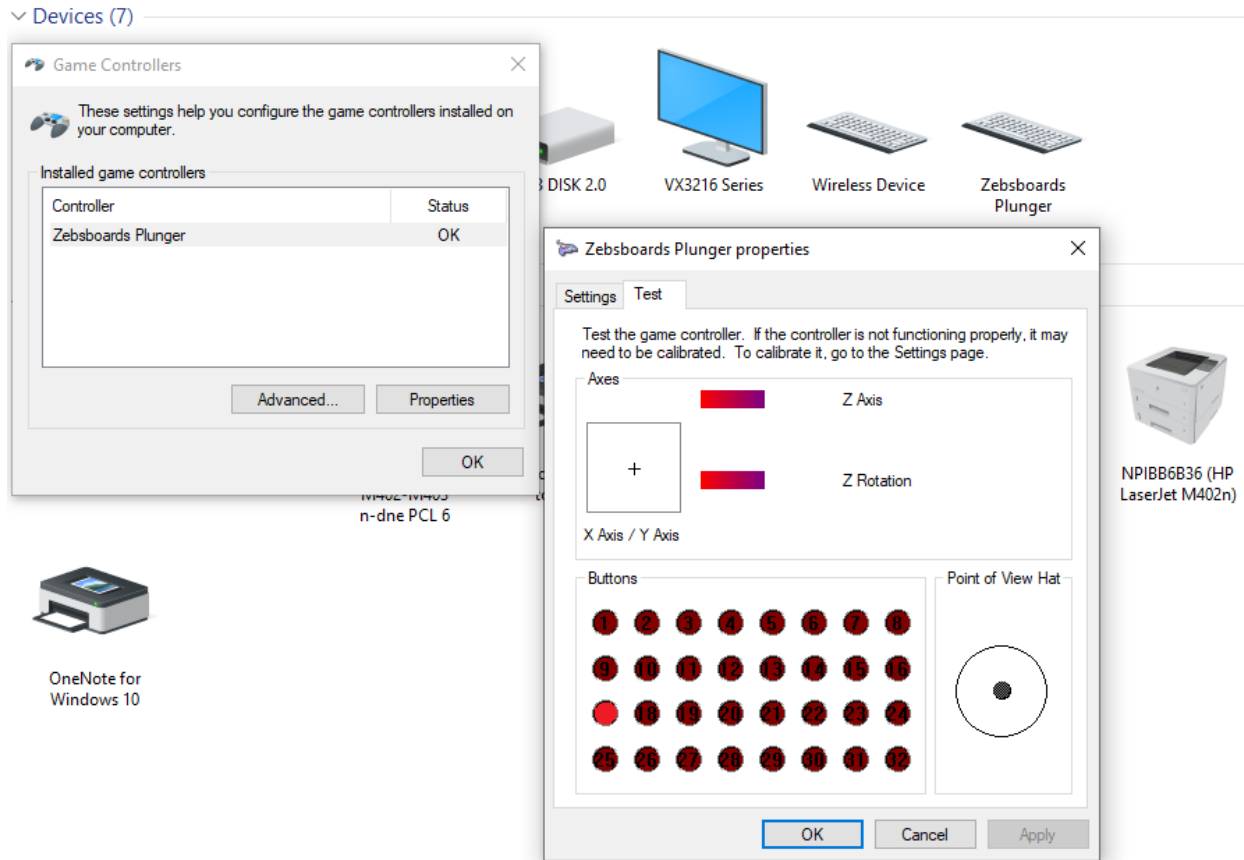
If the adjustment cannot be made to your satisfaction, open the preferences\keys tab of the settings in Visual Pinball and increase or decrease the gain settings as required. Repeat the above procedure.

Adjusting the nudge sensitivity with the knob can create an offset in the centering of the x and y axis of the plunger. If you notice a considerable pull in any direction after adjustment, simply unplug the USB cable from the plunger and reconnect it. This will force a reset of the plunger and will calculate a new center position for both axis.

It is recommended to set the nudge gains to the desired level before setting the TILT level as reversing the order will likely disrupt your TILT setting.

## TILT Adjustment

After setting the nudge gain to the desired level, close Visual Pinball and open the gamepad controller applet as described in the calibration section.



To check the level of gain for tilting the machine, nudge the cabinet at a level that you feel is appropriate for tilting and adjust the TILT knob until Gamepad Button 17 flashes.

Set the button number to 17 in the VP keys and preferences Screen to use the tilt function.

The use of the letter 'T' for tilt in the firmware has been discontinued to eliminate the hang-up that could occur with windows due to a misadjusted tilt level.

Turning the knob clockwise increases the sensitivity and counter clockwise decreases the sensitivity.

The TILT routine has a limiting timer in it that will debounce the TILT command by prohibiting the T keypress from occurring more than once every 2 seconds. When adjusting the TILT level be sure to allow for the delay timer to complete before trying to tilt the machine again.

## **Disabling Onboard TILT Feature**

The built in TILT feature can be disabled by using the serial control file ZBTED ZB Tilt Enable / Disable). See the Serial Control Section later in this manual for more details.

## **Launch Ball Button & Plunger as Launch Button**

The Launch Ball Input is Gamepad 16 and is assigned there by default as the button assignment in the firmware is critical to the proper operation of the Plunger as Launch Button Function. If required, a separate Launch Button can be installed and wired to the Gamepad Button 16 input on the plunger and assigned to Gamepad 16 in the game software settings.

Switching between Analog and Digital Plunger modes (normal plunger operation or press to imitate button press) is controlled by sending a serial control signal through the usage of the included script and batch files. See the Serial Control Section later in this manual for more details.

## **Gamepad/Keyboard Mode Switching**

The plunger can be switched between Gamepad only and Keyboard/Gamepad Hybrid modes by quickly pressing the Calibration button once.

The plunger can also be switched between Gamepad only and Keyboard/Gamepad Hybrid modes by pressing the Right Flipper and Start Buttons simultaneously.

The plunger can also be switched between modes by the use of the provided serial control files. See the Serial Control Section later in this manual for more details.

## **Plunger Factory Reset**

The plunger can be easily be reset to factory defaults in the firmware by running the serial control batch file for ZBRST.bat (after 1<sup>st</sup> editing the com port in the file to match your hardware). A reset is also required after a firmware upgrade to force a hardware scan of the plunger to redefine or confirm input assignments for the plunger.

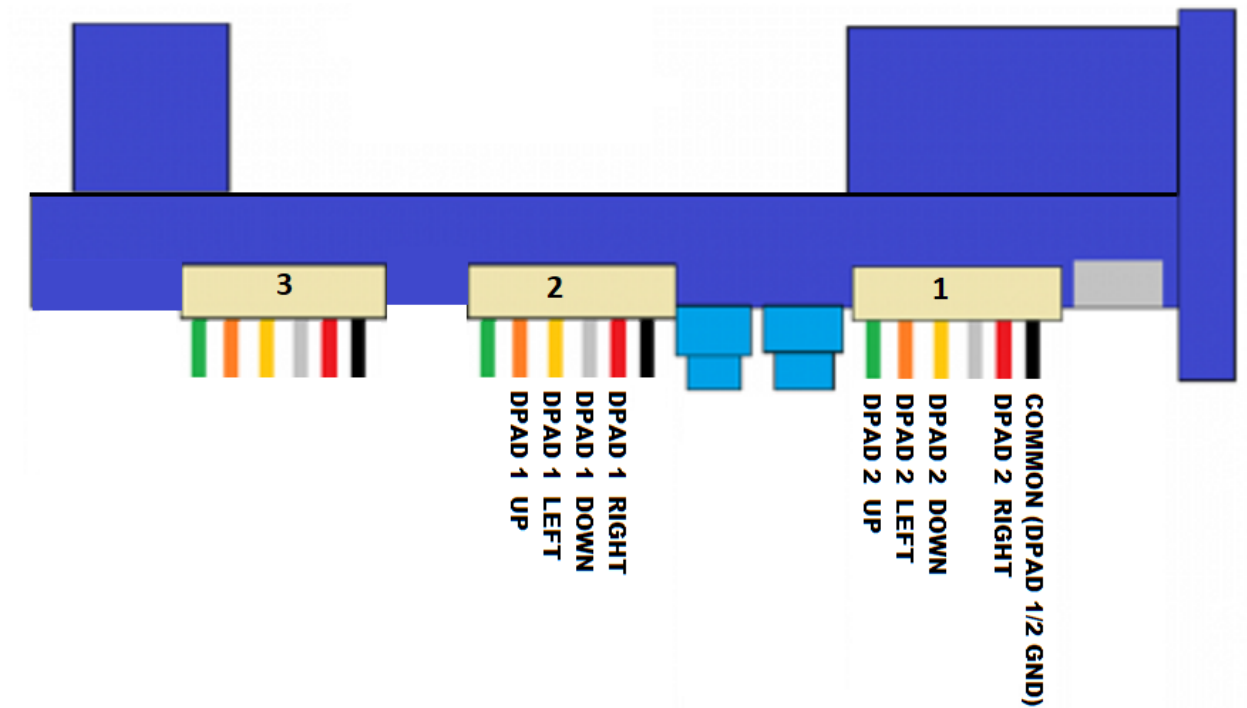
After running the batch file a manual reboot (unplugging and reconnecting) of the plunger is required to finish the firmware reset.

## Factory Default Keycodes

LShift	Left Flipper	Button 1
LCTRL	Left MSave	Button 2
1	Start	Button 3
q	Exit	Button 4
2	Extra Buy-in	Button 5
5	Coin	Button 6
END	Coin Door Open/Close	Button 7
=	Volume DOWN	Button 8
-	Volume UP	Button 9
8	SMenu Down	Button 10
9	SMenu UP	Button 11
0	SMenu Enter	Button 12
7	SMenu Cancel	Button 13
RShift	Right Flipper	Button 14
RCTRL	Right MSave	Button 15
Enter	Launch/Fire	Button 16
	Tilt Button Assignment	Button 17

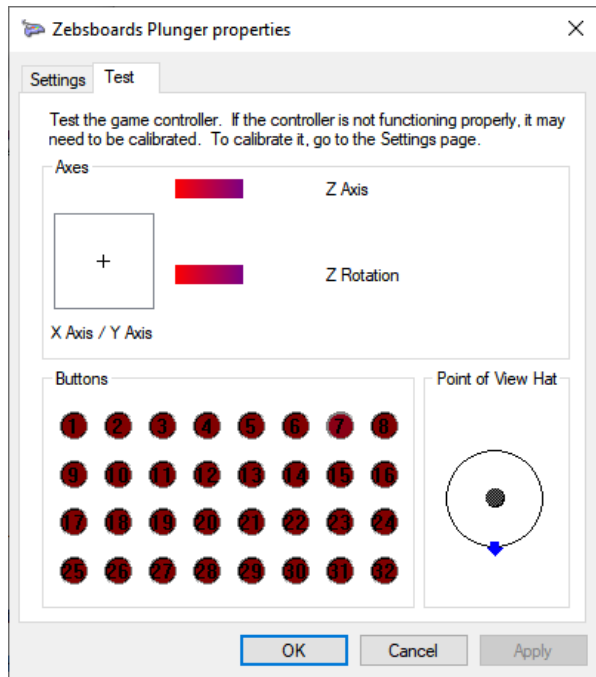
## Dpad/Joystick Connection

The firmware allows for the connection of 2 joysticks for use through the Point of View Hat Switch inputs. These inputs rely on the use of the harnesses provided and run through direct input (- or common) switching. The inputs for the Dpads are as follows:

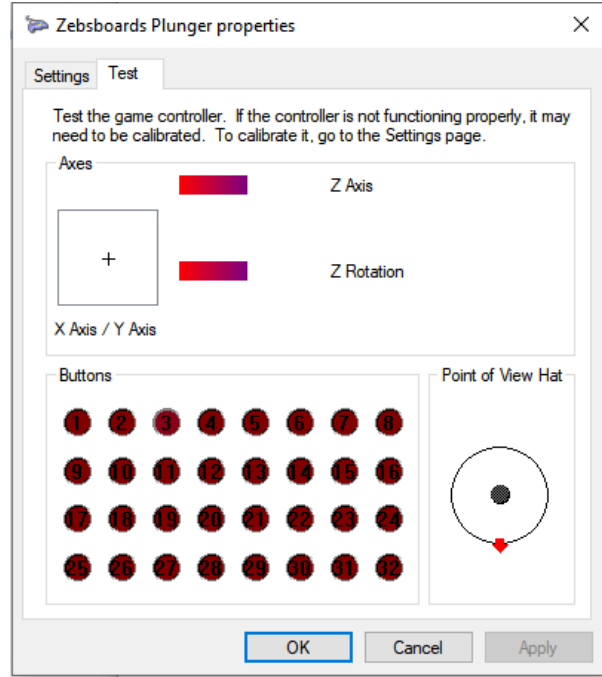


Dpad events show up in the control panel app on the Hat Switch Ring as shown below.





DPAD 1



DPAD 2

## **SERIAL CONTROL**

### Batch File Definitions:

ZBGP.bat - Gamepad Mode Enable - sends a serial character (G) to the plunger and puts it into Gamepad Button Mode

ZBKB.bat - Keyboard Mode Enable - sends a serial character (K) to the plunger and puts it into Keyboard/Gamepad Button Mode - Gamepad buttons will be sent as well as keystrokes

ZBLA.bat - Analog Plunger Enable - sends a serial character (A) to the plunger and puts it into Analog Plunger Mode

ZBLD.bat - Digital Ball Launch Mode - sends a serial character (D) to the plunger and puts it into Digital Plunger/Ball Launch Mode - Pressing on plunger sends an Enter key/Gamepad button press

ZBRST.bat - Reset plunger to factory default - sends a serial character (R) to the plunger and reloads the factory settings (keystrokes, button assignments, etc). Requires reboot of plunger after running.

ZBTED.bat - Tilt Enable/Disable - sends a serial character (T) to the plunger Enabling or Disabling the onboard TILT function - sending command Enables or Disables depending on current state

ZB\*\*.vbs - Runs the ZB\*\*.bat file in a script shell (hidden) - for use in adding commands to vb scripts where a pop-up window is not desired

## **Typical Usage**

Switching between keyboard and gamepad modes is usefull for systems using Visual Pinball and PinballFX2/3. Due to the reliance on VPINMAME, Visual Pinball responds best to keyboard controllers as VPINMAME and some tables have keystrokes coded directly. In the case of PINBALLFX2/3 or The Pinball Arcade, a full gamepad is prefereable as it makes setting up xbox360ce (the controller interface software) as easy as can be. Being able to switch modes completely removes the need for TSR software such as XPADDER or JOY2KEY.

## **Control Batch Files / VBS Scripts**

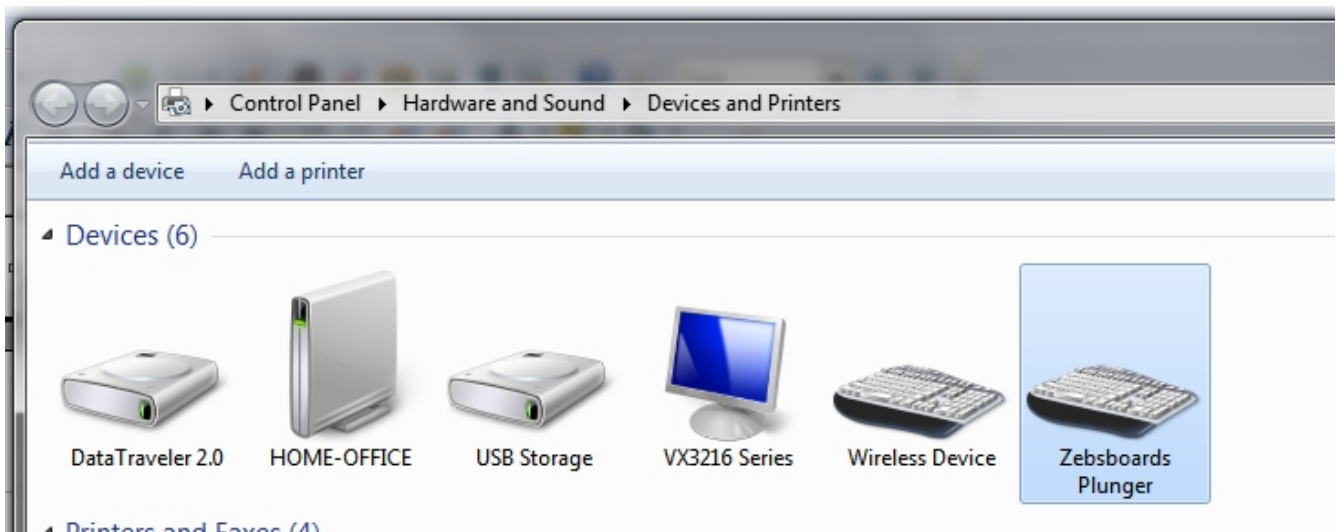
The easiest method of sending the commands to the plunger are by the following batch files or vbs scripts (the vbs scripts are used to run the batch files in hidden command boxes).

In order to use the files, the serial port assigned to the plunger needs to be entered in the batch files.

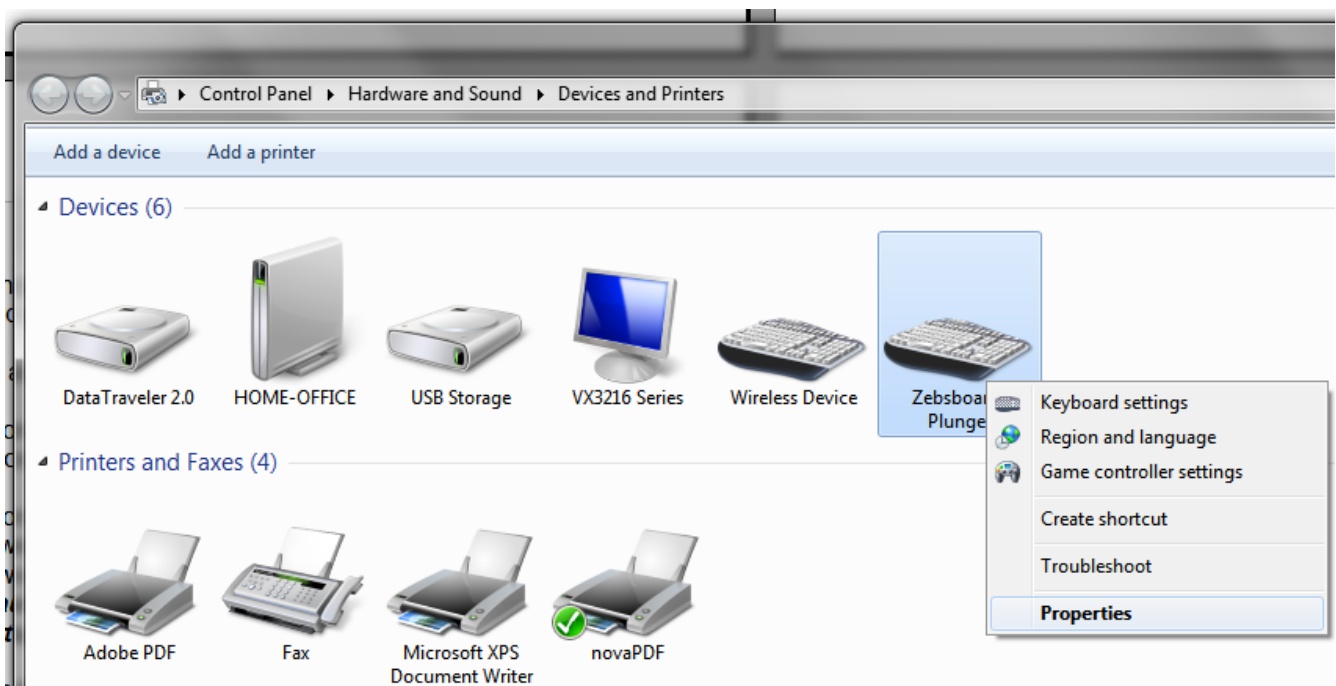
## Finding The Plunger ComPort

To find the comport assigned to the plunger do the following:

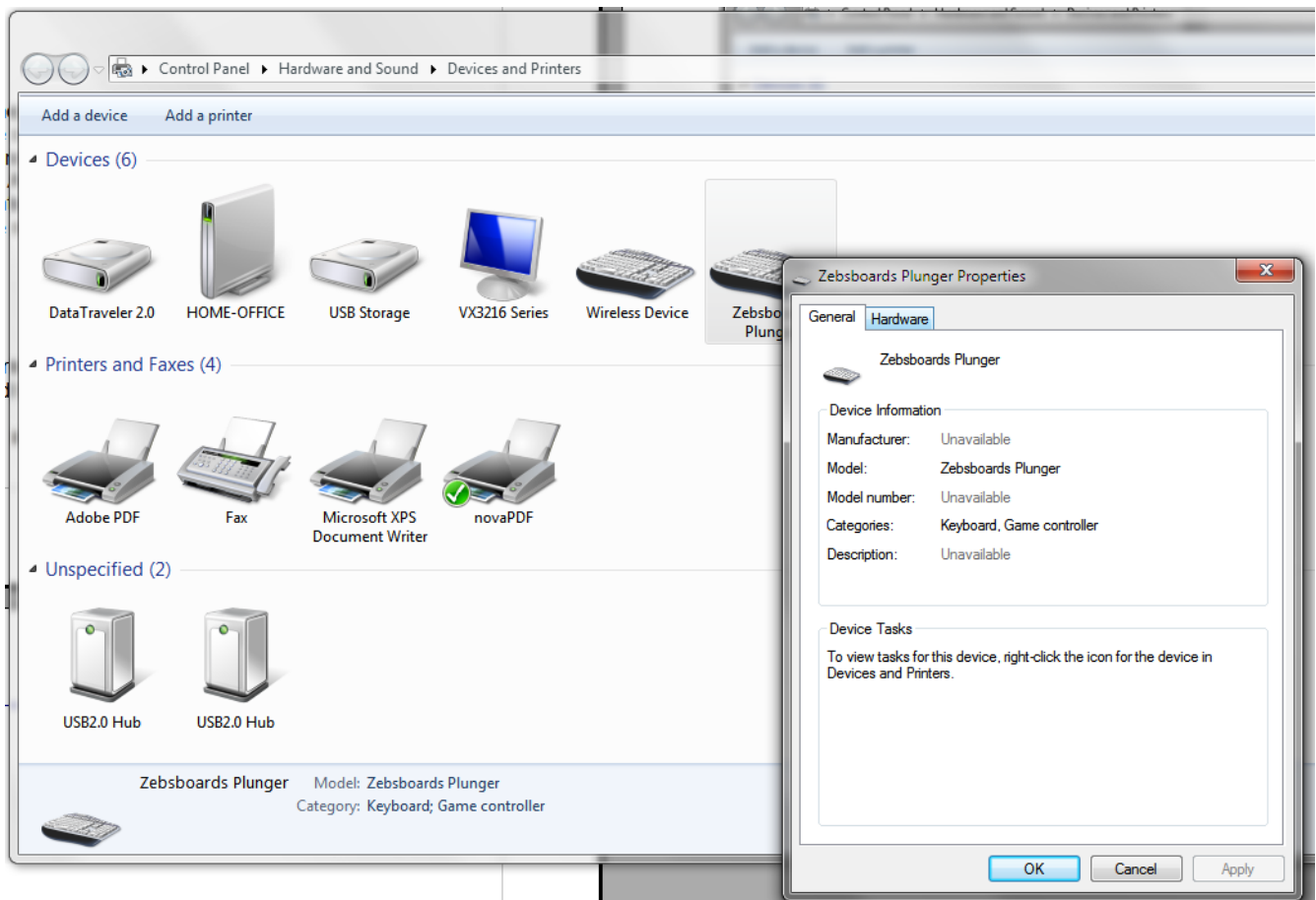
### Open Devices and Printers screen and locate the zeksboards plunger



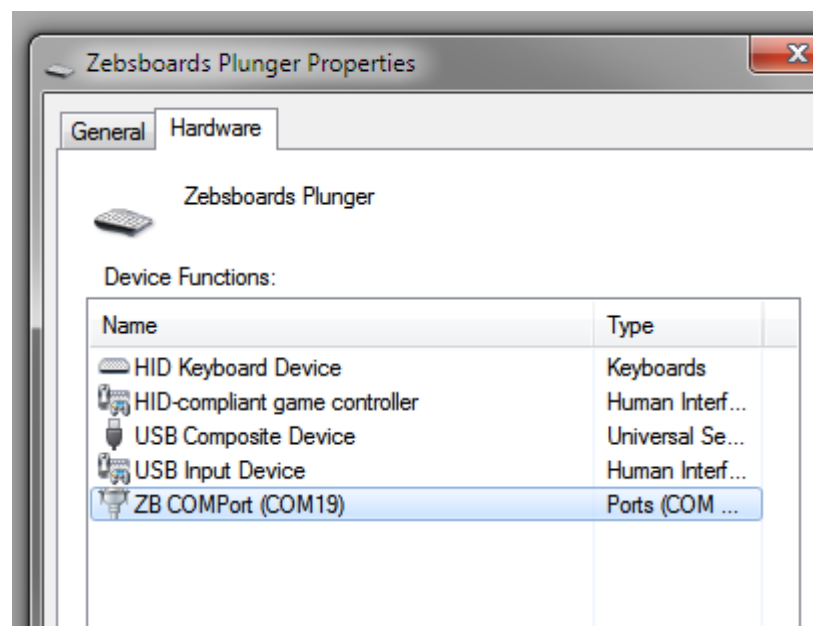
### Right Click on the zeksboards plunger and select properties



## Select the Hardware tab



## Make note of the comport in the listing

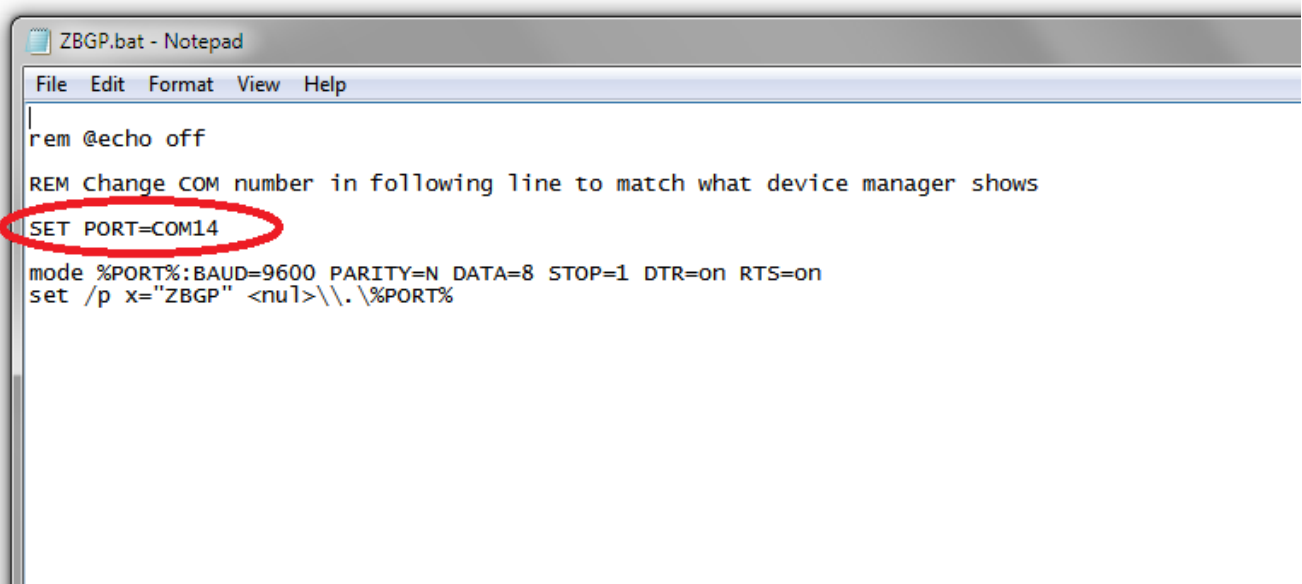




## Modifying the Batch Files

The Serial Control Files can be found on the thumbdrive included with your plunger or downloaded in the firmware package linked on the front page at [www.zebsboards.com](http://www.zebsboards.com)

Extract the files and open ZBGP.bat in notepad (right click and choose edit, don't double click to open).



```
rem @echo off
REM Change COM number in following line to match what device manager shows
SET PORT=COM14
mode %PORT%:BAUD=9600 PARITY=N DATA=8 STOP=1 DTR=on RTS=on
set /p x="ZBGP" <nul>\\.\%PORT%
```

Change COM number to match comport number found in device manager.

Save file and repeat for each of the following .bat files. Nothing needs to be done with .vbs files.

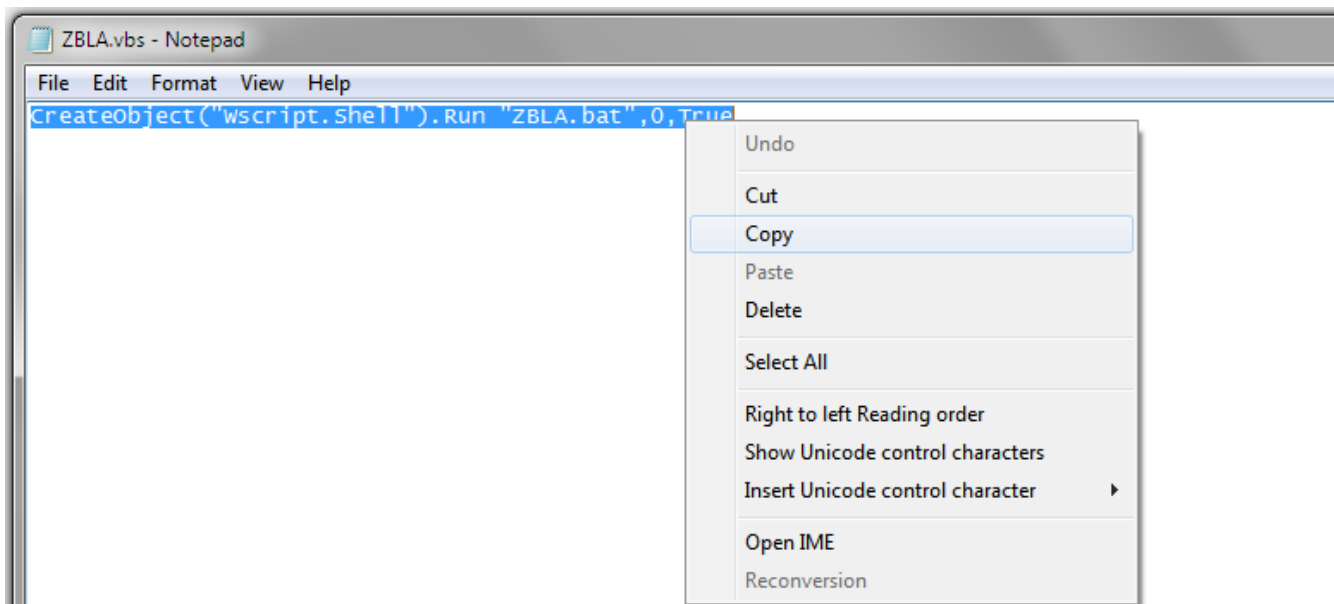
## Using DIGITAL/ANALOG Switching Files

In Visual Pinball the easiest way to use the files (ZBLA / ZBLD) is to add the vbs command for the bat file directly into the script.

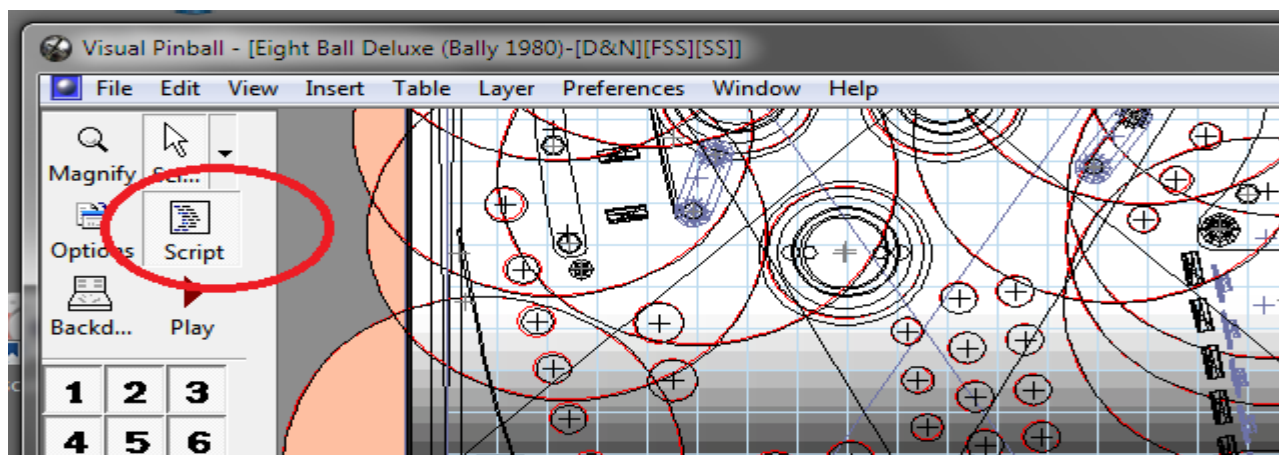
Start by copying ZBLA.bat and ZBLD.bat to the ..\VisualPinball\Tables directory of your vp installation.

Start the visualpinball editor and open/load a table that uses a mechanical plunger (ie: Eight Ball Deluxe).

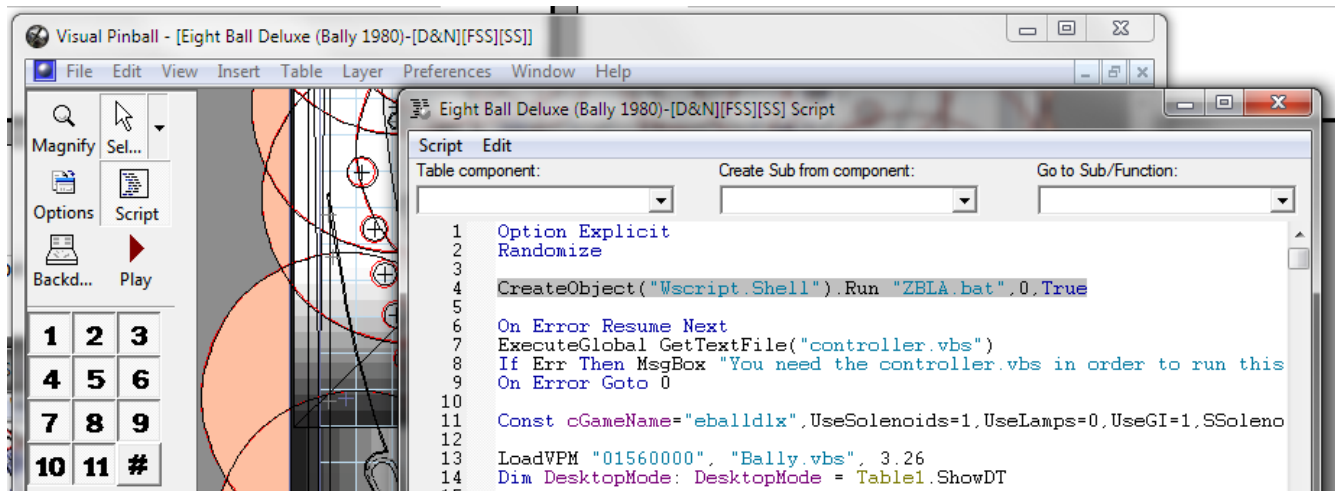
Open the ZBLA.vbs script file that unzipped with the ZBLA.bat file in notepad, highlight the line of text and copy it (right click and select copy).



Return to the VP Editor and click on the Script Button to the left of the table layout as shown below.

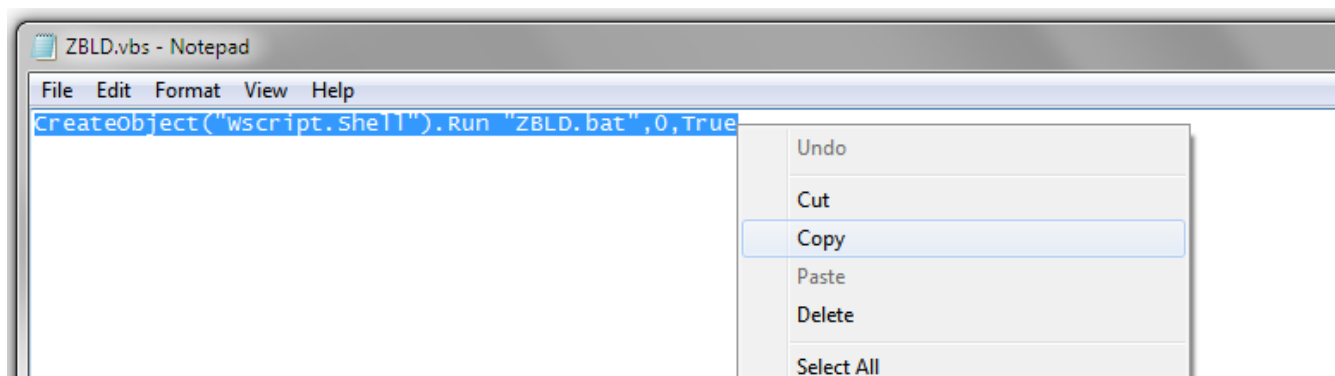


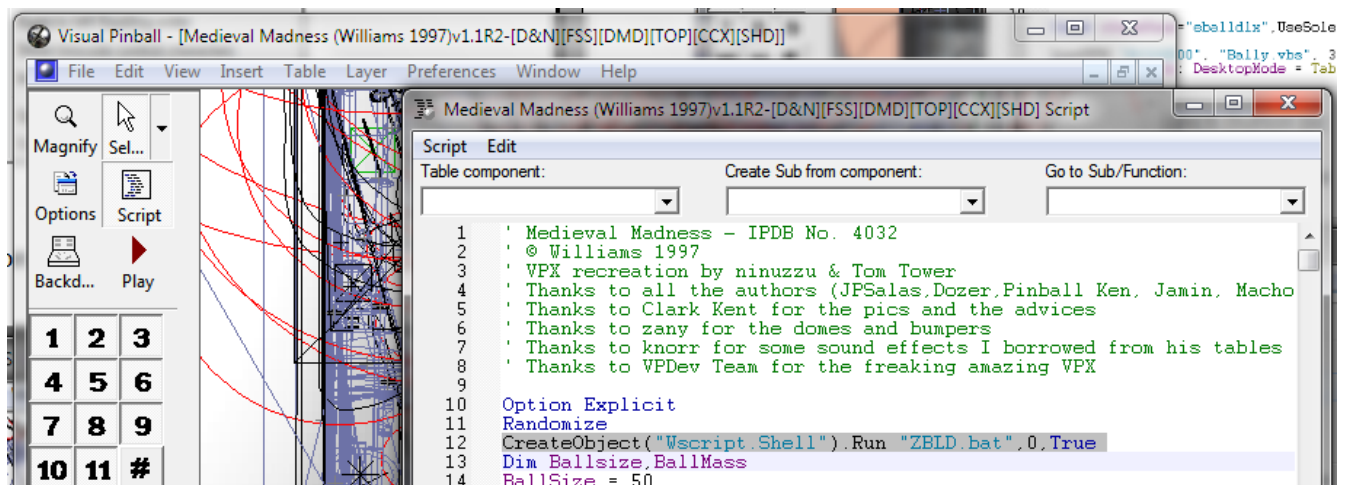
Paste the line of text copied from the ZBLA.vbs script into the table script as shown in Line 4 below.



Save the table and load a table that uses a Launch Button (ie: Medieval Madness)

Repeat the above procedure using ZBLD.vbs as shown below





Now run the Launch Button Table that you edited (Medieval Madness in the example).

You will find that the pushing on the plunger will launch the ball as if it were a launch button.

Now run the Analog Plunger table that you edited (Eight Ball Deluxe in the example).

You will find that the plunger operates as you would expect, pulling back and releasing and responding on screen to the plunger rod movement.

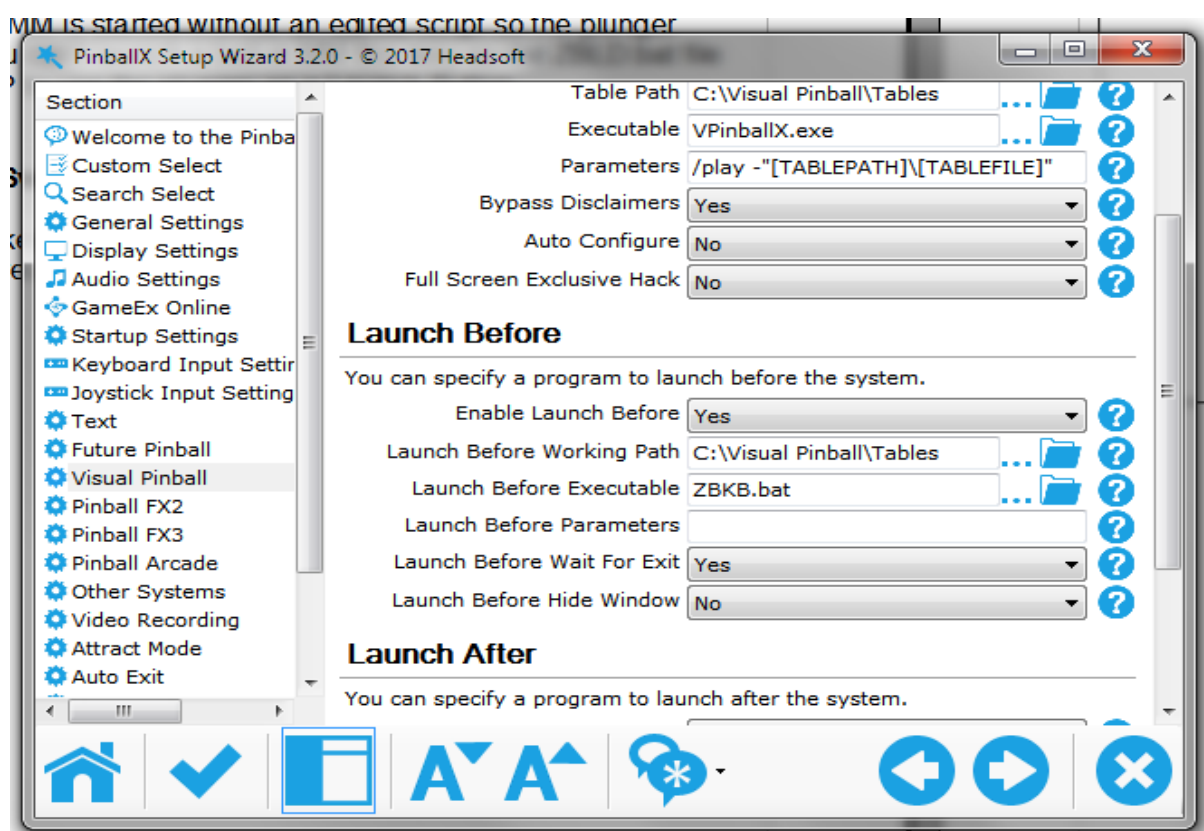
The main issue to remember is that if you are using the script edit method of switching the ball launch mode you will have to edit the script of every table you install with the proper command line. Failing to do so may leave you in the wrong mode when loading different tables if the mode line is missing

ie: EBD has the ZBLA.bat command and switches to Analog upon start. Upon exit the plunger is still in Analog mode but MM is started without an edited script so the plunger remains as an analog plunger. You can't launch a ball in MM this way so the ZBLD.bat file would have to be run outside of VP to use the plunger as a Launch Button.

## Using GAMEPAD / KEYBOARD Switching Files

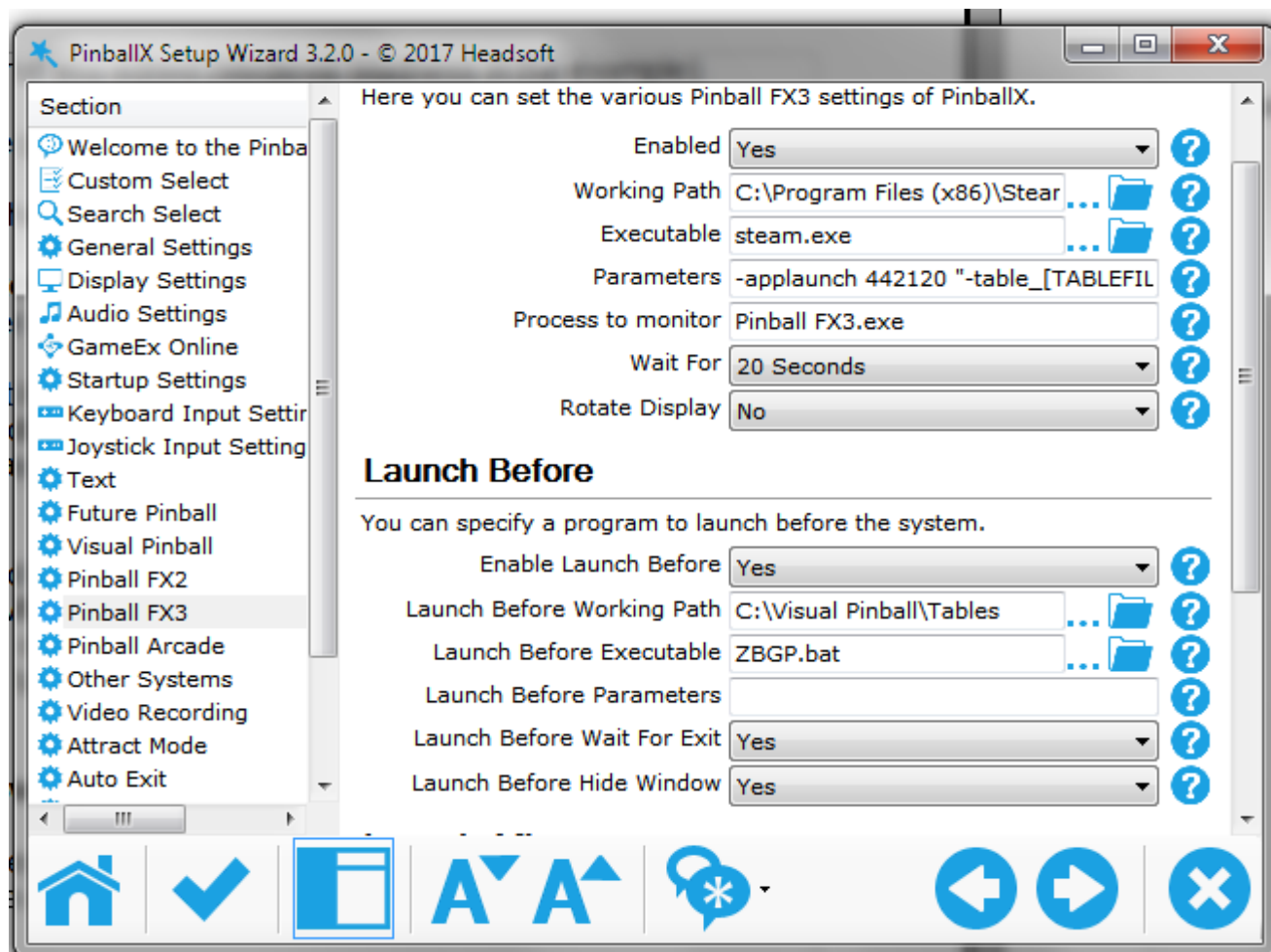
Switching between gamepad and keyboard modes can be accomplished by running the appropriate bat file in the run before and/or run after sections of the PinballX settings.

### Keyboard Mode





## Gamepad Mode



## **Links to further Information**

### **Identifying Your Plunger Firmware**

<https://www.zebsboards.com/forum/ext/dmzx/fileupload/files/d9eab665cbb79d11f0846a2f21d2d90e.pdf>

### **A Simple Utility to Locate the Bootloader COMPort of your plunger**

<https://www.zebsboards.com/forum/ext/dmzx/fileupload/files/55b9c46b8ce7b56e63ea381bfa889cab.zip>

### **Visit Zebsboards Forums for further information and firmware updates**

<https://www.zebsboards.com>

## **TROUBLESHOOTING**

### ***Plunger has erratic behaviour on ball launch / doesn't return to 0 position***

Make sure that the lower housing is pushed back fully against the Upper Housing mounting plate and not loose or slipping

Run calibration utility described earlier in this manual

### ***Plunger doesn't calibrate properly in Windows calibration***

Calibration in Windows is not needed and can give unwanted results, do not use Windows calibration tool. If you have used it, return to the calibration screen, click on "RESET TO DEFAULT", click ok, exit the screen and reboot computer

Run the calibration utility described earlier in this manual

### ***Plunger launches early before end of stroke***

Plunger is not aligned properly. The plunger is designed to be mounted in 3/4" cabinet material, if the cabinet material is less than 3/4" shim out the Upper housing mounting plate by the difference

Make sure that the lower housing is pushed back fully against the Upper Housing mounting plate and not loose or slipping.

Run the calibration utility described earlier in this manual

### ***Plunger causes computer to hang on boot***

Tilt and / or Nudge settings too high. Turn down Tilt and Gain settings (blue knobs under plunger) and re-adjust software gain in nudging axis (x/y). Re-adjust Tilt sensitivity after setting nudge in software.

Possible issue with Plunger not resetting. Make sure that USB charging while computer is off is disabled in your BIOS (see mainboard manufacturer's manual for instructions)

### ***Plunger won't switch on serial commands***

Incorrect comport settings / driver not installed.

Open devices and printers and verify successful driver installation for plunger.

Open batch files in notepad and verify correct comport in file.

Verify that there are no comport conflicts with software assigned ports (Freezy's dmd script, Serial addressable led comport, etc)

### ***Plunger button inputs don't work after firmware upgrade***

Hardware scan bit not reset in plunger.

Modify comport setting in RST.bat file and run. Unplug USB cable and reconnect to force hardware scan.

Plunger Opening Template

