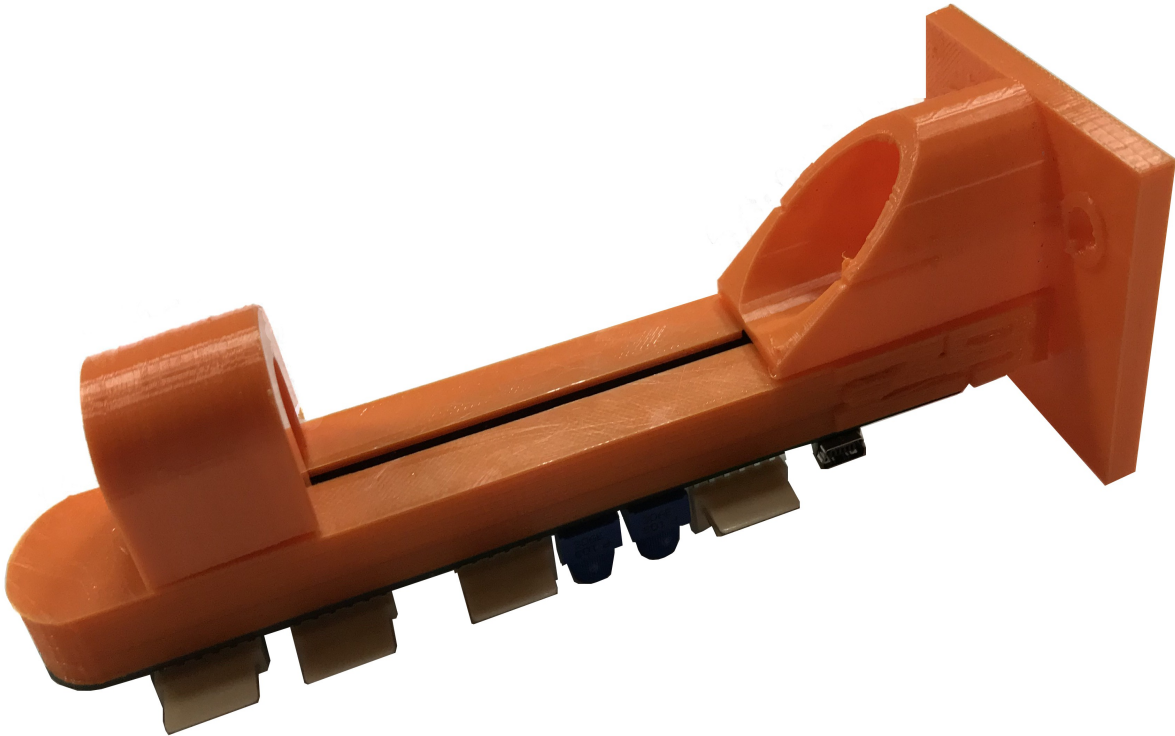




DIGITAL / ANALOG PLUNGER INSTALLATION & USE

Firmware V3R3.5 and Higher





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.

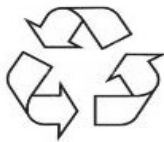
Static Damage Prevention

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.

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INCLUDED IN KIT

1pc	Upper Housing/Mount
1pc	Lower Control Housing
1pc	Slider Block / Clip
1pc	Stainless E Clip
2pc	Flat Washer – Shim
3pc	1/2" x #10 x 32 Machine Screw
3pc	#10 Star Washer
4pc	30" 6pin Wire Harness
1pc	6' USB2.0 MiniB Cable

THEORY OF OPERATION

The Zebsboards Digital / Analog Plunger consists of a 22 button keyboard/gamepad encoder, an accelerometer based analog nudging sensor and a linear potentiometer plunger sensor all combined into one compact device.

Button input is based on button switches connecting the input to the signal ground when pressed. These signal grounds are then converted to hard coded keypresses or gamepad button presses internally and sent the computer through the full speed USB connection.

Analog nudge sensing is accomplished by monitoring the signals sent by an adxl335 accelerometer to the microcontroller on the circuit board. These signals are fully smoothed and referenced to an auto calibrated center position giving reliable and repeatable results.

Sensing of the movement of the ball shooter rod (plunger) is done through a B10K linear potentiometer.

Since its inception, the plunger has had the ability to read the travel of the rod in either a positive or negative direction allowing for proportional movement either by drawing back the rod and releasing it or by 'smashing' the rod with the palm of your hand (palm smash). As well, by supplying the plunger with a ground signal on the ZBLaunch lead (Zebsboards Ball Launch) the plunger has the ability to be able to switch between acting as a traditional plunger or as a substitute for a Launch Ball button for tables without plunger mechanisms.

Starting with Firmware revision 3.5 (current) the ZBLaunch wire connection is no longer required as it has been replaced by a simple serial control command. The plunger can now be switched between keyboard and full gamepad emulation by serial control commands as well.

INSTALLATION AND CONNECTION

Assemble screws and star washers



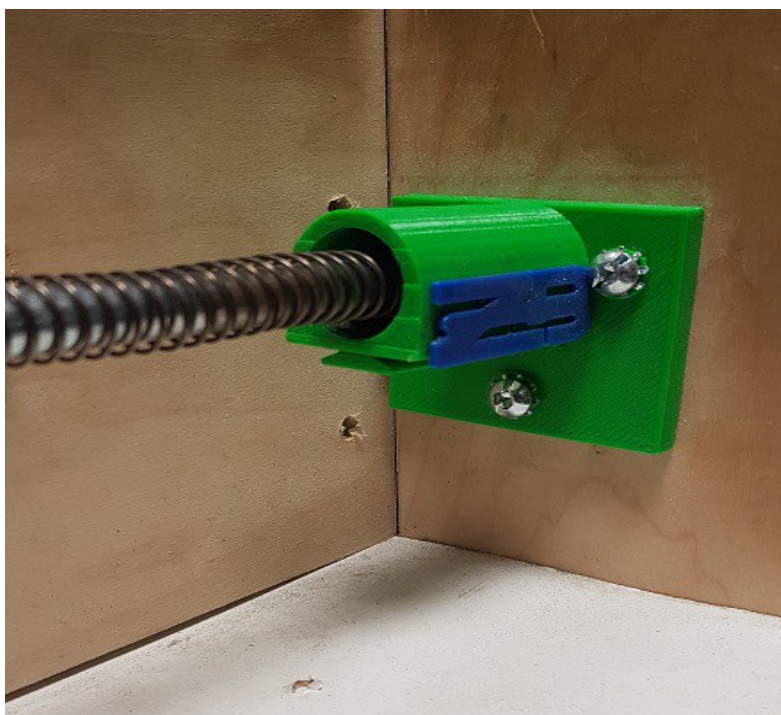
Suggested opening for Plunger (template available at end of manual)



Insert ball shooter in opening (ball shooter not included)

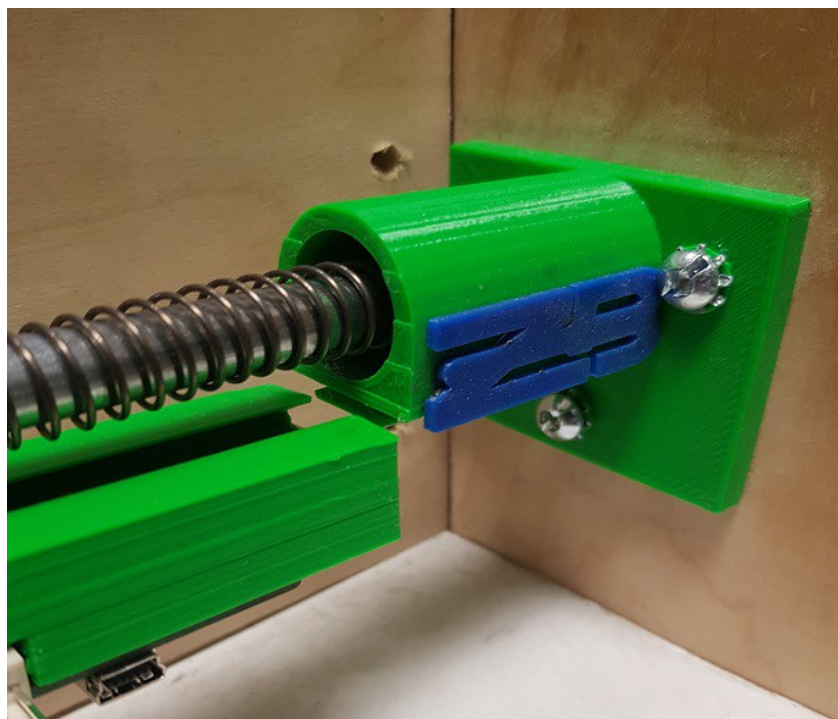


Mount plunger upper housing using supplied machine screws and star washers



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

Align lower housing slot with upper housing dovetail tab



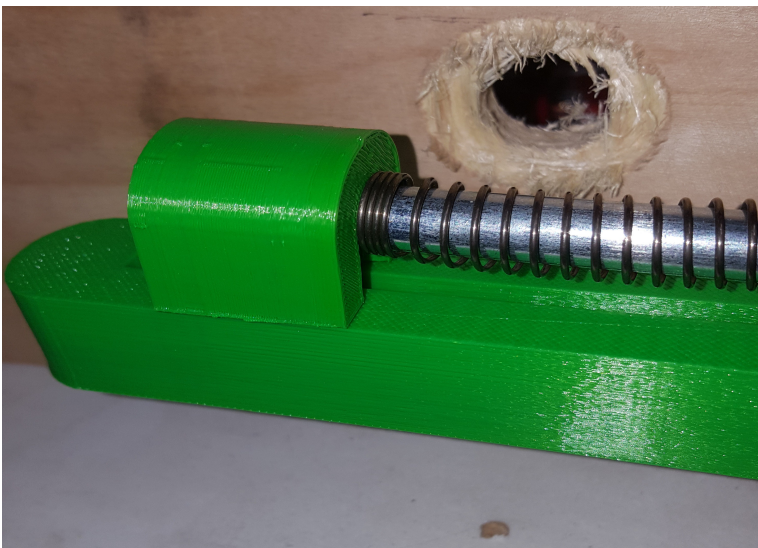
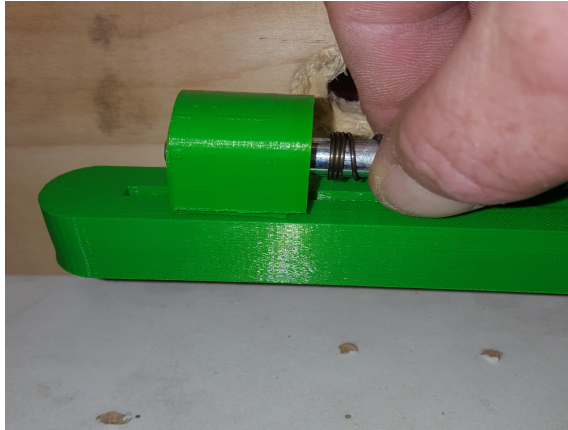
Push housing back fully



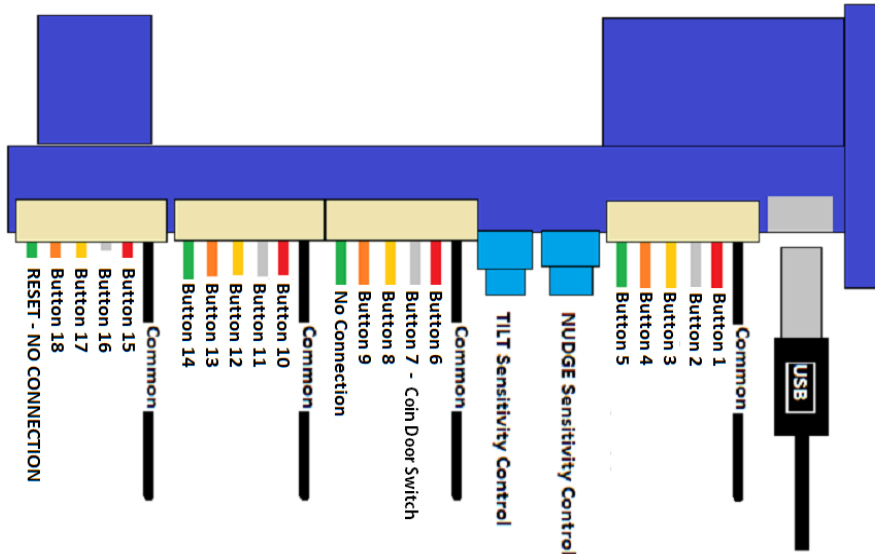
Position slide block over metal tab and push back firmly against c-clip



Pull back spring, align slide housing slots with slide block tabs and push firmly into place



Connections



Button 7 **MUST** be used for coin door switch only. Firmware is coded to provide a single click output when switch is activated/deactivated and will **NOT** provide constant signal for other applications

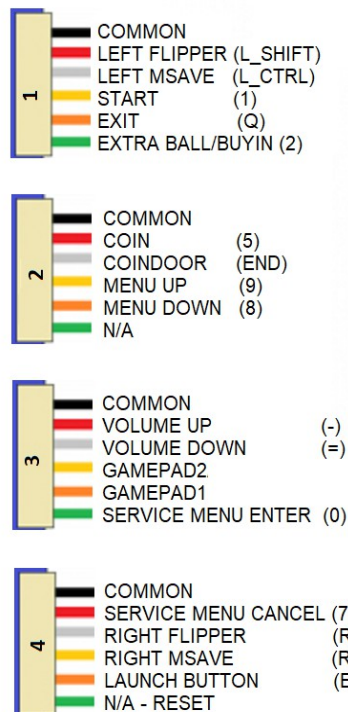
Button 19 is indicator light for zblaunch mode. Illuminated means plunger acts as digital button, not illuminated means plunger is in analog mode

Button 20 (virtual button) is digital launch button output, assign to launch ball in game settings

Button 21 (virtual button) is tilt threshold indicator light and output. Assign button 20 to tilt in game settings

Reset input is provided as a convenience feature, grounding input will reset plunger (equivalent of unplugging USB cable)

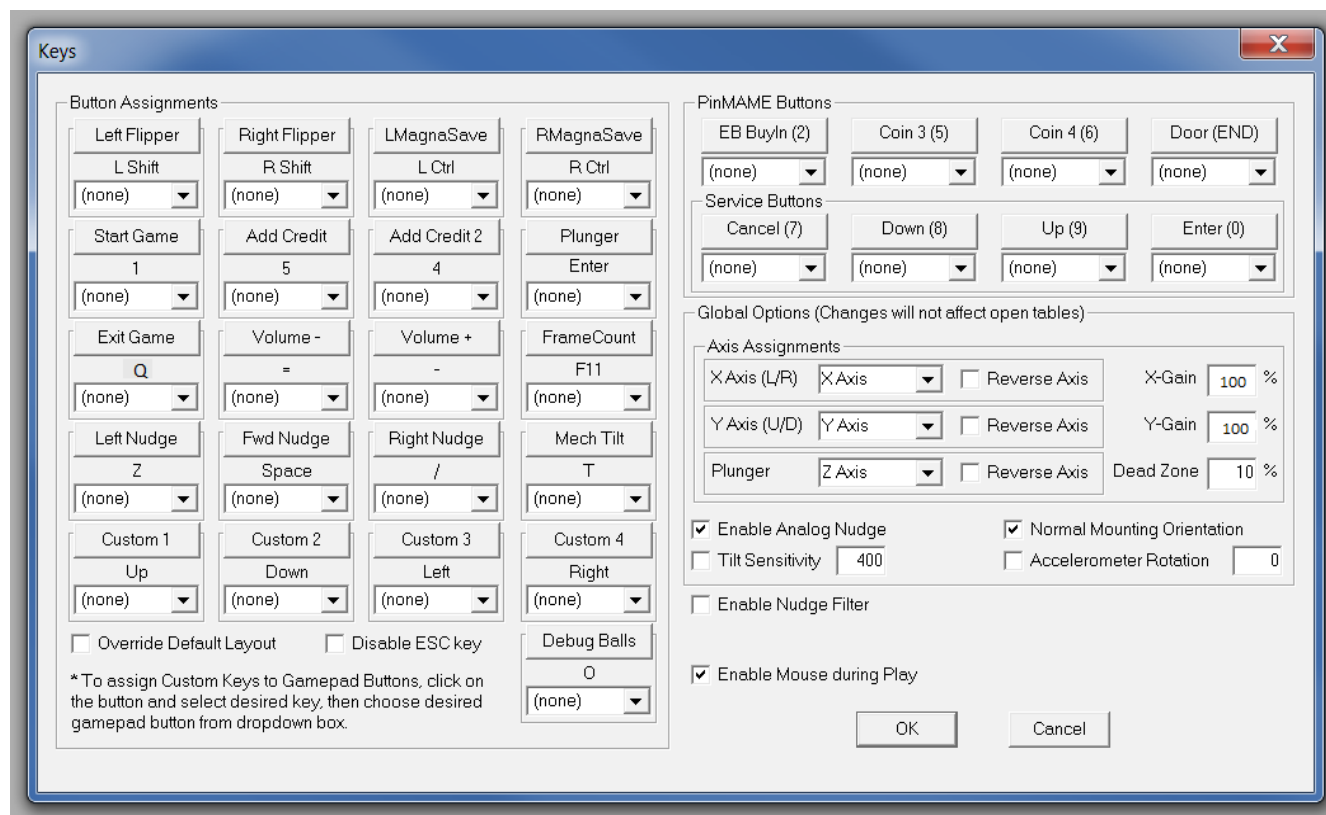
V3R5HB GAMEPAD MODE INPUTS



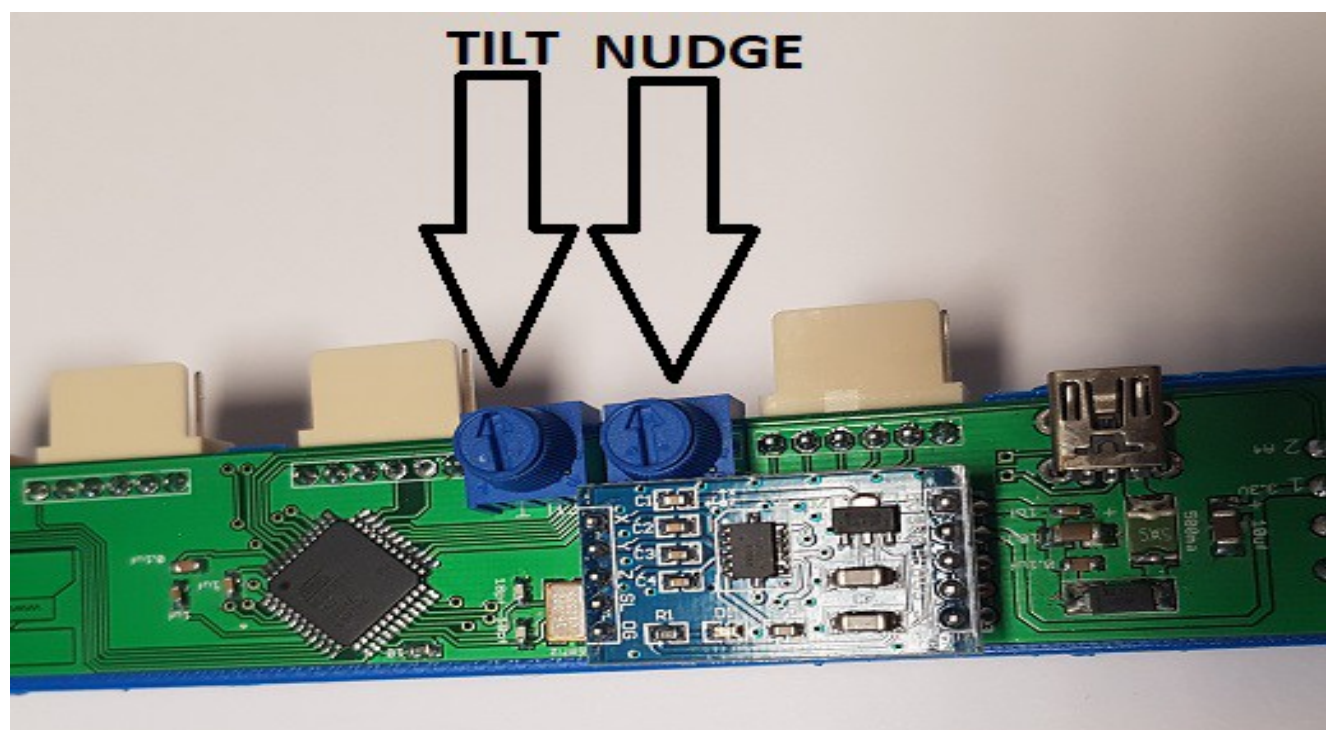
- ASSIGN 't' / GAMEPAD BUTTON 21 TO TILT IN GAME PREFERENCE SETTINGS
- GAMEPAD BUTTON 19 IS INDICATOR LIGHT FOR ZBLAUNCH MODE
- GAMEPAD BUTTON 20 IS OUTPUT BUTTON FOR ZBLAUNCH IN FULL GAMEPAD MODE
- GAMEPAD BUTTON 21 IS INDICATOR LIGHT AND OUTPUT BUTTON FOR TILT FUNCTION

V3R5HB FIRMWARE

The plunger is hardcoded for the Standard button layout for Visual Pinball. Additionally, there are 2 gamepad buttons available to be assigned to any function not covered by the hardcoded keystrokes



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 Notepad in your desktop. 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 the letter T appears in notepad.



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.

SERIAL CONTROL

Serial commands can be used to change 2 states, the controller type (keyboard / gamepad) and the plunger function (digital / analog – Launch Button / Traditional Plunger).

The commands used for this are sent as string values as listed below:

- ZBGP** Gamepad Mode - Button presses are sent as gamepad button presses and device appears to software as a gamepad only
- ZBKB** Keyboard Mode - Button presses are sent as keystrokes (hard coded in firmware), 2 gamepad buttons and device appears to software as both a keyboard and limited gamepad. ***By default the plunger starts in Keyboard Mode at system startup.***

In either of the above modes the axes are recognized as gamepad axis points (x, y – nudging, z – plunger).

- ZBLA** Analog Plunger Mode - Plunger acts as a traditional mechanical plunger would, pulling back or pushing in reports a z axis movement. ***By default the plunger starts in Analog Plunger Mode at system startup.***
- ZBLD** Digital Button Mode - Pushing in on the plunger sends either an ENTER keystroke (Keyboard Mode) or GAMEPAD BUTTON 20 press (Gamepad Mode) for as long as the plunger is pressed in

Typical Usage

Switching between keyboard and gamepad modes is useful 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 preferable 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.

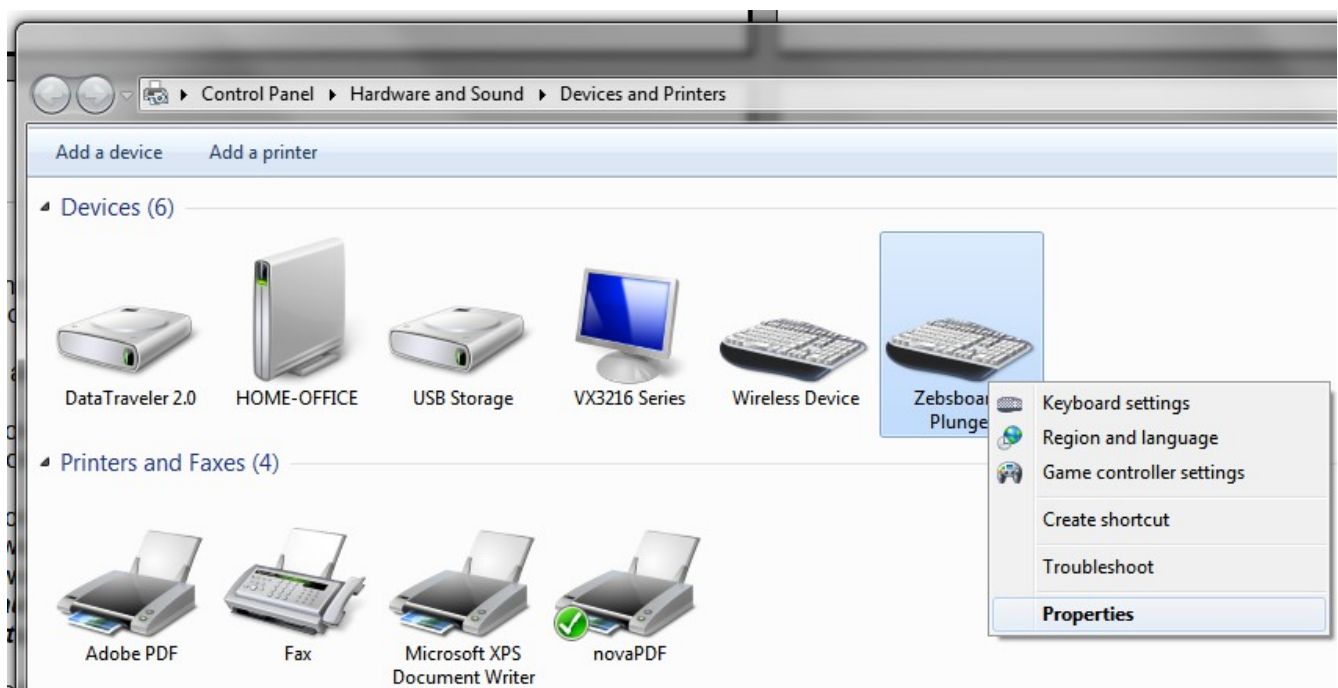
Finding The Plunger ComPort

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

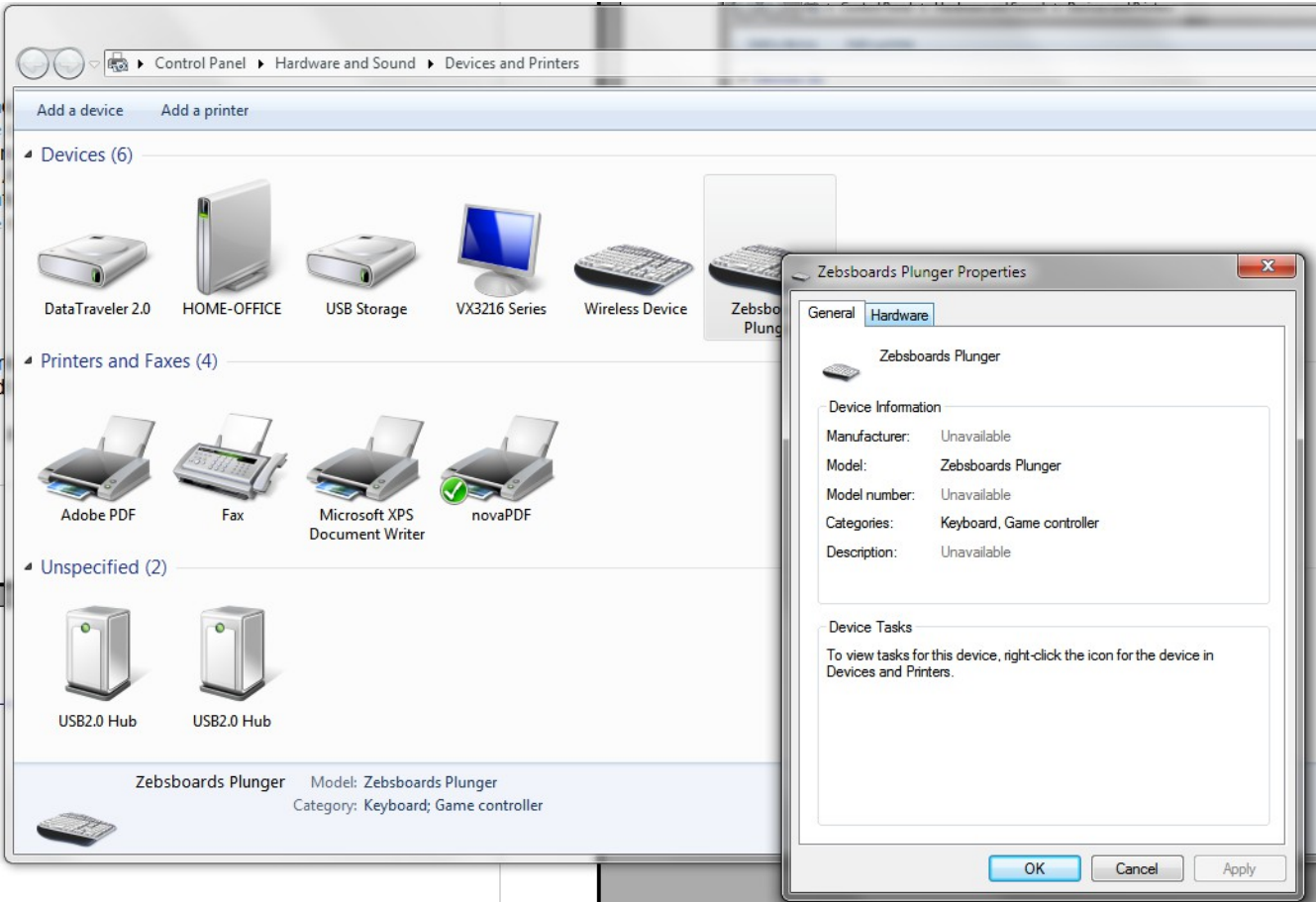
Open Devices and Printers screen and locate the zeksboards plunger



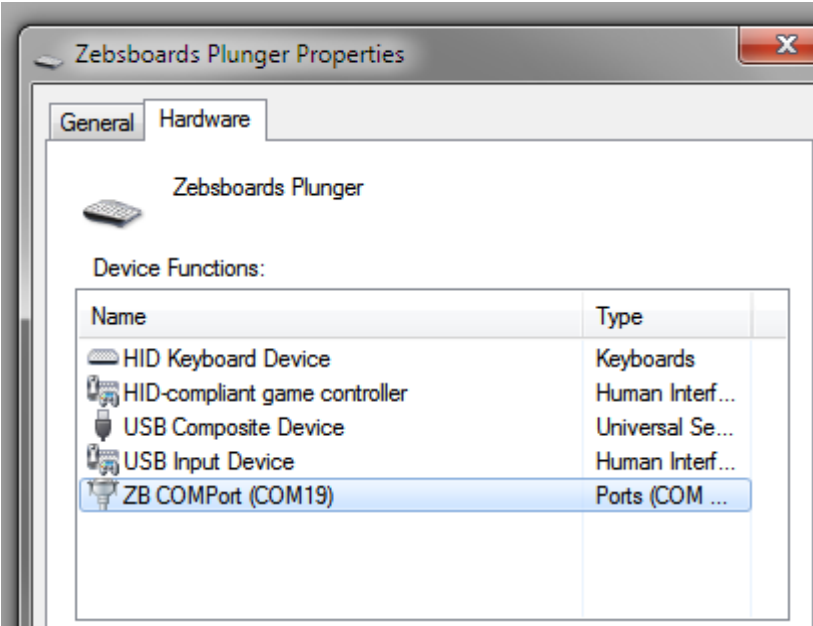
Right Click on the zeksboards plunger and select properties



Select the Hardware tab



Make note of the comport in the listing

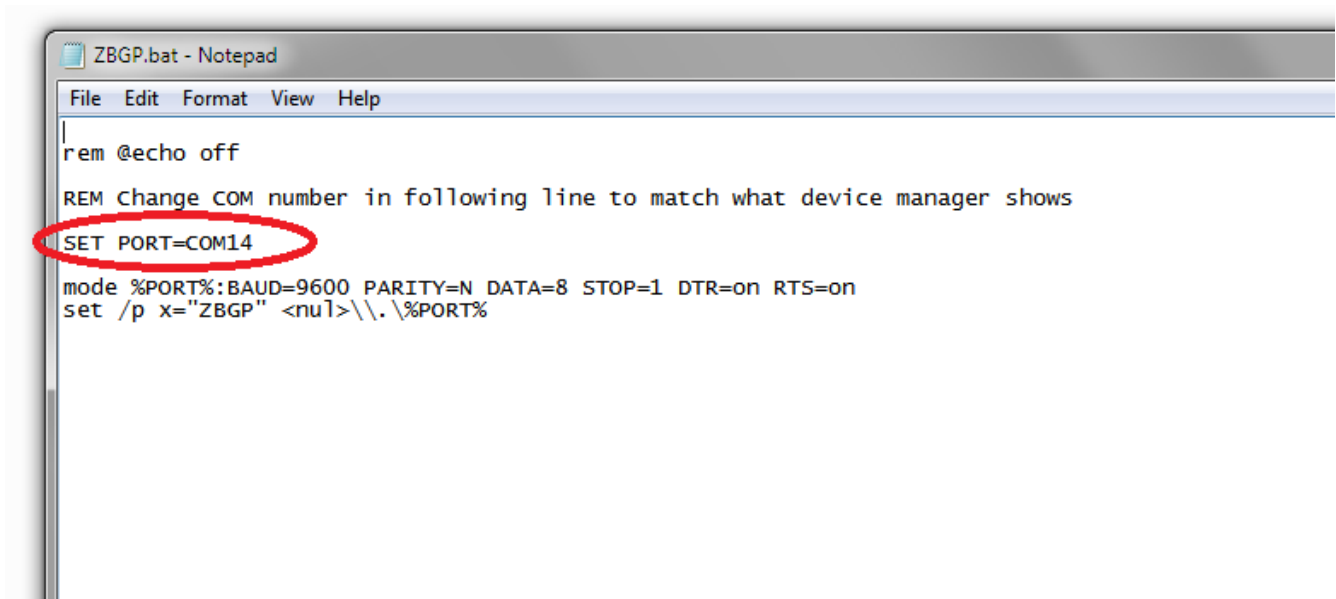


Modifying the Batch Files

Download the Plunger Serial Control Batch files from here ...

<https://www.zebsboards.com/forum/ext/dmzx/fileupload/files/058891f25a26a978a0ff37761cbd7f2c.zip>

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.

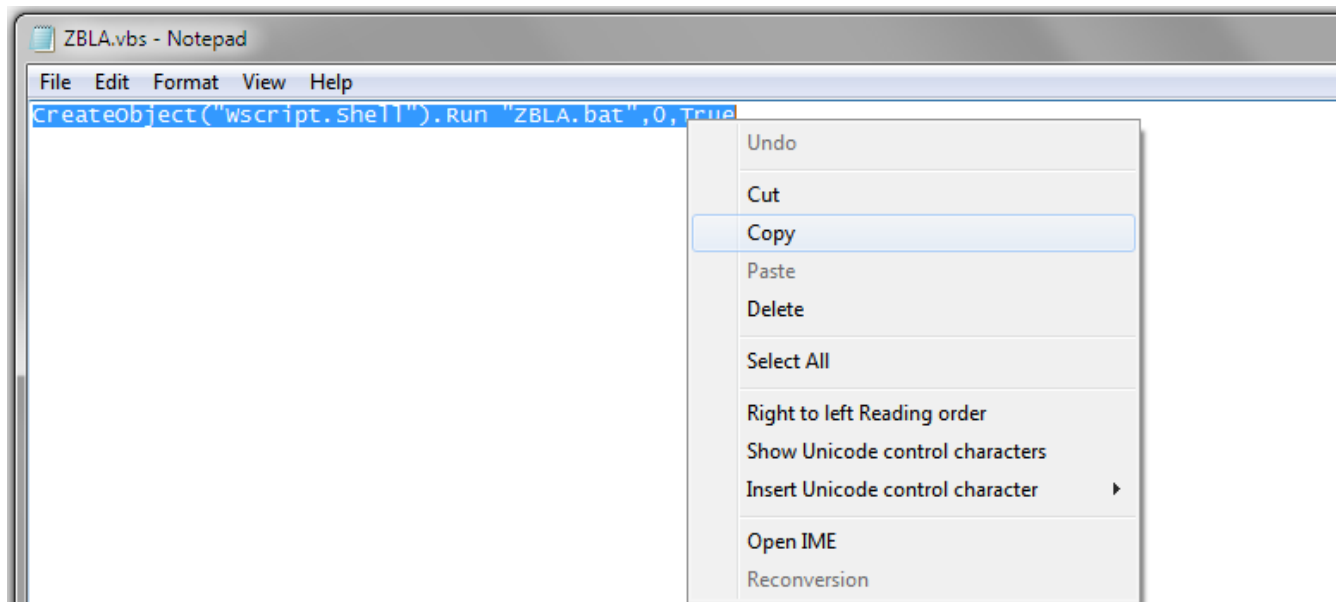
Using DIGITAL/ANALOG Switching Files

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.

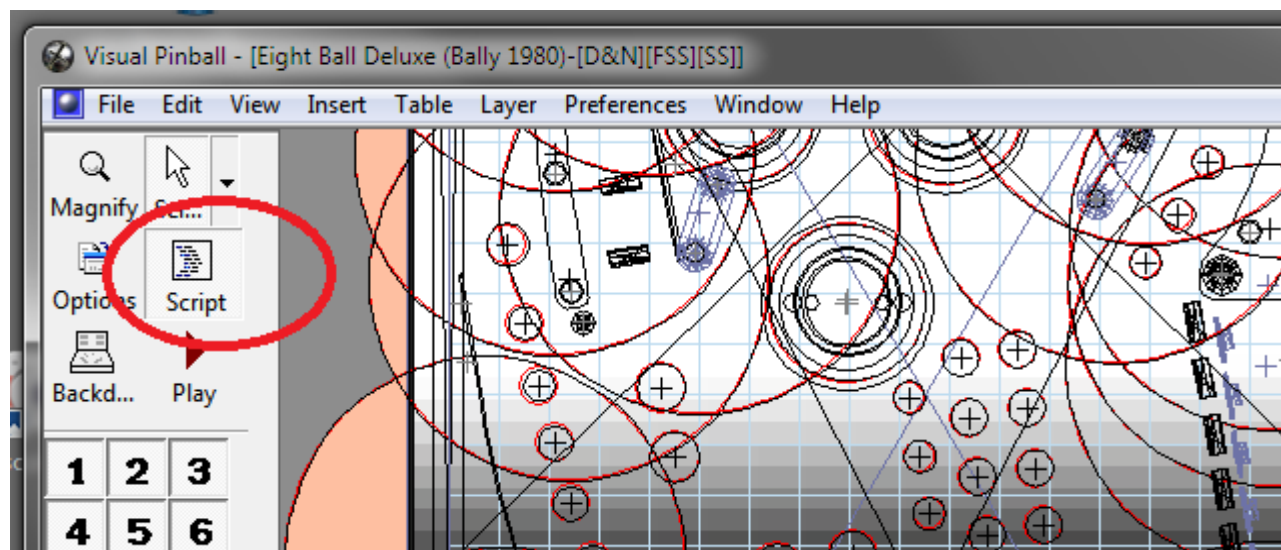
Start by copying ZBLA.bat and ZBLD.bat to the ..\VisualPinball\Tables directory of your vp installation.

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

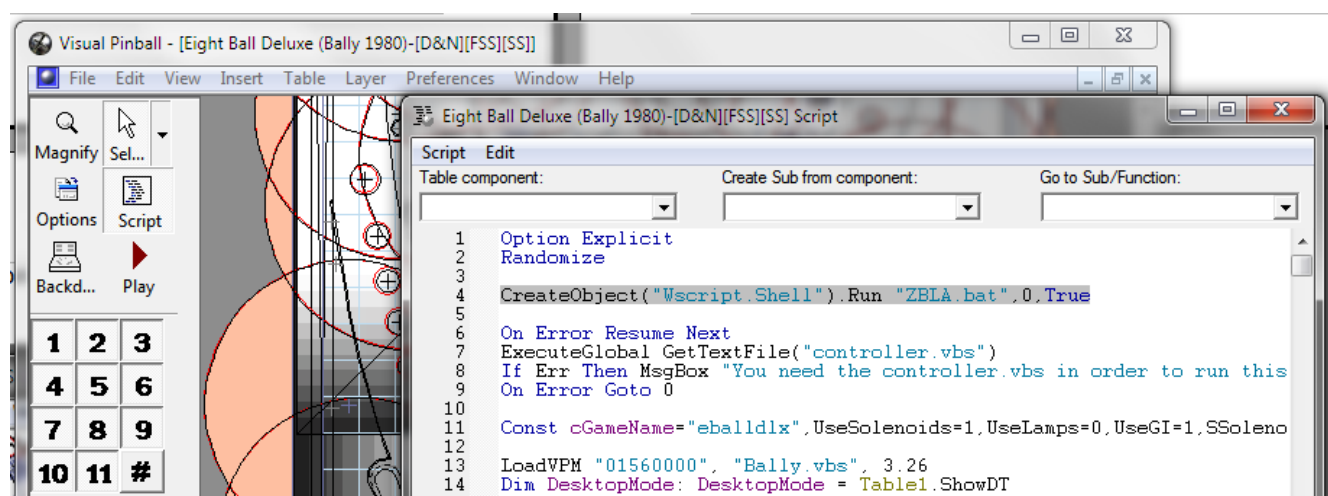
Open the ZBLA.vbs script file that unzipped with the ZBLA.bat file in notepad, highlight the line of text and copy it (right click and select copy).



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

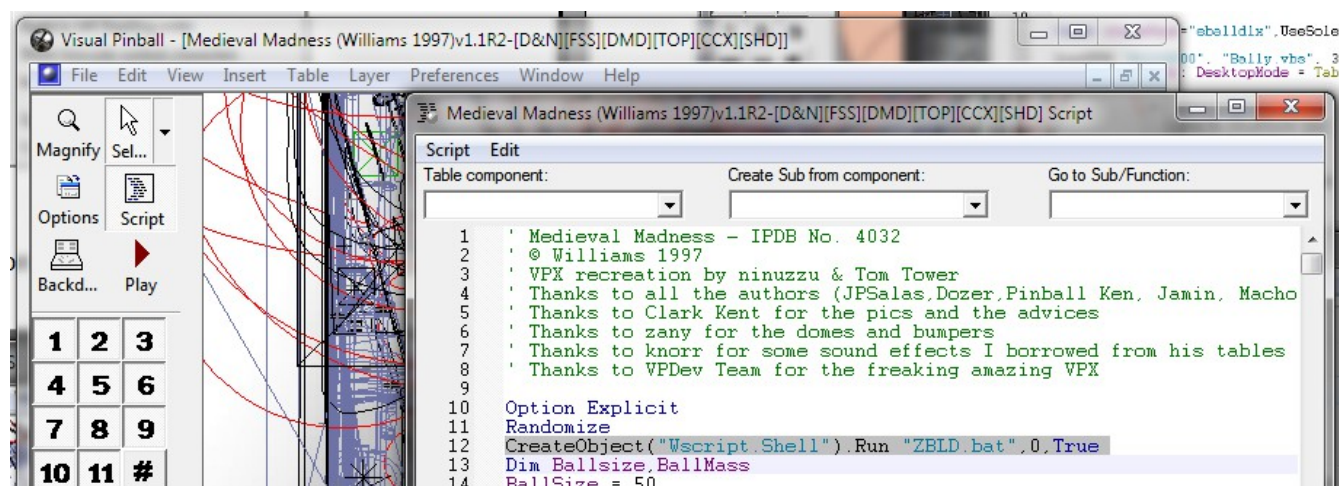
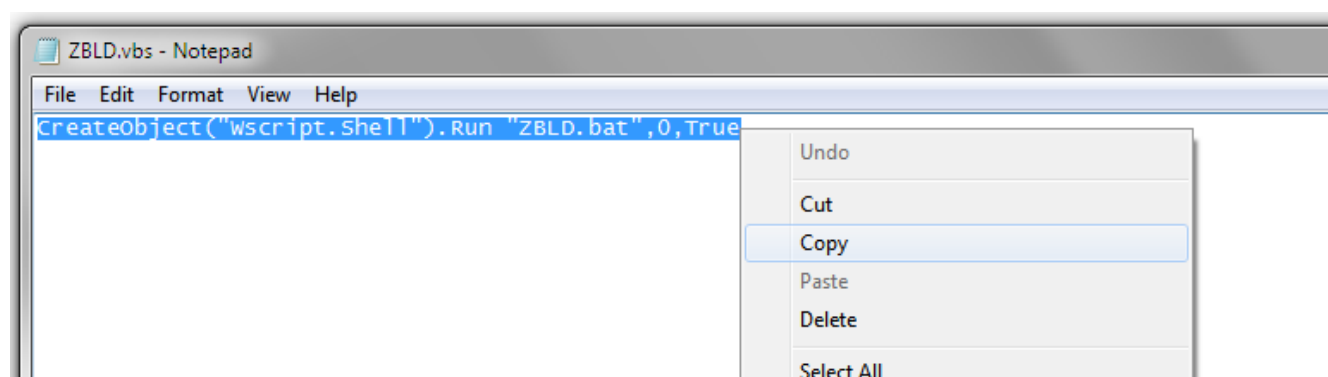


Paste the line of text copied from the ZBLA.vbs script into the table script as shown in Line 4 below.



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.

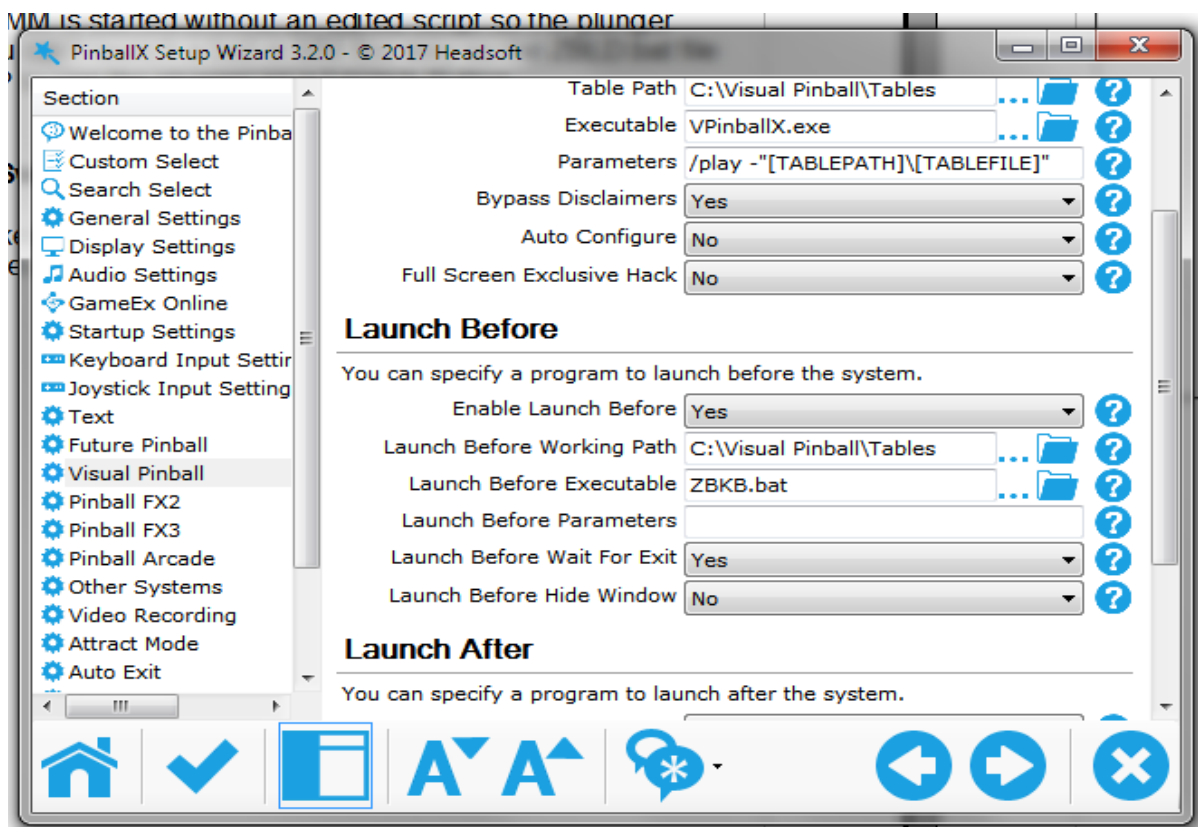
The main issue to remember is that if you are using the script edit method of switching the ball launch mode you will have to edit the script of every table you install with the proper command line. Failing to do so may leave you in the wrong mode when loading different tables if the mode line is missing

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.

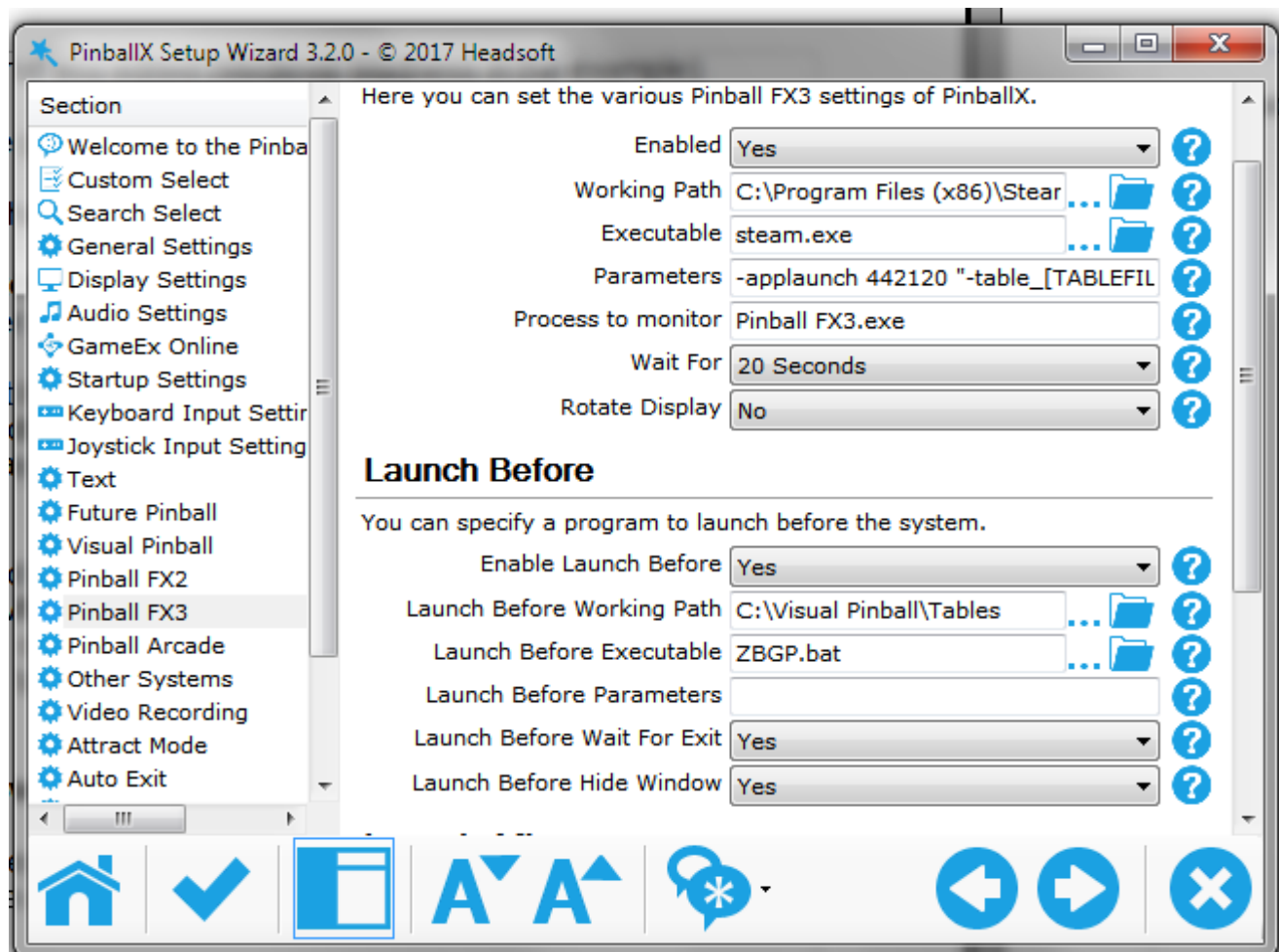
Using GAMEPAD / KEYBOARD Switching Files

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



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

Plunger doesn't calibrate properly

Calibration in Windows is not needed and can give unwanted results, do not use Windows calibration tool

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.

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.

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 Opening Template

