Banshee Jr. Version 2.2 PC Board

Parts and Build Information Guide

April 30, 2018

This guide will help you buy the parts and build a Banshee Jr. Prop Controller Board. This is a Do It Yourself project. What does that mean? Please read on…

Banshee Jr. is a build it yourself project to help our fellow Haunters have access to some of the latest technology in prop and scene controlling. The largest hurdle for home and smaller Haunts is cost. One way to help lower the cost is by letting you use the parts you already have on hand.

To save cost, Haunt Hackers does offer limited information support services via our Facebook Group page. We do not offer repairs for any of their DIY projects. All PC boards are sold without warranty. Any unauthorized shipment of boards and other items to Haunt Hackers will not be returned. We do have a helpful group of supporters on our Facebook page (facebook.com/groups/HauntHackers) that could give you a hand.

As for custom code, you will need to do that on your own. But fear not, the Picaxe series of controller chips use the simple "BASIC" programming language that is both powerful and easy to pick up. The programs in the project library are well commented and can be used to help create your own projects.

It is up to you to buy, build and program the project. We do sell a Printed Circuit Board kit to make the project easier to build. We also have an ever-growing library of programs that run on Banshee Jr. and available for free download.

Please consider these points carefully in deciding if this project is for you.

Sources for the Parts

When designing Banshee Jr., we tried to use parts that TaydaElectronics.com normally stocks. This Asian seller of electronic parts has low prices with quick, low cost shipping. We've used them for several years and never had an issue with our orders. With their low prices, it would be a good idea to stock up on extra parts when ordering. Parts like the pin jumpers needed for the project. (They're small and easily lost.)

Tayda is good, but with their low prices it does limit the variety of parts they carry, so a few parts need to be ordered from other suppliers. For example, Tayda does not carry the Picaxe 20X2 (IC3) controller chip or the USB download cable for programming it. We've found that phanderson.com is a good source with low prices and their shipping to the USA is at a fair price and quick.   The Picaxe 20X2 can be also ordered from robotmesh.com and other stores on the web. Be sure to shop around to find the best total price that includes tax and shipping.

We have included with your PC board two parts to save you both time and money. First is the MSGEQ7 Audio Spectrum Analyzer chip. The cost of order this chip from Sparkfun is $4.99 with another $5 shipping. The other part is the DFplayer Mini Audio player module. While low in price (Under $2.00), the shipping could be a month or more. By including these two parts, we have saved you about $10 and long shipping delays. Also included color button caps for the push button switches.

The following parts list will guide you through ordering from the different suppliers. Be sure to verify the parts are in stock before adding them to the shopping cart. Do not complete any order until ALL parts have been double checked and verified in stock. After all, who wants to pay for extra shipping costs because of an ordering mistake?

Parts list for Banshee Jr version 2.2 board.				
Part	Count	Details	SKU or Part Number	Source
BAT1	1	CR2032 Battery Holder	A-869	Tayda
C1	1	33 PF 25V Capacitors	A-525	Tayda
C2- C5	4	0.1 UF 50V Capacitors	A-553	Tayda
C7	1	100 UF 25V	A-4541	Tayda
D1	1	1N4002	A-158	Tayda
LED1	1	3 MM Red LED	A-261	Tayda
LED2	1	3 MM Green LED	A-262	Tayda
R1-R7	7	330 Ohms 1/4-Watt Resistors	A-2067	Tayda
R8	1	470 Ohms 1/4-Watt Resistor	A-2049	Tayda
R9, R10	2	1K Ohm 1/4-Watt Resistor	A-2123	Tayda
R11, R12, R13	3	4.7K Ohm 1/4-Watt Resistors	A-2027	Tayda
R14-R18	5	10K Ohm 1/4-Watt Resistor	A-2115	Tayda
R19, R20	2	22K Ohms 1/4-Watt Resistors	A-2111	Tayda
R21	1	200K Ohms 1/4-Watt Resistor	A-2134	Tayda
S1-S3	3	SPST Push Button Switch	A-5129	Tayda
Jack1	1	DC Power Jack 2.1mm Barrel	A-4118	Tayda
Jack2, Jack3	2	3.5mm Stereo Chassis Jack	A-853	Tayda
IC1	1	MSI MSGEQ7 Audio Spectrum Analyzer	Included with PC board	
IC2	1	PICAXE-20X2 Micro-controller	PICAXE-20X2	phanderson.com
IC3	1	DS1307 Real Time Clock	A-254	Tayda
USB Cable	1	USB Download Cable*	Rev-Ed AXE027	phanderson.com
X1-X3	3	DG301 Screw Terminal 2 Positions 5mm	A-668	Tayda
XTL1	1	32.768KHz Crystal	A-1592	Tayda
Socket: IC2	1	20 Pin DIP Socket	A-1600	Tayda
Socket: IC1, IC3	2	8 Pin DIP Socket	A-001	Tayda
T1	1	PN2222	A-109	Tayda
T2	1	IRF540 MOSFET	A-089	Tayda
Case	1	Plastic Project Box 03 (Optional)	A-2383	Tayda
Heat Sink	1	For IRF540 MOSFET	A-1490	Tayda
Hardware for T2	1	M2.5x12mm 0.45mm Pitch Bolts		Local Store or eBay
Hardware for T2	1	Hex Nut, M2.5-0.45 Threads		Local Store or eBay
Hardware for T2	1	0.5-inch double side mounting tape		Local Store or eBay
MOD1	1	DFplayer Mini MP-3/wave player	Included with PC board	
8 Pin Female	2	Pin headers for MOD 1	A-1305	Tayda
Button Color Caps	3	Blue, Green and Red	Included with PC board	
Battery	1	CR2032 Battery for BAT1		Local Store
Micro SD-Card	1	2 GB or larger at Class 4 or better		Local Store or eBay
Jumpers	3	Mini Jumper 2.54mm Gold Plated	A-1324	Tayda
Pin Headers	2	40 pin Single Row Pin Headers	A-197	Tayda
Use the 40 pin Single Row Pin Headers to make the following size headers by cutting				
JP1	1	15-Pin Header		
JP2	1	6-Pin Header		
JP3	1	8-Pin Header		

Notes:

Most items can be found at taydaelectronics.com. Both prices and international shipping are low with turnaround taking about week to get your parts in. Not a bad idea to stock up on extra parts when ordering parts for Banshee Jr.

*Order if you do not have a Picaxe Download cable.

Banshee Jr. Build Documentation

As stated when you order your Banshee Jr. PC board, this build is for those experience with "Through the hole" soldering projects and the tools necessary to do the work.

> The installation of parts is based on their height with the smallest going in first. (This will aid in keeping the parts flushed with the PC board.) Please review the parts and their order of installation before soldering. Any parts with long leads (like Resistors) will need the excess length cut off close to the PC board.

1) Install the seven 330 Ohm (Orange, Orange, Brown) Resistors in R1-R7.
2) Install the 470 Ohm (Yellow, Violet, Brown) Resistor in R8.
3) Install the two 1K Ohm (Brown, Black, Red) Resistor in R9 and R10.
4) Install the three 4.7K Ohm (Yellow, Violet, Red) Resistors in R11, R12 and R13.
5) Install the five 10K Ohm (Brown, Black, Orange) Resistors in R14–R18.
6) Install the two 22K Ohm (Red, Red Orange) Resistors in R19 and R20.
7) Install the 200K Ohm (Red, Black, Yellow) Resistor in R21.

> When installing D1 Diode, there is a white band on one side. (Make sure it matches the band on the PC board.)

8) Install the 1N4002 1 amp 100-volt Diode in D1 and cut the leads.
9) Install XL1 (32.768KHz Crystal). After inserting the leads, lay the Crystal in it side as marked on the PC board. Solder the leads and cut the excess length off.

> Note that all IC sockets have a small notch on one side. The notched side always matches the printing on the PC board. This nocked will help in installing the IC or other parts later.
>
> When soldering multi-pin parts like Socket, check that all pins are straight and fit through the holes on the PC board. When soldering, start with just one pin and then check that the part is flush with the PC board. If not, melt the solder while pushing the part flush on the board. Next, solder a pin on the opposite side of the part and verify that the part is still flush with the PC board. Now, solder the remaining pins.

10) Install the two 8-pin sockets for IC1 and IC3.
11) Install the 20-Pin IC Socket for IC2.

> This would be a good time to check the solder connection on the board. After all, you just did about 50 solder joints and there is a chance one or more will need to be resoldered.

12) Install the 33pf (33) Disc Capacitor at C1 and cut the leads.
13) Install the four 0.1 uf (104) Disc Capacitors at C2 – C5 Disc Capacitors and cut the leads.
14) Install LED1 (Red) and LED2 (Green). The longer lead goes in the top (+) hole and cut the leads.
15) Install Jack2 and Jack3 1/8-inch Audio Jacks. Solder the center pin first and remelt the join and push the jack flush with the PC board. Now, solder the other four pins on each jack.
16) Install S1, S2 and S3 push button switches. Push the switches through the holes in the board till they are flat on board and level. (Do not install the color buttons cap at this time.)
17) Install Bat1, the CR2032 Battery Socket. (Do not install the Battery at this time.) The large tab goes to the center of the board.

18) Install the 2N2222 (PN2222) Transistor for T1. Note the diagram for T1 on the PC Board and insert matching the Transistor's flat side matches. Push the transistor down till it about 1/8 of an inch from the PC board. Solder the three pins and cut the extra part of the leads off.

Jump Pin Headers JP1, JP2 & JP3 are made by cutting up the 40 pin headers. JP1 is a 15-pin header. JP2 is an 6-pin header. JP3 is a 8-pin Header. Either use a Dremel cutting wheel or a pair of small and sharp wire cutters. Use painter's tape to help hold the headers in place while soldering. Only solder one pin of a header and check for alignment and it's flush with the board. (Melt the solder if you need to adjust a header placement.) Finnish by soldering the other pins of the header.

19) Start with solder just one pin of JP3, the 6-Pin header for the I2C port. (Next to the program jack.) After soldering the first pin, check the alignment and melt the solder joint should the placement need fixing. Now, solder the other pins.
20) Now install JP2, the 8-pin Header. Follow the steps for JP1.
21) Install JP1, the 15-pin header. Start with solder just one end pin on one side. Verify the alignment and melt the solder joint should the placement need fixing. Now solder the other end pen on the other side. Check one more time that everything is aligned and then solder the last 13 pins.
22) Install the two 8 female pin headers (A-1305) for the DFplayer Mini Audio Module. Install the first header and solder one pin. Verify that the header is in flat and straight. This is crucial for the module to plug into these headers. Now, solder the 7 pins and do the same for the other socket.
23) Install the three blue 2-Pin Terminals for X1, X2 and X3. Place them on to the PC board with the terminal connection holes to the outside. Solder one pin and check for alignment and adjust as needed. Now solder the other pin on each terminal.
24) Install the Jack 1, the DC Power Jack 2.1mm Barrel. Solder one pin and verify the placement of the jack. Please note these pins for Jack 1 will require extra solder because of their larger size.
25) Install C1 (100 UF 25V Capacitor) Note the positive side of the Capacitor (longer lead) goes to the (+) hole.

The IRF540 MOSFET will handle about 1 amp without a heatsink. It can handle about 10 amps if the optional TO220 Heatsinks are added before soldering in place. See Photo #1 for suggested arrangement.

26) Install the IRF540 MOSFET (T2) with the metal tap to the top side of the PC board. (Follow label on PC board.) Make sure the Heat-Sink do not touch the PC board or any other parts. Cut a piece of double sided tape about the size of the bottom of the Heat-Sink. Peel the protective tape off from both sides and stick it to the bottom of the Heat-Sink. This will work not only as an insulator, but hold the MOSFET in place while soldering. Now, solder the three pins of the MOSFET and cut off the extra leads. Use extra solder so it flows through the hole and beads up the topside of PC board. This will ensure the part will not bend and break off easily.

Review the board for bad or incomplete solder joints. Remove any cut wires or extra solder from the board.

Power Check.

Before installing the parts in their sockets, a simple power test should done. Remove all metal from the test bench. This includes tools, parts and leftover wire cuttings. Connect the 5 Volt power source with four more amps to Jack 1.

After applying power, the Green Power LED should light up. If not, please review the trouble shooting section of this document.

Remove the power and wait for the Green Power Light to go out.

Final Installation of Components.

Static protect must be used with these final parts and note what side has the notch. Plugging the chips in backwards can destroy the chip. When install IC1, IC2 and IC3, the pins will be bent outward a bit too far for the socket. Use a pair of needle nose pliers to bend them inward so the pins line up with the holes in the socket. Make sure every pin goes into the socket before pushing them in all the way in.

27) Install the MSGEQ7 Audio Spectrum Analyzer chip into IC1's 8-pin socket. (Near the top of the PC board.) Please note the notch on the left-hand size of the socket. Make sure the notch on the MSGEQ7 matches.
28) Install DS1307 Real Time Clock (RTC) chip into IC3 socket to the right of the battery holder. Remember to match the notch like in the last chip.
29) Install the Picaxe 20X2 chip into the IC3 (20 pin) socket. Be careful plugging in the chip since there many more pin and it's easy to bend or break a pin off. Also, plugging it backwards will destroy it.
30) Install the DFplayer Mini module into the two 8-pin headers lower lift side of the board. Make sure the slot for the Micro SD-Card is at the top edge of the PC board.
31) Install the CR2032 "button" battery into the BAT1 socket with the "+" (imprinted) side up.

Do a final check that all the parts are plugged into their sockets correctly. Notch all the Intergraded Circuits have their notches to the left or top side of the chip. A chip in backwards will damage not only that chip but other parts on the board. DO NOT RUSH THIS STEP!

Note: Still working on the System Checkout tool program and will complete this section later.

Final Systems Check

Install the latest version of the Picaxe programming software from Picaxe.com for your computer. Plug in the USB Download cable to your computer. (Follow the directions to verify that the Download cable is working.)

Connect the main power (5 Volts) to Jack1 on the Banshee Jr. PC board and verify the Green power LED is lit. Now, connect the Download cable to the 1/8-inch program jack (near the power jack). Hook up a headphone or powered speakers to the 1/8-inch audio jack located near the servo connections.

Use the programming software to download the project code into Banshee Jr to verify everything is working. (See notes included with your project's program.)

If your Banshee Jr is not working, please review your work for errors.

Figure 1