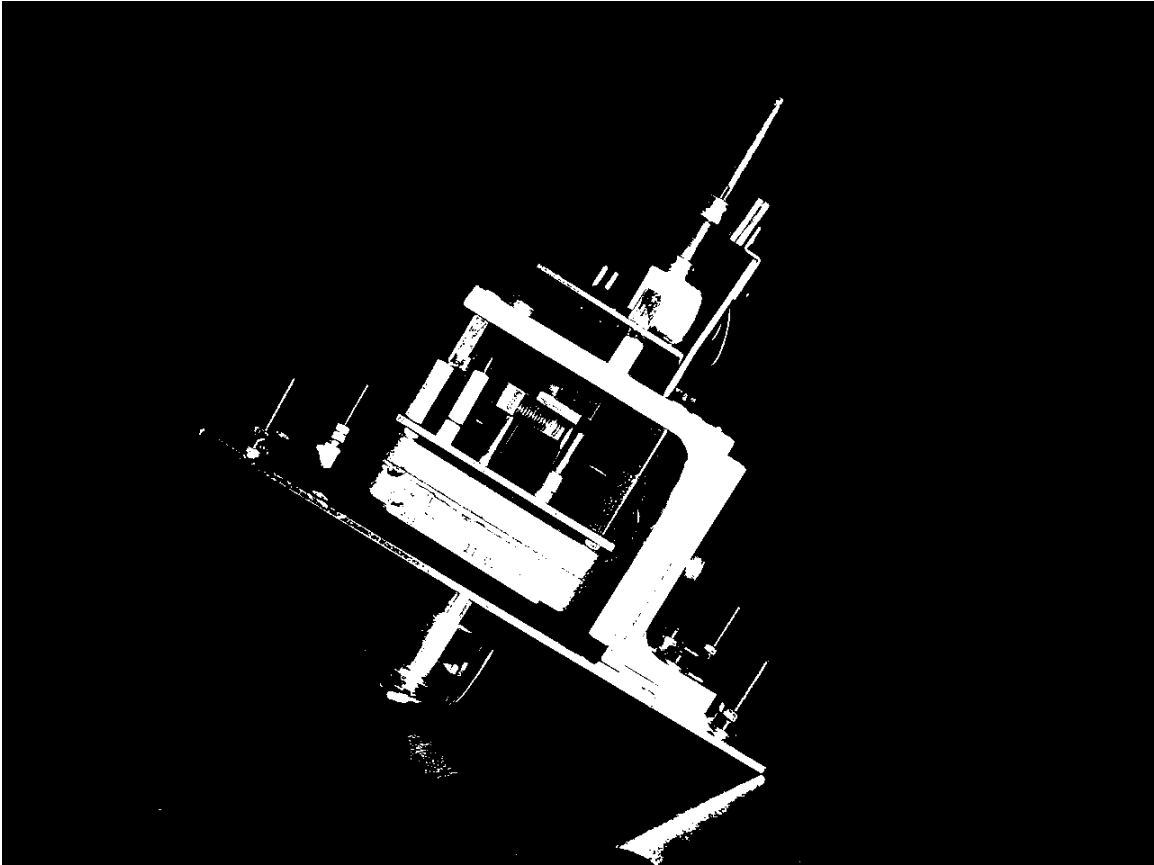


Mark Davidson's

WOBBLE HEAD



An upgrade for Bally's 1992 Doctor Who Pinball Machine

Documentation ©2002 by Al Warner in association with BA Associates

Notice Regarding this Upgrade

WARNING!

Although this upgrade has been tested and the equipment used will not directly cause harm to your pinball machine, if you do something wrong you can seriously damage the game electronics.

To perform this upgrade you should:

- Be familiar with safe handling procedures for electronic components.
- Be able to use hand tools such as a drill and screwdriver.
- Be able to follow directions.

Pinball machines are designed to be serviced and are subsequently well built, but by modifying any device you accept the risk that you may break something.

PLEASE READ THESE INSTRUCTIONS COMPLETELY THROUGH BEFORE STARTING. If you are like us, you probably downloaded the instructions from the internet before your kit arrived. Good Move!

All attempts have been made to make this an easy and clean install but please note that all machines and parts were not made exactly the same way. It is possible that you will need to modify your machine to properly install Wobble Head. We will inform you of any inconsistencies that we have found to help the process along.

I make no warranties on the Wobble Head, expressed, implied, statutory, or in any other communications with you. I specifically disclaim any implied warranty of merchantability or fitness for a particular purpose, I do not warrant that the operation of Wobble Head will be uninterrupted or error free. In no event will I or any supplier be liable to you or any other person for any damages, including any incidental to consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use of or inability to use the Wobble Head even if I have been advised of the possibility of such damages.

Please understand that Wobble Head was created for collectors to add a feature that was removed from the original game. I want nothing more than for you to enjoy the upgrade and this project was originally created to build one for myself and a friend. Please remember that this is a hobby for me and I'll try to help you with any problems as they arise but I may not be able to give you exactly what you want. E-mail me at mark@basementarcade.com if there are any questions. Questions regarding the documentation should be directed to al@alsarcade.com.

Thanks to Clay H., Pfutz, and Richard H. Poser II for their support and guidance. Thanks to Clay Cowgill for his disclaimer, it saved us a ton of research.

Introduction

Thank You for purchasing Wobble Head. We think you will enjoy it. The kit is as easy to install as we could make it.

Terms Used

The cabinet portion containing the circuit boards and which the Dalek is mounted to is the **Backbox**. The Dalek mounted on your machine has two parts (which are currently glued together), the top portion is the **Head** and the lower portion is the **Body**. We mention this only because the term “Head” is often used to refer to the backbox and we are trying to avoid any confusion. The **Dome** is the protective cover that is over the Dalek.

Inventory

The Wobble Head Kit includes:

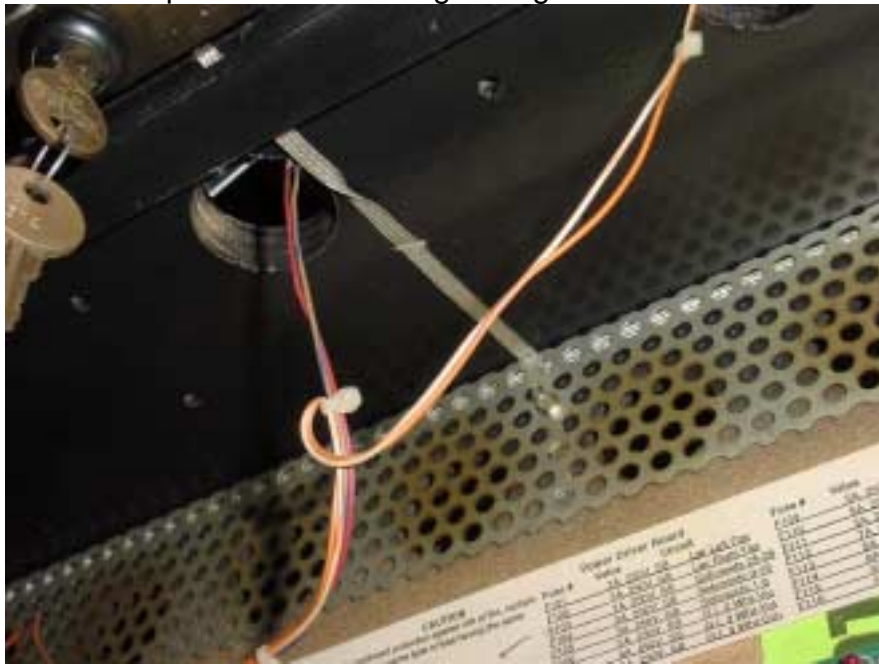
Qty	Item
1	Wobblehead Mechanism
1	Wiring Harness
1	6/32” Allen Head Cap Screw
7	Phillips head screws
1	Installation Manual

Tools Required

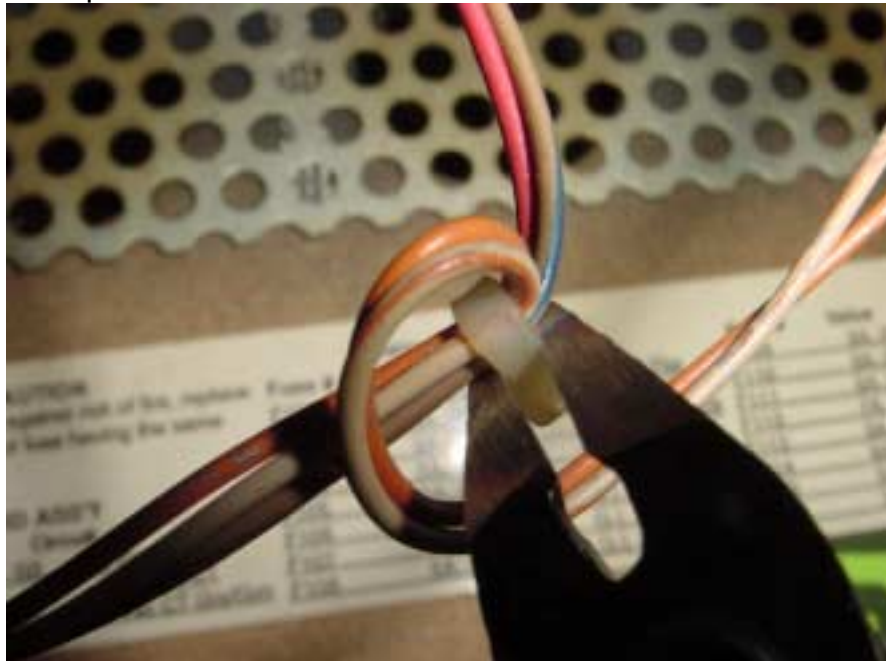
Cutters, Security Torx Bit or Wrench, Pencil, Drill with 3/32” bit, Phillips Screw Driver, Strong Hands, ¼” Nut Driver or Wrench, 5/16” wrench, Allen Wrench Set.

Preparation

Open up your backbox and locate the wires that lead to the Dalek head. You will see two holes with a pair of wires coming through them.



Wire ties are used to keep them together. Carefully, snip the wire ties with a pair of cutters to separate the two sets of wires.



Unplug the connector from the wires coming through the center hole. This is the flasher lamp's wiring.

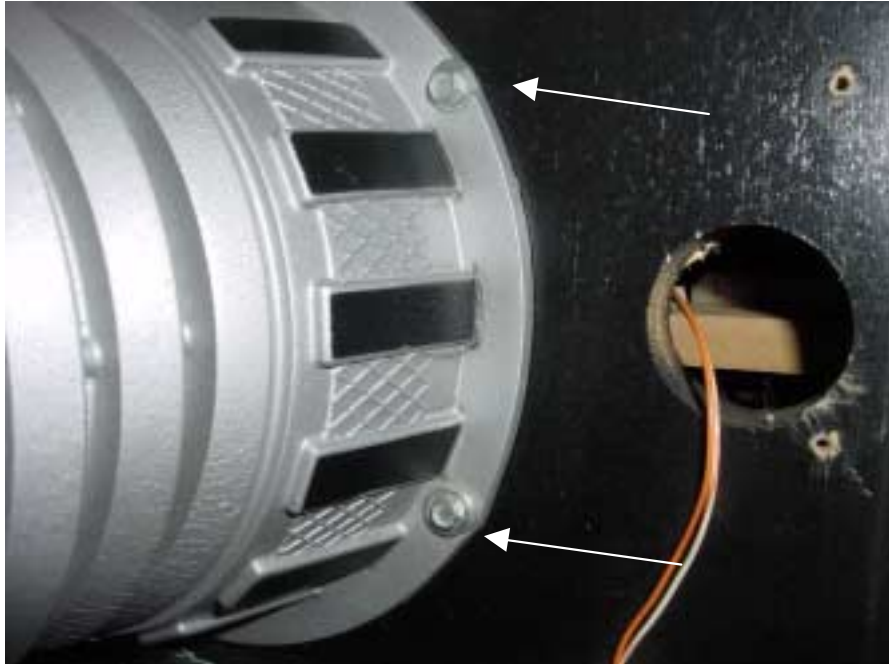


Close the backbox light board, but do not replace the translight. Fold down the backbox.

The Dalek's dome is secured to the backbox with 6 security torx screws. Remove them and remove the dome.



Remove the Dalek by removing the 4 ¼” Screws that are attaching it to the backbox. Keep the washers as we will be using them.



Remove the 2 ¼” screws holding the flasher bulb and remove it, fishing it's connector through the hole.



You now have an open hole. The Wobble Head's motor will be going through the hole. Unpack the Wobble Head mechanism.

Installation

As you may know, the Dalek on your machine was designed to be motorized, but to save cost they glued the top to the bottom and mounted it as you found it. All we have to do is separate the two where the glue is. For this, your tool is your hands and brute strength. Grasp the head and separate by pulling the two parts apart as shown below. The glue gives up pretty easily. DO NOT use the Dalek's "Eye Stick" to pry it, put your fingers between the two parts as shown and pry it that way.



We will now adapt the head to be mounted on the assembly. Drill a 3/32" hole through the top of the head where the indent is.



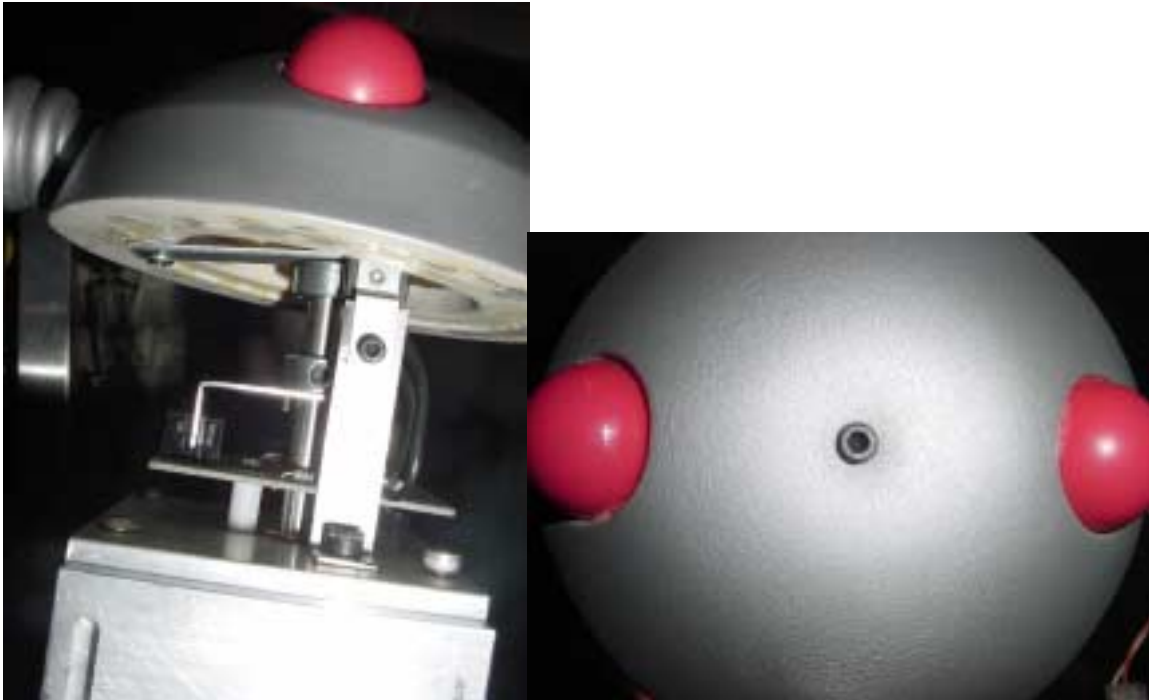
The centering of the eyepiece and head is accomplished by mounting a strip of machined steel to the underside of the head. Position the strip as shown with the edge of the steel $\frac{1}{2}$ " from the edge of the head. Mark where the pilot hole you will be drilling will be with a pencil.



Drill a $\frac{3}{32}$ " hole on your mark and secure the centering strip with one of the screws provided as shown. Your results should resemble the finished product below.

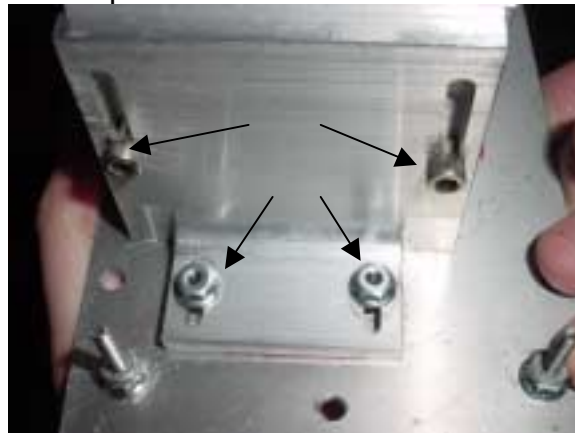


Mounting the head on the shaft is accomplished by putting the hole in the centering strip over the shaft and screwing the head down to the shaft from the top with the enclosed 6/32" allen head cap screw.



Adjusting Wobble Head is the most difficult portion of this install. I'll make no bones about it, you will hate this part. As much as I know you want to try out Wobble Head, you'll need to spend some considerable time getting this right.

First off, no two bodies are molded the same on the inside. Using the set screws on the side of the mechanism, you'll need to adjust the left and right position and the top to bottom position. You may notice that the set screws are not even from left to right and front to back. This is OK, because our goal is to get the head shaft as close to center as possible. You also want the gap between the head and base to be as small as possible.



Put the body on the mechanism. The nuts on the mounting plate can be adjusted to raise or lower the body. You can use the included nuts along with the washers you took off to tighten down the Dalek to the base. Try mounting the body over the motor and screw the head on. Adjust wherever necessary to try and get it perfect. The gap between the bottom of the Dalek body and the mounting plate will be hidden by the decal on the bottom of the dome.



While doing this, you may become convinced that there is no possible way that you're going to get it to line up, but you'll need to remove the head, loosen the screws, readjust, and try again. Hold the assembly so that you can see how it will look when mounted. You'll want to adjust the kit so it looks good from that angle. We've adjusted Wobble head to a good neutral position to start so try that one first.

By the time I was done adjusting it, my clearances were less around a millimeter and the head was pretty much centered. Removing the body shows that the mechanism looked a little crooked and not well aligned, but you have to remember that the heads were made 10 years ago and the environments they were subjected to were less than perfect. We've also found that the molding on some of the heads and bodies were off. They would probably be a reject in the moving head arena but looked just fine in the stationary.

Spend as much time as it takes to get it right. You'll be removing the head many times to try and align it. When it's right, you'll know it.

After you get it right, remove the head, remove the body, and get ready for the mounting portion of our program.

Mounting the Assembly

The Wobble Head's opto pair (shown below) determines if the head is facing center when it is broken by the metal flag. When orienting the mechanism on the backbox you will want the opto facing the player and centered.



Place the motor in the hole we have opened as shown below.



Push the mounting plate up so that it's flush and hold it in place.



Mark the six holes where we will be drilling pilot holes for our head to go into. As you do this, keep the unit as far to the back of the backbox as possible.

There is a little play but you want to get the mechanism as far back and as straight as possible. The general illumination light bar will be extremely close to the Dalek's body when we finish assembling this so you'll want to get as much frontal room as possible.



Remove the mechanism and carefully set it aside.

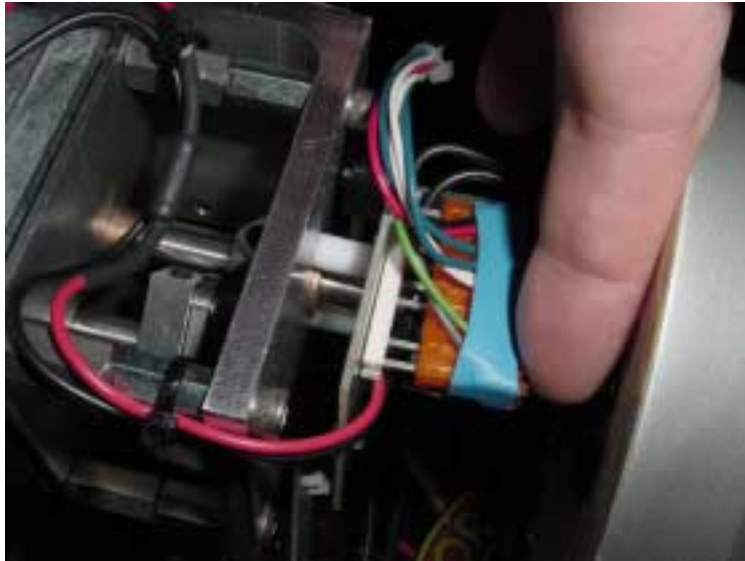
Drill six 3/32" pilot holes where your marks are.



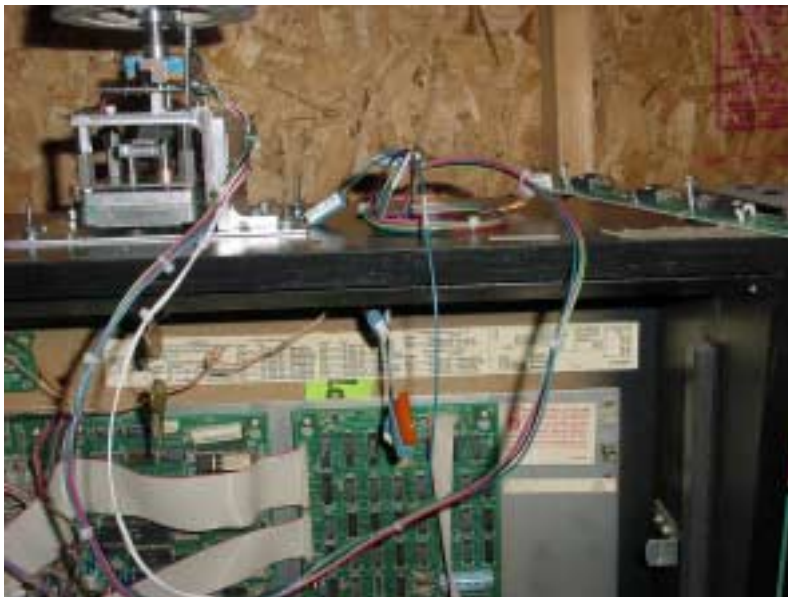
Replace the mechanism and mount it using the 6 phillips screws provided.



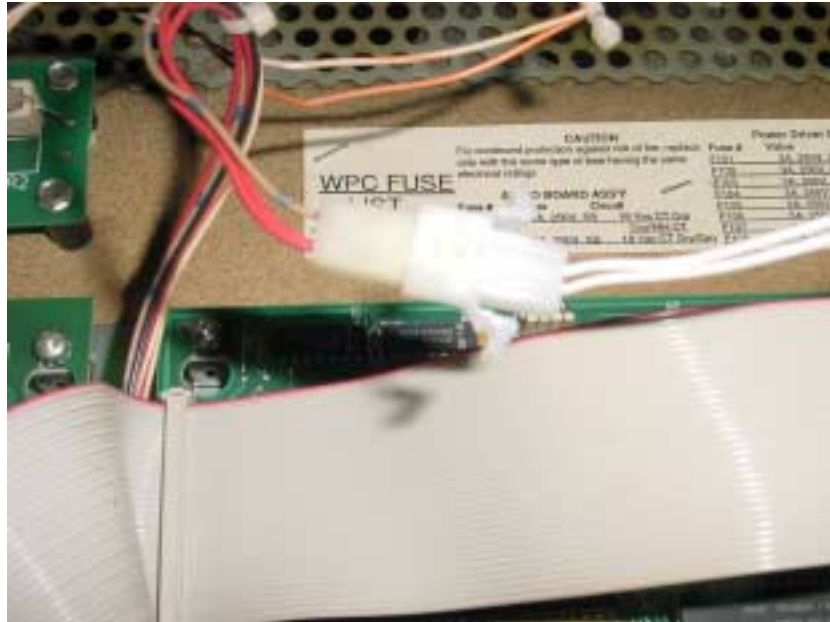
Connect the single large connector on the one end of the wiring harness to the Wobble Head circuit board and move the flasher bulb to the socket on Wobble Head. Raise the backbox of the game to the upright position.



Open the backbox door and fish the wires through the open hole (we have removed the light bar in front of the Dalek for this picture).



Reconnect the flasher light with the new wire.



Each of the connectors on the new wiring harness has a number on it that corresponds to the connector it will attach to. Find one of the existing plugs by looking for it's number on the Driver and CPU boards (See Appendix C). Carefully remove the plug that is there by pulling on the plug (not the wires). We're using #107 for our demonstration so you can start there as well.



Insert the Wobble Head wiring connector over the open pins as shown. The plug is keyed to prevent you from inserting it upside down.



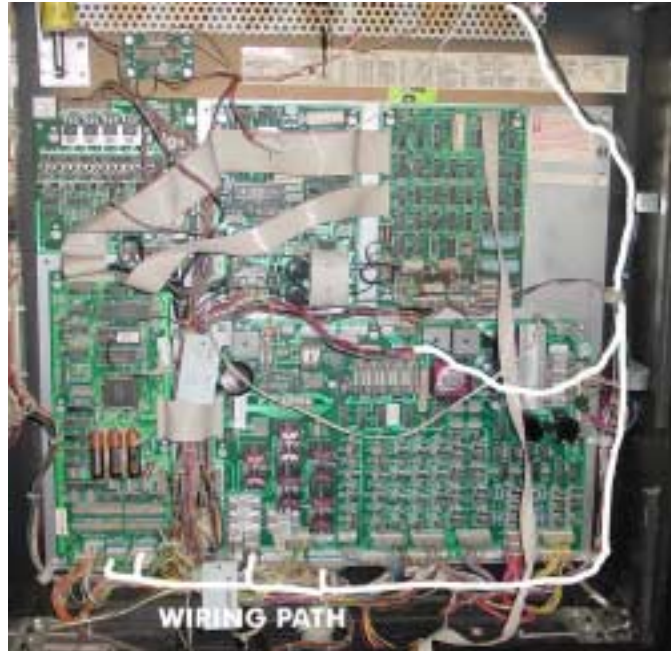
Plug the original plug into the extension we've created.



We have just spliced a wire into the circuit. The nice part about this design is that it's completely removable at any time and doesn't hurt the wiring.

Repeat the process for connectors 118, 122, 206, and 208. Appendix C has a diagram of the connector locations.

Tidy up the wiring using the existing wire management hooks. You might want to use some wire ties (not included) to connect wobble head's flasher cable back in the way it was when you removed the original socket.



At this point you can either lower the backbox and reinstall the body and head or try out the assembly. Either way, you need to turn on the head in software. With the backbox raised, turn on the machine and push the following buttons located on the coin door in the following order:

- 1) Press [Enter]
- 2) [+] repeatedly until you get to "Adjustments"
- 3) [Enter]
- 4) [+] once to get to "Feature Adjustments"
- 5) [Enter]
- 6) [-] repeatedly until you get to "A.2 49 Unused"
- 7) [Enter]
- 8) [+] (screen shows "Backbox Head Disabled")
- 9) [+] (screen shows it as "Enabled")
- 10) [Enter]
- 11) [Escape]
- 12) [Escape]
- 13) [+] repeatedly until you get to "T. Tests"
- 14) [Enter]
- 15) [-] once to get to "Backbox Head"
- 16) [Enter]
- 17) Watch the show! (Press [Escape] repeatedly to exit the tests).

The faults are always there when you do this for the first time. There is some way to clear them, but I only found it by accident. Since then, I haven't had any faults to clear so it's a mystery to me.



If you haven't reassembled the body, head and dome yet, do so now. If you forgot the bulb (trust me it could happen), replace it now. Replace the translight glass.

Your Wobble Head is installed! Enjoy his wobbly antics during Multiball and Video Modes. We hope you enjoy it!



Appendix A – Troubleshooting

GAME REBOOTS WHILE PLAYING

Wobble Head gets its power from the 20 volt circuit that is located on your driver board. Adding Wobble Head to your game can cause stress to a circuit that never had it before. We have seen it in one of two machines we tested before releasing this kit. During times when the head was moving and the time expander was also moving, we would get a reset. As a quick fix, we did a driver board swap and the problem was resolved. Since this might not be an option for you, please understand that this installation could cause similar distress. You will need to address it by fixing the 20V bridge rectifier and/or associated capacitor. Details can be found at:

<http://www.marvin3m.com/wpc/index2.htm#reset> (link used with permission).

HEAD DOESN'T RETURN TO EXACT CENTER

Having never owned an actual prototype unit; I played around with the motor and the units ability to seek center. I am now convinced that the original prototype was equally sloppy in centering the head and here is why.

Wobble Head's movement is slightly faster in one direction than the other. The motor keeps moving for a second or so after the game cuts power to it and it may miss center. This is especially true if the software tells the head to stop if it is on its "faster return stroke"

You may also notice in game mode that motor is not fully on or fully off. The voltage to the motor is sometimes varied with the flash of the lamp in the Dalek and speech from the machine. This is yet another variable that changes how the head stops, as it is never fed the same voltage twice.

If your head is not centered as much as you would like, I would suggest replacing the 10-ohm resistor, heat shrunk to the red motor wire, with a larger (20 ohm) 2 watt resistor. This *may* improve you head centering. Keep in mind that the voltage to the head motor is fed from an unregulated supply, and this too adds more variables to obtaining the perfect wobble from the head on your machine.

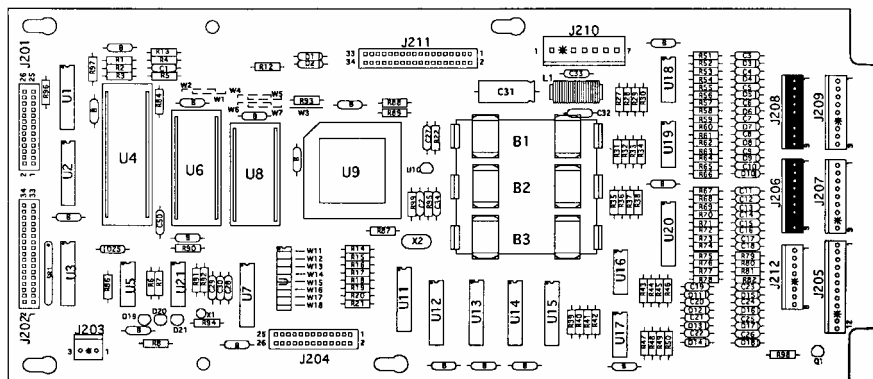
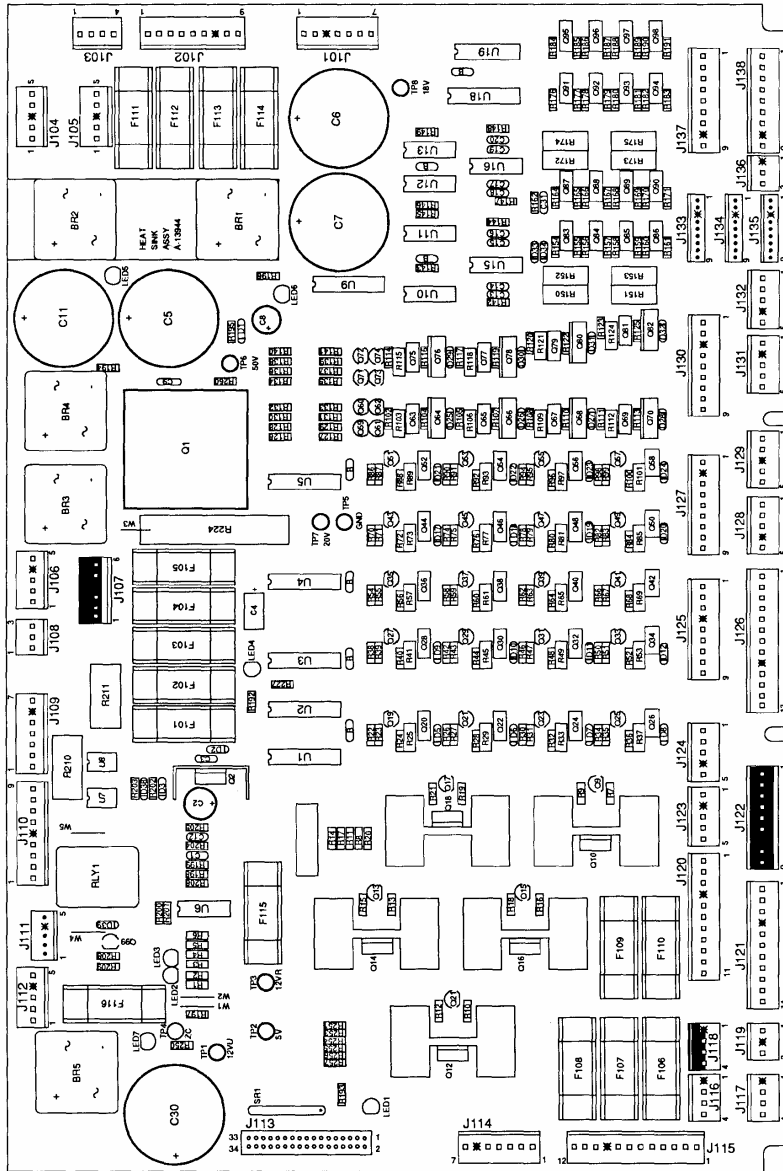
The 10 ohm resistor added what seemed to be the best "all around" value to slow the motor slightly for general use.

The current design does not produce any faults, and it is our opinion that the originals would do this sometimes as well. There is a 50/50 chance that it will find middle. The motor is 25 RPM, the same as the prototype machine.

Appendix B – Maintenance

Wobble Head requires no maintenance. It was pre-lubricated before it was sent to you. Because it is made mostly of aluminum and stainless steel it should resist most obverse conditions. As with any device of this type it should be kept dry.

Appendix C – Connector Locations

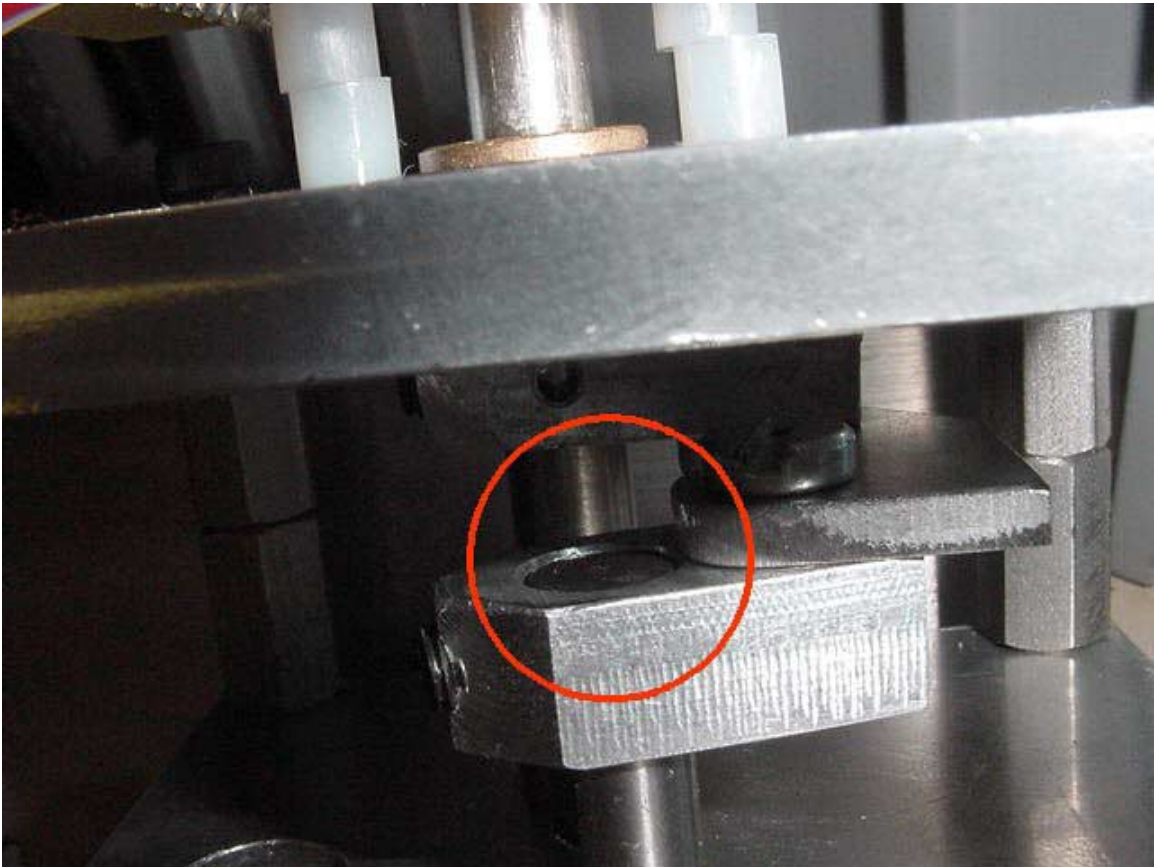


ADDENDUM

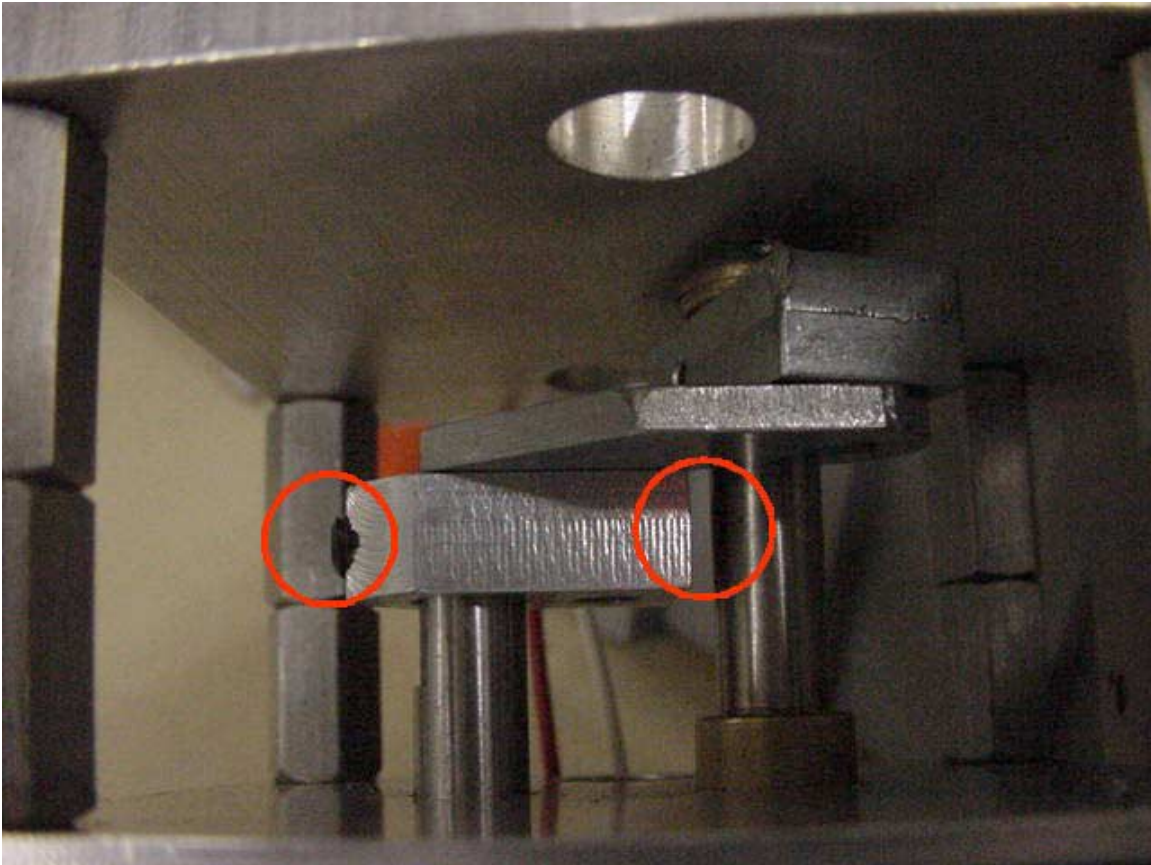
Motor seems to be locked up

There are some tight clearances on the wobble mechanics and two points to watch out for.

The first photo (below) shows the top of the motor shaft and the first cam lobe. The shaft of the motor must remain below the top of the cam lobe (as shown). If the shaft of the motor is above the top of the lobe, the "B" clip that connects to the second cam lobe will interfere with the motors rotation. If your cam lobe has slid down during shipping, loosen the setscrew for locking the cam lobe to the motor (side with the angle cut in the lobe) and slide the cam up. Retighten the setscrew when complete.



There are also two setscrews on the motor cam lobe. One of them may cause interference on the output shaft if it should come loose during shipping. The following picture shows the location of both setscrews. If the setscrew on the right (highlighted on the right in the picture) should back out, it may hit the shaft. Re-tighten as necessary



Rotating the motor to make adjustments

It is not necessary to disassemble the wobble motor should you need to make any adjustments. If the motor is locked against a shaft or locked up in any way, apply voltage to the motor pins using a 9-volt battery. The motor leads are marked on the PC board as MOT. Swap the + or - to these 2 leads to move the motor in a clockwise or counter clockwise direction to gain access to any of the setscrews. The motor will rotate slowly as is it rated for 24 volts.