Banshee 4 Parts and Build Information Guide

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

Banshee is a build it yourself project to help our fellow Haunters have access to some of the latest technology in prop 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 not offer any "one-on-one" support services or 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 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, 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 many 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. (Order more than just few of the pin jumpers needed for the project since they are small and easily to lose.)

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 40X2 (U1) 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.

Digikey.com is a good source for the Resistor Arrays, Serial EEPROM and Heat-Sinks for the MOS-FETs. They sell the parts at a "Fair" price and shipping rates are not too bad. Mouser.com is a good replacement if Digikey.com should run out of one or more parts. While their prices are close, Digikey is a bit better on shipping cost.

The parts list (on the next page) 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?

Please note that the two Audio Spectrum Analyzer (MSGEQ7) chips and DFplayer Mini Audio player are included with your Printed Circuit Board kit. After ordering a bunch of the MSGEQ7 chips from eBay and finding the quality below par (not working), I reached out to Mixed Signal Integration. MSI was more than happy to supply Haunt Hackers with factory fresh chips to insure quality parts for the Banshee Project. This also saves you $15 by including the two MSGEQ7. (Most retailers charge $5 a chip plus another $5 shipping.) We also include the color button Caps for the five push button switches since there are supply issues with these items too.

Parts List for Banshee Version 4 PC board.

Part	Count	Details	Tayda SKU	Digikey.com* SKU	Other Sources
BAT1	1	CR2032 Battery Holder	A-869		
C1, C2	2	33 PF Capacitors	A-525		
C3-13	12	0.1 UF 50V Capacitors	A-553		
C14, C15	2	100 UF 25V Capacitors	A-4541		
D1-5	5	1N4002	A-158		
J1, J2	2	1/8" audio jack	A-853	490-SJ1-3525N	
LED1	1	3 MM Red LED	A-261		
LED2	1	3 MM Green LED	A-262		
Q1-4	4	IRF540 MOSFET	A-089		
Heat-Sink	4	TO-220 style Heat-Sink for Q1-Q4		HS106-ND	
3mm or 1/8 Inch	4	Screws with nuts or Pop-Rivets		Local hardware store	
R1, R11, R12	3	22K Ohm 1/4-watt Resistor	A-2111		
R2, R3	2	680 Ohm 1/4-watt Resistor	A-2075		
R4-6	3	10K Ohm 1/4-watt Resistor	A-2115		
R7, R8, R13	3	1K Ohm 1/4-watt Resistor	A-2123		
R9, R10	2	200K Ohm 1/4 Watt Resistor	A-2134		
R14, R15	2	270 Ohm 1/4 Watt Resistor	A-2069		
RN1	1	8 Unit 330 Ohm Resistor Array		4116R-1-331LF	
RN2	1	9 Unit 10K Ohm Resistor Array		4610X-101-103LF	
RN3	1	4 Unit 4.7K Ohm Resistor Array		4605X-101-472LF or CSC05A014K70GEK	
S1-5	5	SPST Push Button Switch	A-5129		
U1	1	PICAXE-40X2			phanderson.com
U2	1	DS1307 Real Time Clock	A-254		
U3	1	24FC512 Serial EEROM		24FC512-I/P-ND	
U4, U5	2	MSGEQ7 ASA chip	Included with PC board kit.		
U6	1	LM7805 5 Volt Regulator	A-179		
U7, U8	2	4N33 Optocouples	A-223		
U9	1	74HC4052 4-Channel Multiplexer	A-027		
X1-7	7	2 Pin Terminals (Blue or Green)	A-664		
X8, X9	2	3 Pin Terminals (Blue or green)	A-669		
XL1	1	8 MHz Resonator	A-721		
XL2	1	32.768KHz Crystal	A-1592		
Socket: U1	1	40 Pin DIP Socket	A-292		
Socket: U2-5	4	8 Pin DIP Sockets	A-001		
Socket: U7-8	2	6 Pin DIP Sockets	A-624		
Socket: RN1, U9	2	16 Pin DIP Socket	A-003		
Mini Jumper	5	Jumper 2.54mm Gold Plated	A-1324		
DFplayer Mini	1	MP-3/Wave audio media player	Included with PC board kit.		
8 Pin Female	2	8 Pin Single Row Female Pin Header	A-1305		
Button Caps	5	Color Cap for Tactile Push Buttons	Included with PC board kit.		
Battery	1	CR2032 Battery for BAT1	CR2032		Local or eBay.com
Micro SD-Card	1	2 GB or larger and class 4 or better			Local or eBay.com
USB Cable	1	USB Download Cable	Rev-Ed AXE027**		phanderson.com
Case	1	Plastic Project Box 04 (Optional)	A-2392		
40 Pin Headers	4	40 pin Single Row Pin Headers	A-197		
Use the 40 pin Single Row Pin Headers to make the following headers					
JP1	1	8-Pin Headers			
JP2	1	10-Pin Header			
JP3	1	13-Pin Header			
JP4, JP5	2	12-Pin Header			

*Mouser.com can be used in place of Digikey.com

**Order the PICAXE USB Download Cable if you don't already have one. This is needed to program the Picaxe 40X2 chip.

Banshee Build Documentation

As stated when you ordered your Banshee PC board, this build is for those experienced with "Through the hole" soldering projects and have the tools necessary to do the work. Please do the steps one at a time and check them off as you go.

> 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. In the case of Resistors and Diodes, their leads will need to be bent to match their mounting holes. Any parts with long leads will need the excess length cut off close to the PC board after soldering.

1) Install the three 22K Ohm (Red, Red Orange Color Bands) Resistors in R1, R11 and R12. Bend the resistor's leads so they go through the holes and lay flat on the PC board. On the underside of the PC board, bend the leads away from the resistor so it holds it in place. Solder one lead of the resistor and verify it's flat on the PC board. Now, solder the other side of the resistor and cut both excess wires as near as possible to the solder joint. Any lead left behind could cause a short.
2) Install the two 680 Ohm (Blue, Grey, Brown Color Bands) Resistors in R2 and R3.
3) Install the three 10K Ohm (Brown, Black, Orange Color Bands) Resistors in R4, R5 and R6.
4) Install the three 1K Ohm (Brown, Black, Red Color Bands) Resistors in R7, R8 and R13.
5) Install two 200K Ohm (Red, Black, Yellow Color Bands) Resistors in R9 and R10.
6) Install the two 270 Ohm (Red, Violet, Brown Color Bands) Resistors in R14 and R15.

> Diodes D1, D2, D3, D4 and D5 all have a white band on one side. Make sure it matches the white band on the PC board.

7) Install the five 1N4002 1 amp 100 volt Diodes in D1, D2, D3, D4 and D5 and cut the leads.

> Note that all IC sockets have a small notch on one side. The notched side always goes on the top or left side when installing the socket. This is marked on the PC board too. This notch will help with installing the IC or other parts later.
>
> When installing multi-pin parts like Sockets, 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 corner of the part and verify that the part is still flush with the PC board. Now, solder the remaining pins.

8) Install the two 6-pin IC sockets for U7 and U8.
9) Install the four 8-pin IC Sockets for U5, U4, U3 and U2 in that order. (This will help to keep the IC Sockets flush with the PC board when soldering.)
10) Install the two 16-pin IC Sockets for RN1 and U9.

> Besides having more pins, U1's 40-pin IC Socket flexes. Solder one of the corner pins and verify the socket is flush on the PC board before soldering the next corner pin. Once all the corners are done, solder the 10th and 30th pin of the middle of the socket and that check at all pins are flush with the PC board.

11) Install the 40-Pin IC Socket for U1.

This would be a good time to check the solder connections on the board. After all, you just did about 150 solder joints and there is a chance one or more many need to be resolder.

12) Install XL2 (32.768KHz Crystal). Lay it down flat on the PC board. (See Photo 2.) Make sure the leads to not touch each other. As always, cut the excess wire from the leads.
13) Install LED1 (Red) and LED2 (Green). The longer lead goes in the "+" hole.
14) Install the two 33 pf (33) C1 and C2 Disc Capacitors. They are near U4 and U5.
15) Install the eleven 0.1 uf (104) C3-C13 Disc Capacitors.
16) Install J1 and J2 1/8-inch Audio Jacks. There are two holes on the PC board for little dimples on the bottom of the audio jack to keep it straight. Mount the audio jack and be sure it's flat on the PC board. Solder the single pin (closes to the edge) first and melt the joint and push the jack flush with the PC board. Now, solder the other four pins on each jack.
17) Install RN2 (10 Pin, 10X-1-103LF) 9-Unit 10K Ohm Resistor Array. Pin 1 is to the left side of the printing. (Look

The three Resistor Arrays (RN1, RN2 and RN3) replaces 21 individual resistors with three easy to solder packages. As before, solder just one pin and check the mounting on the PC board. Finnish by soldering the other pins. RN1 goes into the 16-pin socket and will be installed later.

for the "1" marking on the PC board.)
18) Install RN3 (5 Pin, 5X-1-472LF) 4-Unit 4.7K Ohm Resistor Array. Pin 1 is to the left side of the printing. (Look for the "1" marking on the PC board.)
19) Install XL1, 8 MHz Resonator. As before, solder just one pin and verify it's correct. Now, solder the other two pins and cut off any excess leads.
20) Install S1, S2, S3, S4, S5 push button switches. Push the switches through the holes in the board until they are flat on the board and level.
21) Install Bat1, the CR2032 Battery Socket. (Do not install the Battery at this time.) The large tab goes to the right side of the board.

Jumper Pin Headers and the 8 servo headers (JP1-5) are made by cutting up the 40 pin headers. JP1 Header is an 8-pin Header, JP2 is a 10-Pin Header, JP3 is a 13-Pin, JP4 & JP5 are 12-pin Headers. To cut off the pin headers, use either a Dremel cutting wheel or a pair of small and sharp wire cutters. Painter's tape can be used to help hold the headers in place while soldering. Only solder one pin of a header and check for alignment and that it's flush with the board. (Melt the solder if you need to adjust a header placement.) Finnish by soldering the remaining pins of the header.

22) Start with soldering just one pin of JP2 (10-Pin header). After soldering the first pin, check the alignment and melt the solder joint should the placement need fixing. Now, solder the other pins.
23) Now install JP3, the 13-pin Header. Follow these steps for JP2.
24) Install the JP1, the 8-Pin header.
25) Install the two 12-pin headers for the Servo ports 0-7. As before, use painter's tape to hold just one 12-pin header on the PC board and then solder just one pin. Remove the tape and adjust the header so it lines up straight on the PC board and then solder the 11 remaining pins. Do the same JP5, the other 12-pin header.
26) Install the two 8-pin single in-line sockets used to mount the DFplayer Mini Media Player. They are located on the bottom left side of the PC board. (Below U4 and U5.) Install the first socket and solder just one pin. Verify that the socket is in flat and straight. This is crucial since the module will need to lineup with all three sockets. Now, solder the 7 pins and do the same for the other socket.
27) Install the two (blue) 3 Pin Terminals for X8 and X9. Place the first terminal on 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 two terminal pins. Do the same with the other 3 pin terminal.

28) Install the four 2 Pin Terminals for X1, X2, X3 and X4 (Green) by first sliding the terminals together. (This will make one terminal block with eight connections.) Place them on to the PC board with the terminal connection holes to the outside. Solder one pin on the left and check for alignment and adjust as needed. Repeat this step with the pin on the right side. Now, solder the other six terminal pins.

29) Install the three 2-Pin Terminals (Green) for X5, X6 and X7. 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.

30) Install C14 and C15 (100 UF 25V Capacitors) Note the positive side of the Capacitor (longer lead) goes to the "+" hole. Bend the leads apart to hold the parts in place and solder. Cut the excess leads.

31) Install the LM7805, a 5 Volt Regulator in U6 with the metal tap to the right side of the board. (Nearest the 40 pin Socket.) 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. Cut the excess leads.

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

32) Mount the Heatsinks on the four IRF540 MOSFETs using the screws and bolts or Pop-Rivets (3 mm or 1/8 Inch in size.) Please see photo #1 for how to mount the MOSFETs on the Heatsinks. Note: Heat transfer compound is not required.

33) Install the four IRF540 MOSFETS (Q1, Q2, Q3 and Q4) with the metal tap matching the markings on the PC board. Make sure the Heatsinks do not touch each other or any other parts. 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. Cut the excess leads.

34) Install the five color button caps. S1=Red, S2=Green, S3=Blue, S4=Yellow and S5=White. (See photo 2.)

Review the Banshee OC 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 be done. Remove all metal from the test bench. This includes tools, parts and leftover wire cuttings. Connect the 7-12 Volt power source with one or more amps to the "7-12 V Input" terminal. The (+) is the positive terminal and the (-) is the negative terminal.

After applying power, the Green Power LED should light up. If not, please review your work for mistakes.

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

Final Installation of Components.

> Static protection must be used with these final parts. Please note what side of the IC socket has a notch on one side and the IC will need to match it. Plugging an I.C. in backwards can destroy the chip. When install the RN1 (16-pin Resistor Array) and U1, U2, U3, U4, U5, U7, U8 and U9, 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 all the way in.

35) Install the two 4N33 into the 6-pin sockets of U7 and U8 near the right side of the board.
36) Install RN1 (16-pin Resistor Array) into the 16-pin socket near the B.0 to B.7 servo output pins.
37) Install DS1307 Real Time Clock (RTC) chip into U2 socket to the right of the battery holder.
38) Install 24FC512 Serial EEROM chip into U3 socket above the U2 socket.
39) Install 74HC4052 4-Channel Multiplexer IC into U9 socket below the battery holder.
40) Install the two MSGEQ7 ASA chips into U4 and U5 sockets on the lower left side of the board.
41) Install the Picaxe 40X2 chip into the U1 (40 pin) socket. Be careful plugging in the chip since there many more pins and it's easy to bend or break a pin off. Also, plugging it backwards will destroy it.
42) Install the DFplayer Mini module into the two 8-pin sockets on the lower left side of the board.
43) Install the CR2032 "button" battery into the BAT1 socket with the "+" (imprinted) side up.
44) Install the two pin jumpers on pins 1-2 and 4-5 and on JP1, near the audio jack.

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

For the DFplayer Mini Audio Media Player to work correctly, the Micro SD/SDHC card must be installed. Using your PC, install the project's sound files on the card. Keep pushing till the card comes to a stop. (As this point, the card is in the locked position.) Pushing on the card again will unlock it for easy removal. The Micro SD-Card will only work when it's in the fully locked position.

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 (7-12 Volts) to the Banshee board and verify the Green power LED is lit. Now, connect the Download cable to the 1/8-inch programming jack on the top/right side of Banshee PC board. Hook up a headphone or powered speakers to the 1/8-inch audio jack located on the bottom right side, next to the JP1 and JP2 jumpers.

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

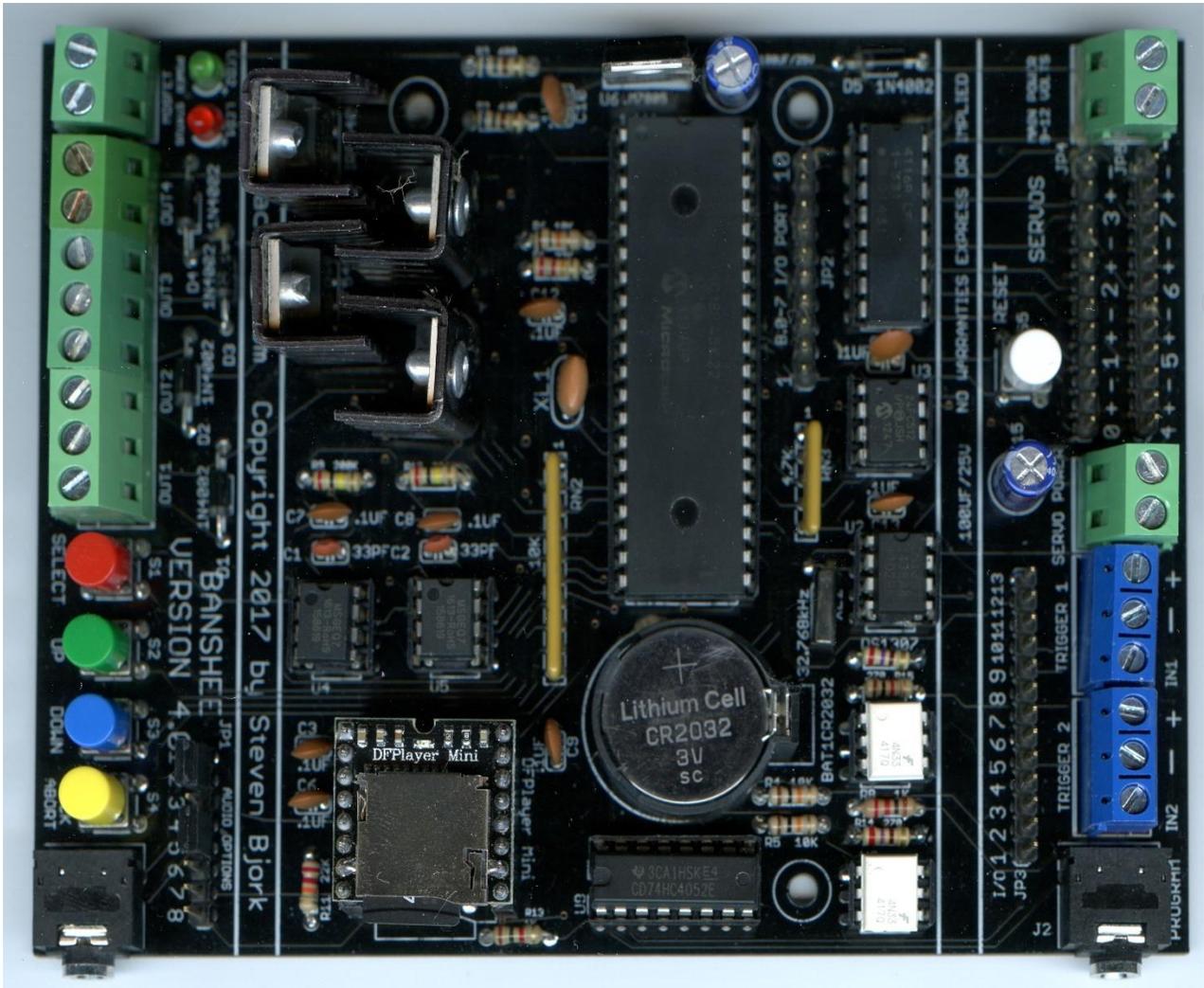If your Banshee is not working, please review your work for errors.

Photo 1

Banshee with DFplayer Mini Audio Module Installed