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FUTABA 9Z

THE UNOFFICIAL WORKSHOP MANUAL

Version 3 Release 5

by QuinCross

July 2012

INFORMATION ABOUT THIS DOCUMENT	
Title	FUTABA 9Z – The Unofficial Workshop Manual
Description	Comprehensive workshop manual for the Futaba 9Z series of transmitters (9Z, WCI and WCII), providing technical reference material and servicing, repair and upgrade procedures.
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Restrictions on Use	Please refer to section 1 (Introduction) in this document, specifically sections 1.3 and 1.4.
Feedback	Please provide all feedback on this document using the "get in contact" links and forms that can be found at www.jamesandtracy.co.uk.

Acknowledgements	
In addition to all who have contributed by proxy through posts on internet forums and personal websites, the following individuals deserve specific mentions and huge thanks from me for their contributions and comments to this or the previous version of the manual. Without these guys giving up their time, effort and equipment, this version of the manual would never have been completed to the current standard. If you meet them on the web, waves or sky say "Thanks!" because we owe them!	
Key Contributors	• Nico Rossi, from Italy – for all the pointers, photos, new information and part numbers. You went beyond the call of duty in helping to update this version of the manual! • René Berger, from Germany - for improving this version by pointing out the current "glitches". • Crazy8's from RCGroups who paved the way in replacing the 9Z's soft button covers.

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1. INTRODUCTION

1.1. Document Overview

This document brings together the wealth of information that is available on the Futaba 9Z series of transmitters (ZAP/ZHP, ZAW/ZAH aka WC1, ZAW/ZAH II aka WC2) into a single workshop manual for servicing, maintaining and upgrading these radios. Most of the procedures contained in this document have been tested on my own Futaba ZAP WC2, and they should hold true (in general) for the earlier 9Z models. Where I have not tried a procedure I have tried to highlight this in the text.

Finally, there are some people I need to thank. There is a lot of information on the web about the 9z and other Futaba radios. Before I got hold of my 9Z radio and serviced it there were many others who blazed the trail for me. Without these RC adventurers out there living (and sometimes blowing up!) the dream, this document would never have come about. This document presents the work of that huge web-wide community – not just us RC guys either – So a really big thanks to all!

1.2. Please help support this work

I'm just a modeler like you – I wrote this in my spare time to help others. I'd like to write more manuals, but to do that I need to buy the transmitters and stuff. For example as a follow on to this manual I would like the next project to be a similar manual for the 14MZ. I can't do this without your help. I have a young family and really can't afford to splash out on kit just to write a new manual, however much I'd like too (my wife would kill me!). So whether you'd just like to spend a few dollars to buy me a beer to say thanks, or contribute ten dollars towards a new workshop manual, my family and I would really appreciate it. A big thank you to the many who have already supported this work.

To donate please click the button below and give whatever you think this manual is worth – it all helps to keep the project going:

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Without your help this manual would not exist.

Thank you, James

1.3. Disclaimer & Warning!

If you intend to use this Workshop Manual then you are doing so at your own risk. Note that only some of the procedures have been tested by me, and then only on

my own 9ZAP WC2 (aka 9ZAW II). You can damage your radio, yourself and others, so please ensure you read the following:

This is not an authorized Futaba document and the author is not employed by Futaba. The author is a private individual and the information contained in this document has been assembled from numerous sources and through direct experimentation; it is not comprehensive and may be incorrect and inaccurate. No reliance may be placed for any purpose whatsoever on the information or opinions contained in this document or any other document referenced here-in or oral statement or on the completeness, accuracy or fairness of such information and/or opinions herein or therein. All information is provided without any warranties of any kind and the author makes no representations and disclaims all express and implied warranties and conditions of any kind, including, without limitation, representations, warranties or conditions regarding accuracy, timeliness, completeness, non-infringement, merchantability or fitness for any particular purpose. The author assumes no responsibility to you or any third party for the consequences of any errors or omissions. Nor does the author accept any liability for any direct or indirect or consequential loss or damages of any kind resulting from any use of this document or any information contained in it.

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1.5. How to Report Errors and Get the Most Recent Version

If you have downloaded this document from a third party site, the most recent version of this manual can be downloaded at:

http://www.jamesandtracy.co.uk/howto/9Z.htm.

It would be a good idea to download a new copy of this document from the above link in any case, as you will be able to leave your email address. This will allow me to automatically notify you of any major updates, changes, errors or omissions if I become aware of them. I intend to do this, but don't take this as a guarantee. Like everyone, I have a lot else that goes on in my life!

This document release is:

Document: Futaba 9Z - The Unofficial Workshop Manual
Version: 3
Release: 4
Release Date: 17/07/2012

This version of the manual may contain inaccuracies and omissions. If you find any please let me know by visiting the above hyperlink. You'll not only be helping me, but

you'll help others too! If you have any information you'd like to add to this manual, or suggestions for it, please also post a message or contact me.

1.6. The Different Futaba 9Z Models

There are 3 main versions of the Futaba 9Z each available in two flavours (Aircraft and Helicopter). The three main versions comprise:

1. The original 9Z – 9ZAP is the aircraft version and 9ZHP the helicopter.
2. The 9Z World Champion Edition I (WC1) – 9ZAW is the aircraft version and 9ZHW the helicopter, but this is most commonly referred to as the 9ZAP WC1or 9ZHP WC1.
3. The 9Z World Champion Edition II (WC2) – 9ZAW II is the aircraft version and 9ZHW II the helicopter, but this is most commonly referred to as the 9ZAP WC2 or 9ZHP WC2.

The differences between the models are very minor for most purposes and, if you can get an original 9ZAP or WC1 for a decent price, you should not be put off your purchase just because it's not a 9ZAP WC2. You can upgrade the set to match the 3 position switches of the WC2 using this manual and you're unlikely to notice the other differences unless you're a extreme 3D pilot or pattern flyer at the very top of your game. To all practical purposes any of these sets can be easily upgraded to do everything 99.9% of flyers could ever need. The key differences between the models are:

1. 9ZAP WC1 – adds Gyro Sensitivity mixing and Fuel Mixture Control. In addition, the VRA and VRB dials are renamed to 'Left Dial' and 'Right Dial'.
2. 9ZAP WC2 – adds (in addition to WC1), four 3-position switches on the face, upgraded sticks and increased frame rate of 2048 around centre for digital servos (analogue servos cannot use this increased response rate)

The differences between Helicopter and Aircraft 'flavours' of the 9Z series are the same throughout:

1. The Helicopter version does not have a throttle ratchet and defaults to Helicopter models in the software. The 3 position switch is at Switch E on the top left hand side (this is also useful for gliders)
2. The Aircraft version has a throttle ratchet and defaults to Aircraft models in the software. It has snap roll switches (see Figure 1) at the back of the transmitter and the 3 position switch is at the top right hand side.

Figure 1 The 9ZA's 'Snap Roll' switches, that are missing in the 9ZH version

If you fly both helicopters and aircraft go for the Aircraft version and upgrade the transmitter using this manual to make a hybrid 9VH/A version with the best of both worlds.

Figure 2 The First Version of the Futaba 9Z

The original 9Z is shown in Figure 2 above. Notice the differences when compared to other 9Z models: The unique PCM1024Z logo between the two dials on the front face and the unique button text and colouring around the LCD.

Figure 3 The Futaba 9ZAW, the second version of the 9Z (aka the 9Z WC1)

The 9Z WC1 is shown in Figure 3 above. Notice that the differences are in the same areas as before: the PCM1024Z logo and the buttons around the LCD.

Figure 4 The FUTABA 9ZAW II, the final and most desirable version (aka the 9Z WC2)

The 9Z WC2 is shown in Figure 4 above. Notice the same differences in the same areas as before. Now it comes with a funky blue colouring (which can appear quite grey except in bright light). Undoubtedly the coolest of the 9Z's, but is that worth the extra money?

2. HOW TO USE THIS MANUAL

2.1. Document Structure

This workshop manual is split into sections and annexes to help you find the information you need. The structure of the document is provided below in Figure 5.

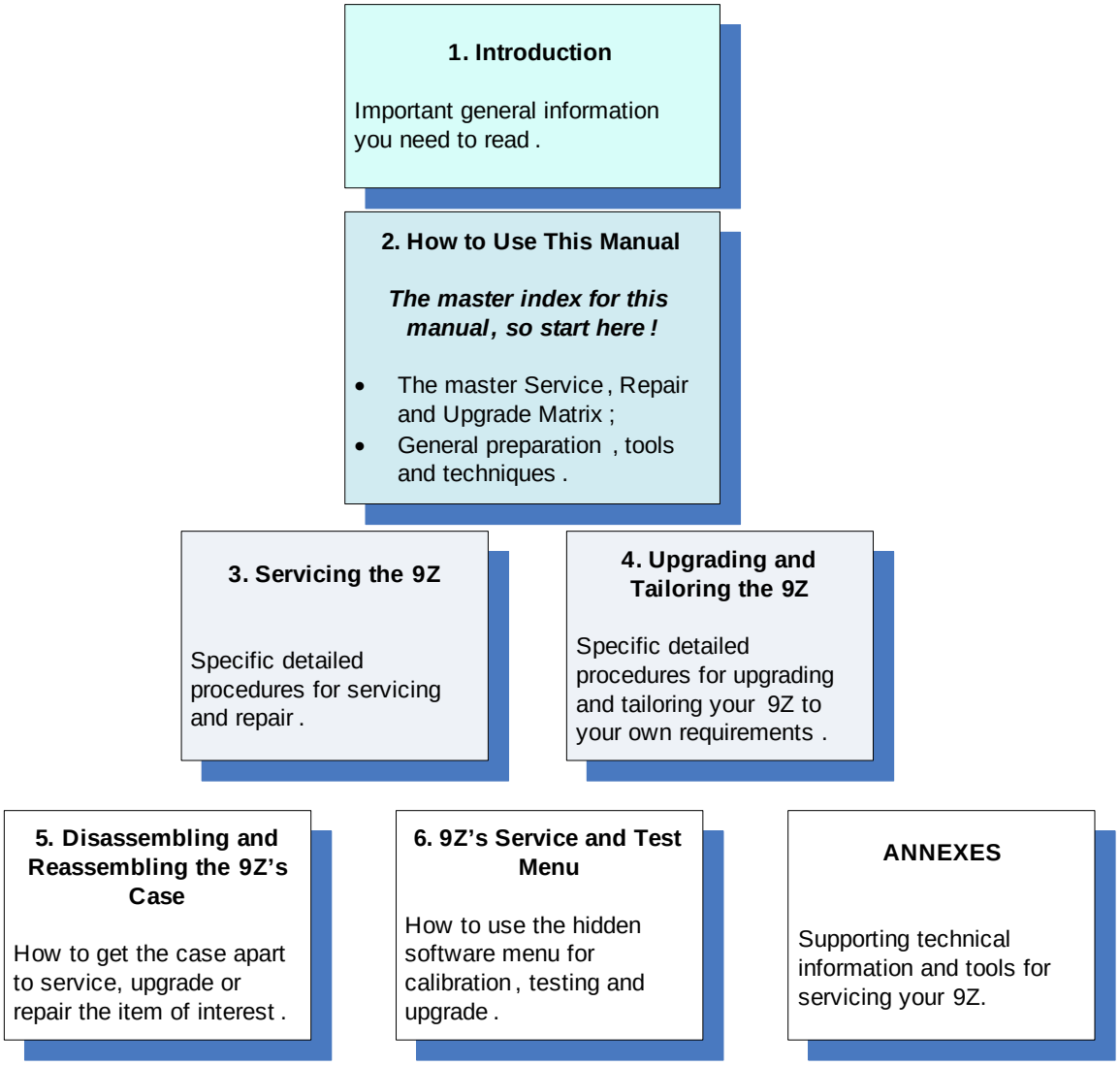


Figure 5 This Workshop's Manual Structure

You can locate the service procedure you need using the Servicing and Upgrade matrix in this document section. For example, having found the procedure you need in this section, you'd then read the detailed process for it in Section 3 (Servicing the 9Z). This procedure would refer you out to other areas of the document when required; e.g. "Disassemble to Stage 3 as described in Section 5 (Disassembling and Reassembling the 9Z's Case) and now calibrate the Joysticks as described in Section 6 (The Futaba Service and Test Menu)".

2.2. Servicing and Upgrade Matrix

You can use the following tables to navigate this manual, solve specific issues or fix faults with your 9Z. Table 1 shows some common faults and issues and the possible ID of the solution in Table 2. Table 2 below provides a matrix of the service and upgrade procedures detailed in this manual, the tools required to perform them and the level of difficulty (refer to the key below the table for an explanation of the symbols). I've rated the level of difficulty based purely on what level of skill I think is needed if the correct "recommended" tools for the job are used. You can get by without the correct tools for many of these procedures, but the level of skill required will be significantly increased.

FAULT FINDING	POSSIBLE SOLUTION
An alarm is sounding and "Back Up" is flashing on the LCD	See ID 9 in Table 2
I cannot change my user name or have forgotten my password	See ID 1 in Table 2
I cannot charge my battery through the charge port	See ID 12 in Table 2
I cannot cycle my battery pack or use my aftermarket digital charger	See ID 21 in Table 2
Poor control around stick centres. Especially a double centre to controls when moved by small amounts.	See ID's 6 & 17 in Table 2
Poor control around stick centres. Erratic servo movement. Servos do not centre after control movements, especially when combined with a 'grinding' feel to joystick controls.	See ID 6 in Table 2
Erratic servo movement to joystick control or servos do not centre after control movements, especially 'jumping' when switching between rates.	See ID 2 in Table 2
Soft button panels do not work, require a very 'positive' push or work erratically.	See ID 7 in Table 2
Switch A behaves erratically or does not work	See ID's 2 & 14 in Table 2
The "On Air" and Alarm Light does not function	See ID's 13 & 20 in Table 2
Poor signal range (original 35 MHz setup)	See ID 8 in Table 2
Poor signal range (following 2.4GHz conversion)	See ID 20 in Table 2

Table 1 Possible solutions to common faults and issues

ID	TASK	DIFFICULTY	SECTION	PAGE
Section 3 – SERVICING				
1	User Password	⚡ 📼	3.1	20
2	9Z Transmitter Calibration	⚡ 📼	3.2	20
3	Replacing Corner Switches	⚡⚡	3.3	20
4	Replacing front face controls and switches	⚡⚡	3.4	21
5	Removing the throttle ratchet for helicopter flying	⚡	3.4.1	21
6	Replacing joysticks and potentiometers	⚡⚡⚡ 📼✂	3.4.2	23
7	Replacing the LCD button panel	⚡	3.5	28
8	Replacing the 35MHz aerial	⚡	3.4	29
9	Backup (Lithium) Battery	⚡⚡⚡⚡ 📼✂	3.5	28
10	Cleaning the LCD Screen	⚡⚡⚡⚡	3.8	33
11	Replacing the LCD Screen	⚡⚡⚡⚡ ✂	3.9	34
12	Transmitter battery pack	⚡⚡	3.10	35
13	RF Module	⚡	3.11	37
14	Hard Resetting the 9Z Back to Factory Settings	⚡ 📼	3.12	38
Section 4 – UPGRADING				
15	Adding extra 3 position switches	⚡⚡ 📼	4.1	40
16	Tailoring the Reference Plane of Joysticks	⚡	4.2	40
17	Strengthening and repairing the Joysticks	⚡⚡	4.3	41
18	Backlit LCD Display	⚡⚡⚡⚡	4.4	43
19	9Z Mode and Version Change (e.g. ZAP to ZHP)	⚡⚡⚡⚡ 📼✂	4.5	44
20	Upgrading to 2.4GHz and Telemetry	⚡⚡	4.6	45
21	Cycling and Fast Charging the Transmitter Battery Pack	⚡⚡	4.7	51
22	Building a DSC Cable for Direct Servo Control	⚡⚡	4.8	54
23	Building your own CAMPAC for increased model memory	⚡⚡ ✂	4.9	54

24	Building your own PC interface for backing up the 9Z	✂	4.9	54
25	Building a Training Cable for Buddy Boxing		4.10	55
26	Adding a 10th Channel to the 9Z	✂	4.11	56
27	Building your own Futaba Service Menu Enabler	✂	APPENDIX A	77

*Key for "Difficulty" Symbols in Above Table:	
Symbol	**Explanation**
	No experience necessary
	You can follow instructions
	As above, plus you are comfortable with household DIY
	As all the above, plus you have soldering experience
✂	Specific tools required or recommended (Section 2.3.2)
	Service and Test Menu Enabler required (Section 6.2)

Table 2 Service and Upgrade Matrix

2.3. Preparation and Tools

This is an important section please read it thoroughly. If you do not have the right tools, general techniques and mindset for the job, you will at best find it hard and at worst you could damage your transmitter.

2.3.1. General Tools

The general tools you will require are shown below in Figure 6. The yellow object is the Universal Service Menu enabler described in APPENDIX A. The tape is to protect your pliers and screwdrivers. The white card is to stick screws through when you remove them, and the pen is to label them so you know where they came from. I'd also suggest you keep a camera handy to take photos for reference when you reassemble the case.

Figure 6 General Tools Required

2.3.2. Specific Tools

I would really suggest you invest in a solder pump (blue syringe in Figure 7) and a variable temperature soldering iron (Blue soldering iron with dial in Figure 7) for any work involving Printed Circuit Boards. They are both very cheap items and you'll use them again and again. Although you can get by without a variable temperature iron, you must have an iron with a needle/small tip that is suitable for the delicate work of desoldering and resoldering components. You will not be able to get by without a solder pump or at the very least some desoldering braid - yes you might get the components off the board, but you will probably damage them if you're not using a pump. As a pump costs something like £2 ($3) you'd be a fool to attempt work without one. You will also probably need a digital multimeter (yellow meter in Figure 7), get one they're also cheap.

Figure 7 Specific Tools - The full toolset required

If you intend to build your own CAMPAC for the 9Z and have a general interest in building other electronic RC gadgets then you'll need a PIC programmer (see Figure 8). This is a piece of kit that can upload code that you've either written yourself or have downloaded from the internet to a PIC MicroChip. There are loads of different models out there on the market and some of the Chinese copies are very cheap ($12). Do some research before you buy, and buy only if you have a wider interest in this equipment. That said, once you have one there are loads of excellent pre-written circuits and codes for our hobby, so you don't need to know about electronics to start making your own custom kit. Using the programmer is very simple, you just hook it up to the PC and microchip and then 'burn' the code onto the chip as you would a CD or DVD. Key things to look out for in PIC programmers are:

1. That the PIC Programmer supports the chips you will be using.
2. Has a good source of software updates to remain usable with newer microchips.
3. Has USB connectivity
4. Has ICP (in-circuit programming) capability
5. Has a ZIF (Zero Insertion Force) connection for hooking up to chips
6. External power supply possible (USB power can brown out on some chips)

Figure 8 USB ICP PIC programmer with ZIF 'hook up' for the chip in green/blue.

2.3.3. Working with Printed Circuit Boards (PCBs)

Components on printed circuit boards can be damaged by static electricity. I personally have never blown up a chip this way, but it pays to be careful. Make sure you're wearing

cotton, if possible do not work in a carpeted area, pick up PCBs on the edges, earth yourself by touching a metal bathroom tap before starting work and frequently earth yourself on the metal sub-case of the 9Z before touching a PCB. If you're really worried you can buy a dedicated earth strap for your wrist very cheaply that you connect to the 9Z sub-case and it will provide a permanent earth, but I don't have (or use) one and so far everything has been fine.

2.3.4. Soldering

When you are soldering and desoldering components be as quick as you can as high temperatures can damage some of them. This is why a variable temperature soldering iron is such a good idea – you set it at a higher temperature for desoldering and it will melt the solder before heat can be dispersed to the component. You can also use crocodile clips as heat sinks to prevent temperature dispersing to delicate components. There are lots of tutorials on the web about soldering and it's very simple!

2.3.5. Working with Ribbon Cables

They're everywhere in the 9Z. You need to be careful how you handle them and that you don't trap or damage them. You also need to recognise that you may need to replace them in some instances just because they're old (although this has never happened to me). Do not twist them or force them, ease them back in and out. Do not remove them with unprotected pliers. They're likely to be as good as new inside the case, but with age they become inflexible, and with too much pulling in and out the connectors become detached from the ribbon. So if you can help it do not remove them unless necessary and in the worst case, replacements can be sourced from Futaba or DigiKey/Farnell/RS Components.

2.3.6. Attitude

Attitude….. as in yours! You need to work as if you're disarming and rearming a bomb. That means slow thoughtful progress. If at any stage you think, "damn, doing that could blow this thing up, but let's take a gamble" walk away and grab a cuppa! If you find yourself about to force some bits together, walk away and grab a cuppa! If your kids come home, walk away and grab a cuppa....well you get my drift! This is your prized radio you're working on - take your time and keep it calm. Nothing, I repeat nothing in the 9Z, requires you to 'force it', everything clicks easily into place. There are far too many posts on internet forums saying things like "Grab it here and pull up really hard" or "Give it a smack here". If you really feel the need to do this kind of thing for pleasure, invest in a classic car or try 'experimenting' in your sex life, do not do it to your radio!!!

3. SERVICING THE 9Z

3.1. User Password

If you have forgotten the user password for your 9Z you can use the Service and Test Menu to display the password, instead of having to reset it through a hard reset of the transmitter. You will need a Service and Test Menu enabler to access the information (see Section 6.2 and APPENDIX A)

The user password can be found on the “System Overview” screen of the Futaba Test and Service Menus. This is fully described in the diagram in Section 6.3.

3.2. 9Z Transmitter Calibration

It is a good idea to recalibrate your transmitter after a few years of use as the hardware settings drift. Typical symptoms include servo neutral positions ‘jumping’ at low rates and sometimes even switches failing to work in one position.

You can test if your transmitter needs recalibration of its joysticks in the following way:

1. Start by selecting a blank (freshly reset) airplane program.
2. Go to the ATV menu
3. Hold both sticks fully up and fully right while switching between AIL, ELE, THR and RUD. If the pointer below the graph moves even a little while you are switching channels you radio needs calibration.
4. Repeat step 3 but now holding both sticks fully down and fully left.
5. Finally, repeat step 3 with both sticks cantered (including throttle axis).

To recalibrate your transmitter you’ll need to access the Futaba Service and Test Menu. This is described in Section 6 (The Futaba Service and Test Menu) and you should refer to the listed Joystick and Switch recalibration menus for the recalibration procedure.

3.3. Replacing Corner Switches

This procedure relates to a like for like replacement of the Corner Switches. If you wish to modify a switch (e.g. replace a 2 position switch with a 3 position) you should refer to Section 4.1 (Adding extra 3 position switches).

1. Disassemble the 9Z’s case to Stage 3 as described in Section 5 (Disassembling and Reassembling the 9Z’s Case).
2. Disconnect the ribbon cables from the corner switches.
3. Remove the switch from the corner panel by unscrewing the retaining plate
4. Desolder the switch from its mini-PCB
5. Replace with a 9Z switch and solder it to the mini-PCB

   Note: *The 9Z switches do not have an offset connector pattern like those of the 8U series, the 8U series switches will fit but they require some gentle bending of the connectors see Figure 9.*

6. Reassemble is a reversal of disassembly

Figure 9 Corner Switch Replacement - NOTE: 8U SWITCH PART NO. IS SHOWN!

3.4. Front face controls, gimbals, and POTs

Note: *I have not replaced the Front Face Controls so this procedure may be incomplete.*

1. Disassemble the 9Z's case to Stage 2 as described in Section 5 (Disassembling and Reassembling the 9Z's Case).
2. Access for general servicing (e.g. greasing bearings and checking POTs) and for replacement of the front face controls and aerial requires the partial removal of the main PCB. Make sure you are earthed and protect your tools so you don't damage ribbon cables etc., see Section 2.3.
3. Remove the 4 ribbon cables, 2 connectors and 3 screws shown in Figure 10 from the main PCB.
4. You will now be able to lever up the main PCB as shown in see Figure 11 to gain access to the front face controls etc.

3.4.1. Removing the Throttle Ratchet for Flying Helicopters

To remove the ratchet action on the Throttle for Helicopter flying, the technique I use is to make a 'ratchet smoother' from a strip of beer can (see Figure 12) or scrap plastic. This strip is cut to fit under the existing ratchet (see Figure 11) and has a hole in one end so it can be held in place by the existing ratchet's screw. This whole assembly of ratchet and 'ratchet smoother' is then screwed back into place (see Figure 13). I find this works much better than flipping the metal ratchet lever upside down which still results in some unwanted 'ratchet' feel. In all cases I'd advise against sanding down the plastic gear to remove the ratchet effect as this would likely result in a non-uniform control feel unless done very, very carefully.

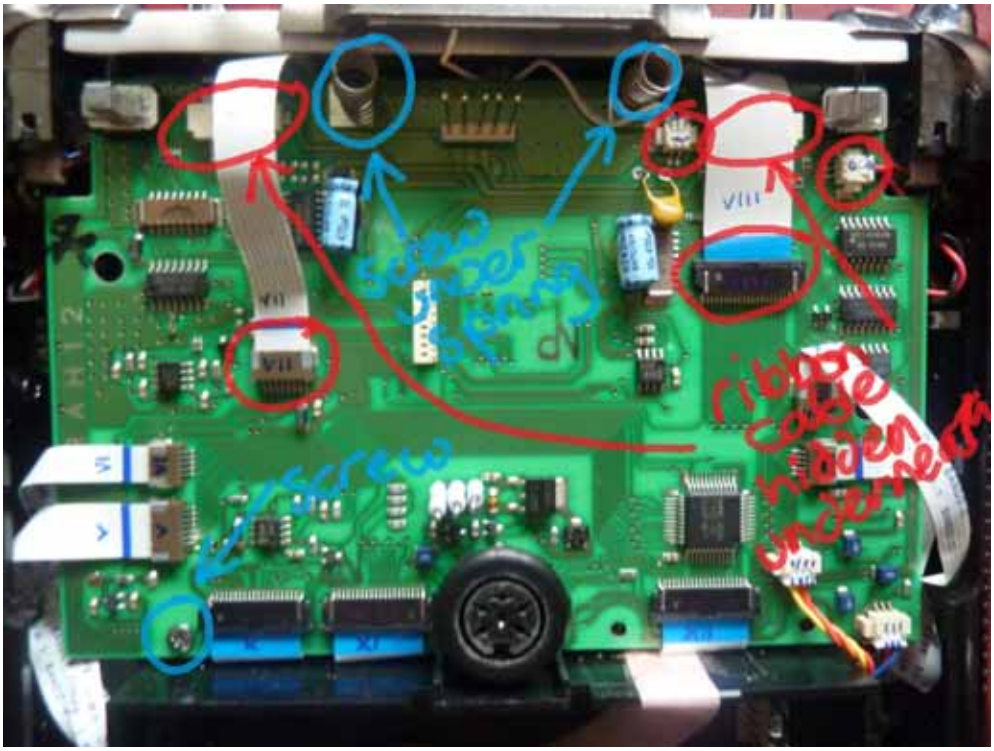


Figure 10 Removing the main PCB

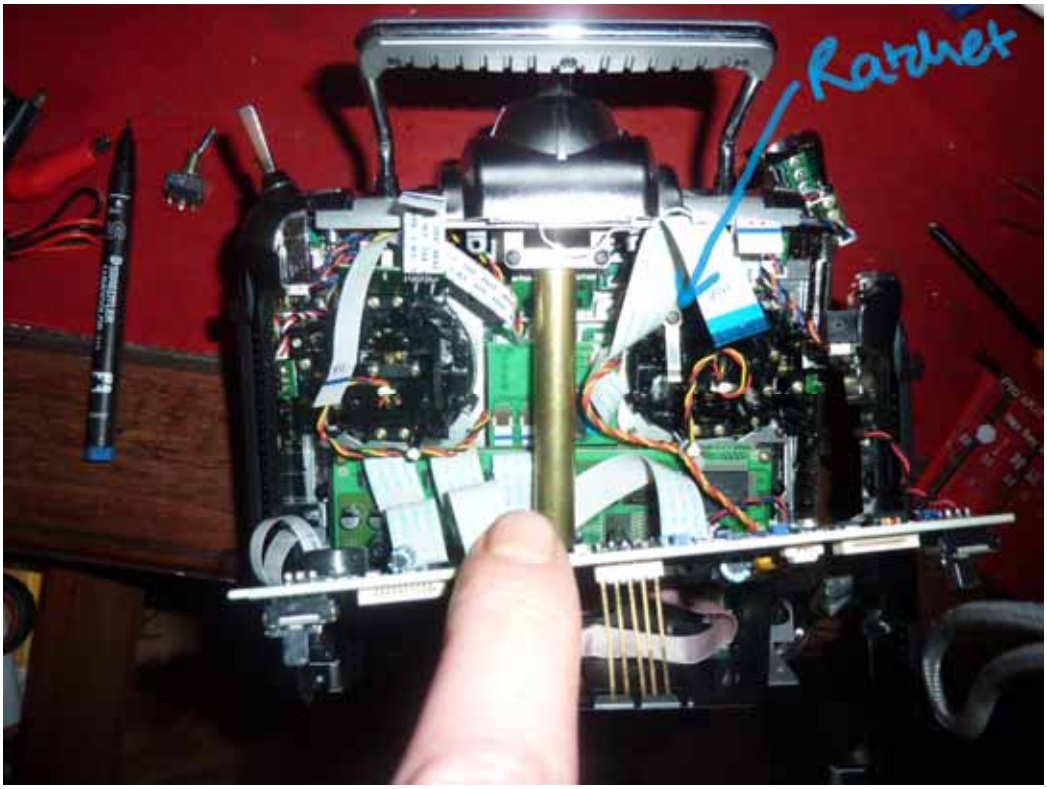
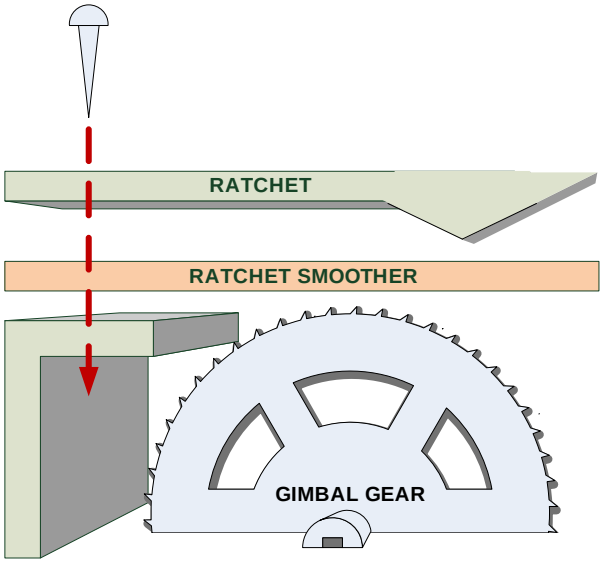


Figure 11 Lever up the PCB - Note: Metal Ratchet on Throttle at Right



RATCHET SMOOTHER MADE FROM DRINKS CAN

Figure 12 Making and installing a "Ratchet Smoother".

Figure 13 Another example of a ratchet smoother

3.4.2. Replacing the Joysticks and Potentiometers (POTS)

The joysticks on the 9Z weaken over time and can crack, whilst you can repair them using the procedure in Section 3.4, they are easy to replace at the same time as you service the complete 9Z gimbal assembly (inc. Potentiometer replacement). If you are replacing the joysticks then you should also replace the POTS at the same time.

Potentiometers or POTS are used in a transmitter to sense how far the user has moved the joystick. After some years the POTS inner surfaces wear and control becomes erratic or inaccurate. When this occurs they need to be replaced. This procedure may

look difficult, but it really isn't as long as you remember to keep all those little springs and screws safe once you've removed them. POTS are fairly standard items in the electronic industry, but their calibration value is critical so make sure you get the right ones. There are two sorts used on the 9Z series of transmitters – one is blue and one is silver. Futaba can provide exact replacements or you can find the little numbers written on the POTS and plug this into Google to find an aftermarket replacement. The required part numbers can be found in APPENDIX C.

To remove and replace the POTS and joysticks in your 9Z simply follow the procedure below:

1. Remove the 4 Allen key screws around the joystick/gimbals (see Figure 34 on Page 40).
2. Twist out the joystick gimbal and disconnect the associated cable (see Figure 14).
3. Remove the retainers for horizontal axis and remove both the pot and the joystick (see Figure 15).
4. If you are replacing the joysticks assemble the parts as shown in Figure 18. It may well be a good idea to add a strengthening collet (see Section 4.3) to the assembly to prevent future joystick failure as this is a fairly common issue.
5. Unscrew the ball bearing at the end of the pot and remove the horizontal POT from the assembly (see Figure 16).
6. Slice the heat shrink tubing on the horizontal POTS connectors and desolder the wires.
7. Solder a new POT onto the wires. It is very important to add new heat shrink tubing to protect the contacts or you risk a short circuit when in use.
8. Reassemble the POT in the horizontal axis gimbal using red Locktite or similar as before and re-fit the joystick.
9. Unscrew the vertical axis POT retainers and pop out the POT (see Figure 19).
10. Desolder the connector PCB, solder it onto a new POT (see Figure 20).
11. Finally, reassemble the vertical axis gimbal. Again, make sure you use red Locktite or similar when installing the new assembly back into the gimbal.
12. Reassemble the rest of the gimbal unit and replace the whole fully serviced unit back in your 9Z. Reassembly is a reversal of disassembly.

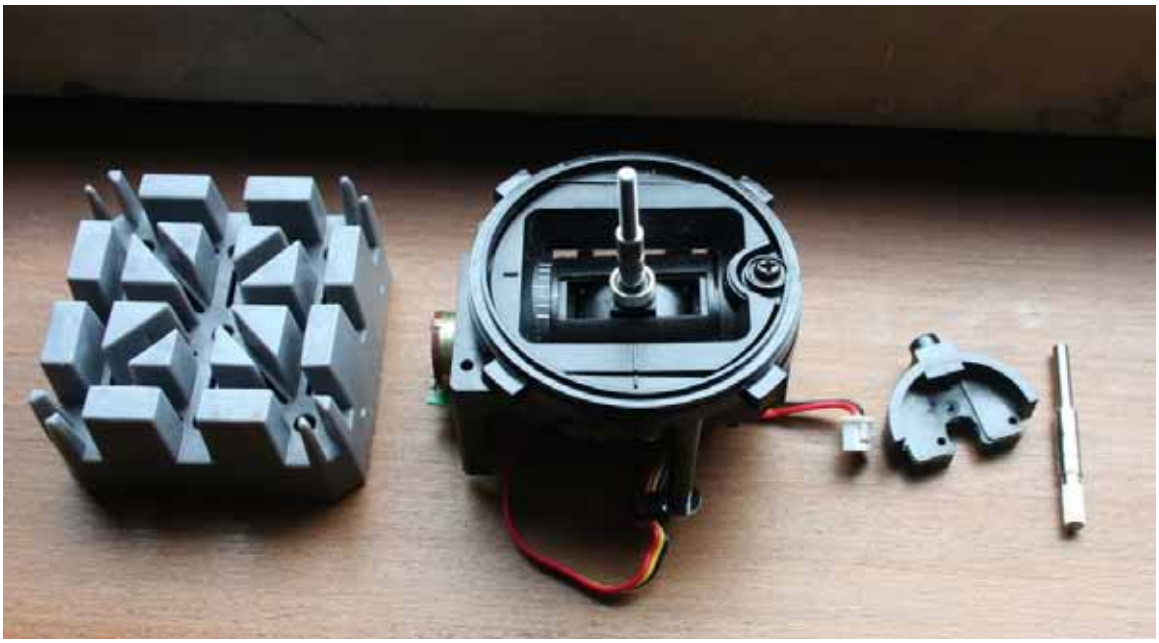


Figure 14 Joystick gimbal removed (Note: new joystick parts for replacement on the right)

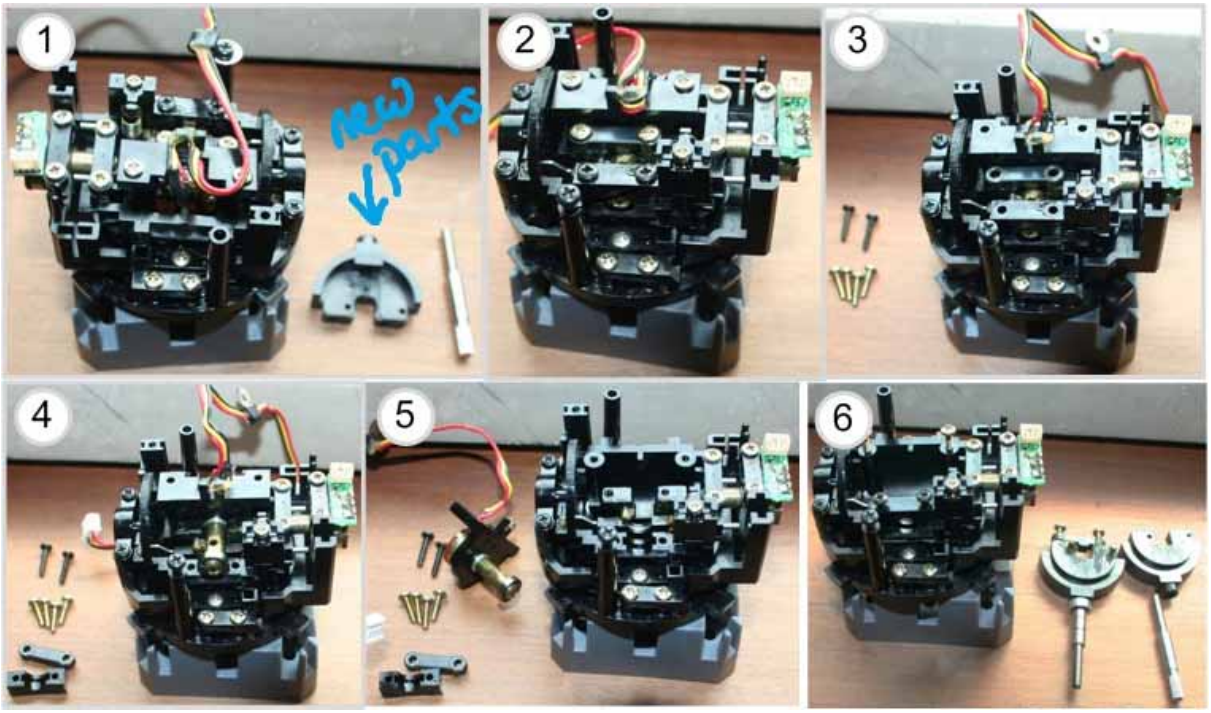


Figure 15 Disassemble the horizontal axis POT and joystick (new joystick parts in 1 & 6)

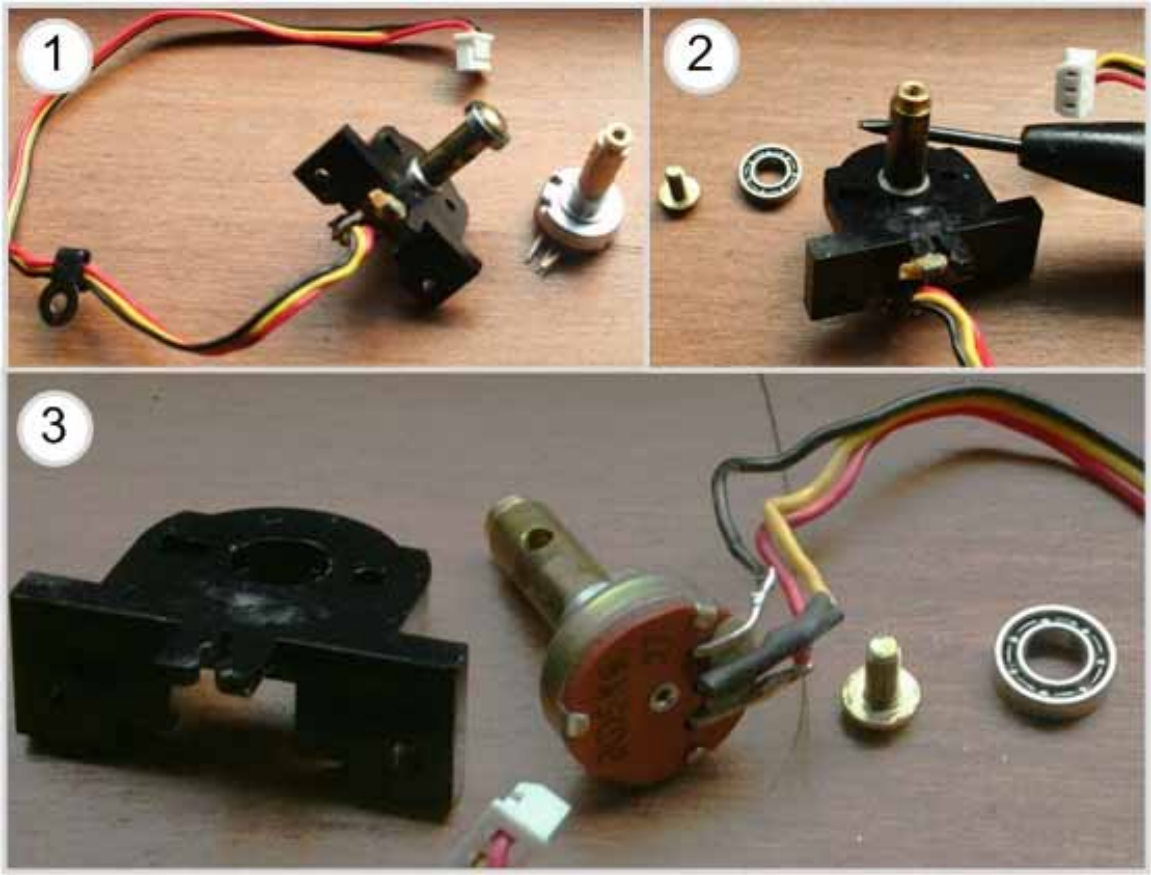


Figure 16 Unscrew the ball bearing from the horizontal axis POT

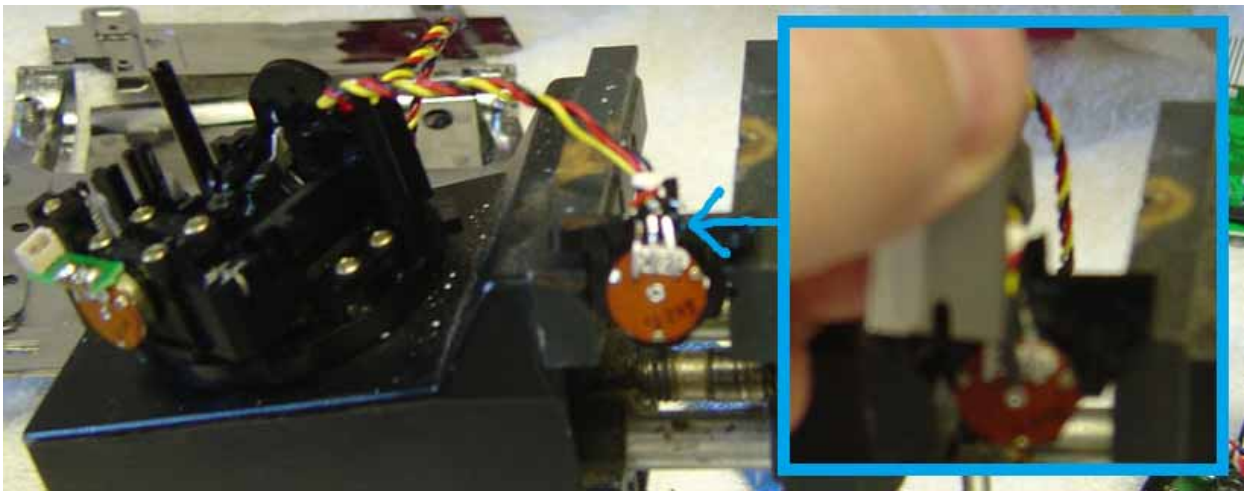


Figure 17 Slice the heat-shrink tubing and desolder the POT

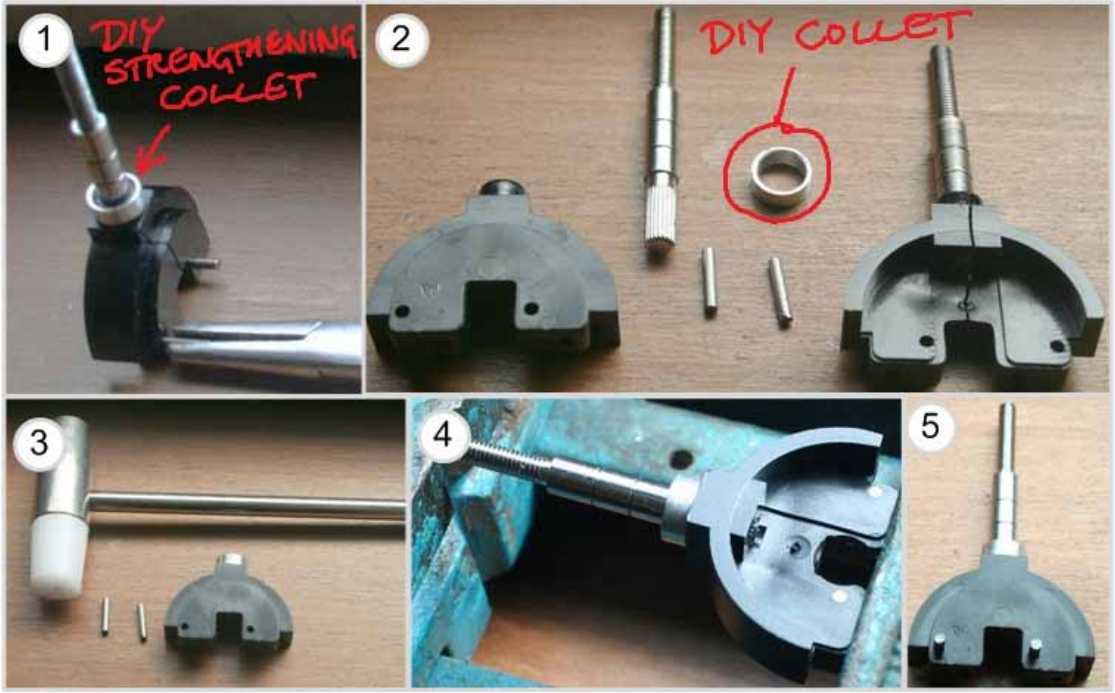


Figure 18 Assembling a new joystick (note: DIY strengthening collet modification)

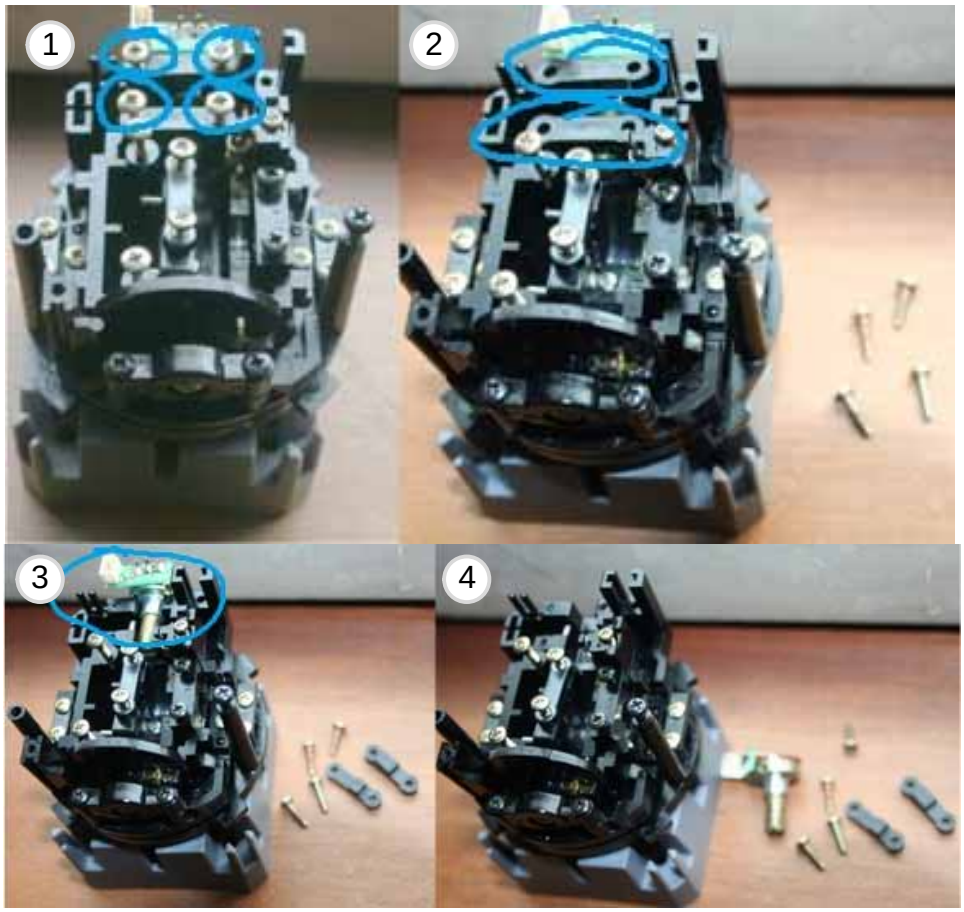


Figure 19 Remove the vertical axis POT retaining plates and withdraw the POT

Figure 20 Desolder the connector PCB (green) from the POT

3.5. Replacement of LCD button panels

The 9Z transmitter, like its predecessor the 9V, uses software buttons that are activated by clicking the corresponding button on the LCD button panel. However, unlike the 9V, these button panels are manufactured as self adhesive units (see Figure 21) and it is common for these panels to become worn and fail over the life of the transmitter.

Figure 21 The three LCD Button Panels shown on a 9ZHP WC2

The primary issue with replacing these panels is finding a supplier that still has stock of the required spare parts. At present it appears that stock of the original 9ZAP/ZHP and

WC1 panels has been completely exhausted. Partial stock of the WC2 panels is still available, but difficult to locate. It should be noted that each model has superficially different button panels (e.g. different branding), but all panels are interchangeable between the 9Z models. This has led to many early 9Z's and 9ZHP's being 're-branded' by the fitting of 9ZAP WC2 panels.

If you can find stock, replacement of the panels is simple:

1. Purchase the required panels (see APPENDIX C for part numbers)
2. Lever up the old panels with an old credit card or other hard plastic card that has been 'sharpened' so that it can slip under the panel and break the initial seal. You can use a knife to start things off, but be very careful as you can easily scratch the 9Z case. For this reason, do not be tempted to use a screwdriver.
3. After removing the self adhesive panels glue residue will be left on the 9Z case. Carefully remove all this residue by rubbing with your finger and then clean the area with a damp soapy cloth. Finally, wipe over to remove any soap residue with a clean damp cloth.
4. After everything has thoroughly dried, peel the backing from the new button panels and apply them to the 9Z case.

3.6. 35MHz Aerial Replacement and Servicing

Note: *I have not replaced the Aerial so this procedure may be incomplete.*

Warning: *Always do a range test after replacing or servicing the aerial. If for some reason you lose RF range after changing the aerial, then it is likely that this spring clip has become dislodged. If this is the case then you'll need to remove the transmitter case top to gain access to the clip. To do this you will need to disassemble the case to Stage 3 (see Section 5) and then completely remove the bolts shown in Figure 57 on page 61.*

The 35MHz aerial that comes with the 9Z cannot be removed for servicing without some disassembly of the transmitter. However, this disassembly is trivial in most cases and simply requires removal of the battery pack if you are careful. It is retained in the case by an Allen key style bolt at its base and the electrical contact for RF transmission is made by a spring clip in the 'ball joint' at the top of the transmitter case (see Figure 22).

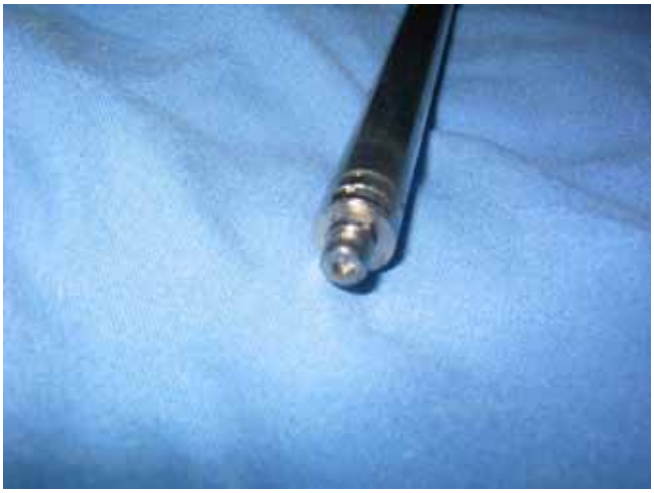


Figure 22 Allen head bolt at the bottom of the 9Z aerial (3/32" or 3mm head)

To remove the aerial for servicing you have two options to access and undo the Allen key bolt that retains it at its base:

Option 1 – Full Access: Disassemble the case and remove the main PCB as described in Section 3.4. Insert a 3/32" Allen key (although some are 3mm) to undo the bolt through the access hole in the base of the battery compartment and undo the bolt (see Figure 23). Maintain pressure on the bolt throughout removal and replacement so it doesn't fall out of its slot. The advantage of this option is that it will give you full access to the bottom of the antenna should the worst happen and the bolt become dislodged and falls out during servicing.

Option 2 – Restricted Access: Disassemble to Stage 1 as described in Section 5.1 (i.e. you only need to remove the transmitter battery pack). Insert a 3/32" Allen key (although some are 3mm) to undo the bolt through the access hole in the base of the battery compartment and undo the bolt (see Figure 23). Maintain pressure on the bolt throughout removal and replacement so it doesn't fall out of its slot. Be very careful! If the bolt drops out you will need to disassemble the transmitter to retrieve it and during disassembly you are likely to jiggle the missing bolt deeper into your transmitter's internal components.

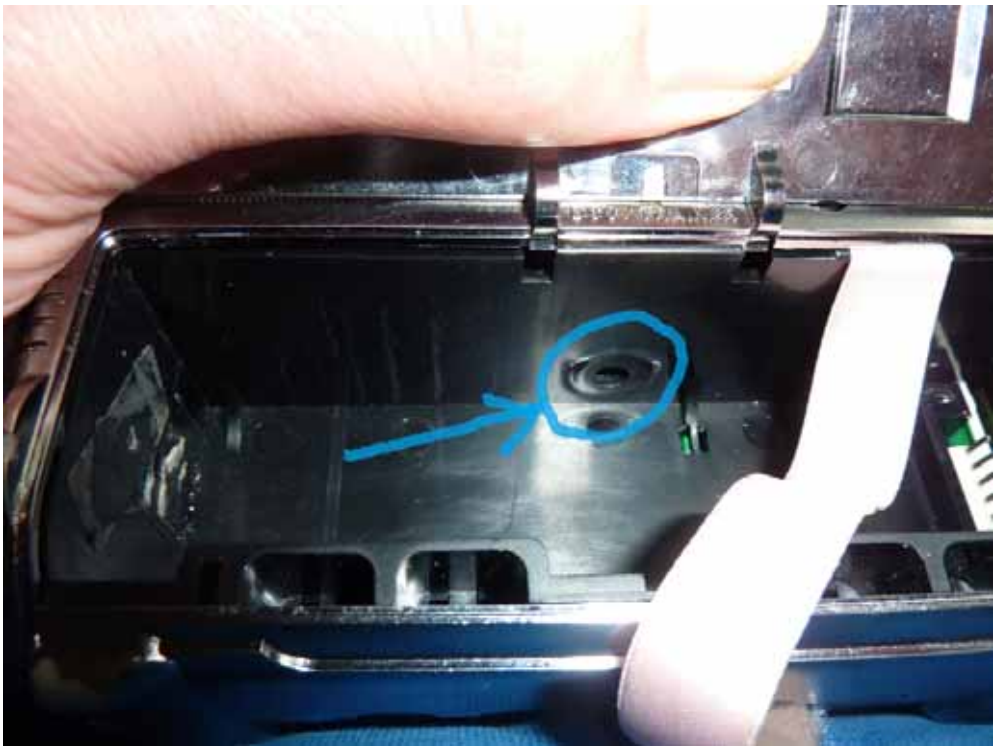


Figure 23 The access hole for the aerial retaining bolt in the battery compartment

3.7. Backup (Lithium) Battery

The main back up or memory battery should be replaced every 5 years. Failure to do so will eventually result in the loss of all your model settings when the battery is exhausted. When this happens a warning message (BACK UP) will be displayed on the LCD and the 9Z will emit an alarm tone that you cannot cancel. Replacement of this battery is not difficult, but you really will need the right tools (refer to Section 2.3).

Note: *This procedure requires the partial removal of one of the LCD's PCBs. Make sure you are earthed and protect your tools so you don't damage ribbon cables etc., again see Section 2.3.*

1. Obtain a replacement lithium battery from Digikey, Farnell or RS Components. The replacement is a BR2032/HEN (£1.47p). Do not be tempted to use a cheaper CR2032!
2. Label the new battery with the date of replacement and protect with tape if required (see Figure 24)

Figure 24 Label and protect the new battery

3. Make sure you have the tools to access the Service and Test Menu ready (see Section 6.2)
4. Backup your settings for your 9Z onto a CAMPAC 64 or Ultrapac 64 as they will be wiped by the battery replacement process.
5. Disassemble the 9Z's case to Stage 4 as described in Section 5 (Disassembling and Reassembling the 9Z's Case).
6. Remove the 4 screws retaining the top PCB of the LCD assembly (see Figure 25).
7. Flip the top PCB onto its back (see Figure 26).

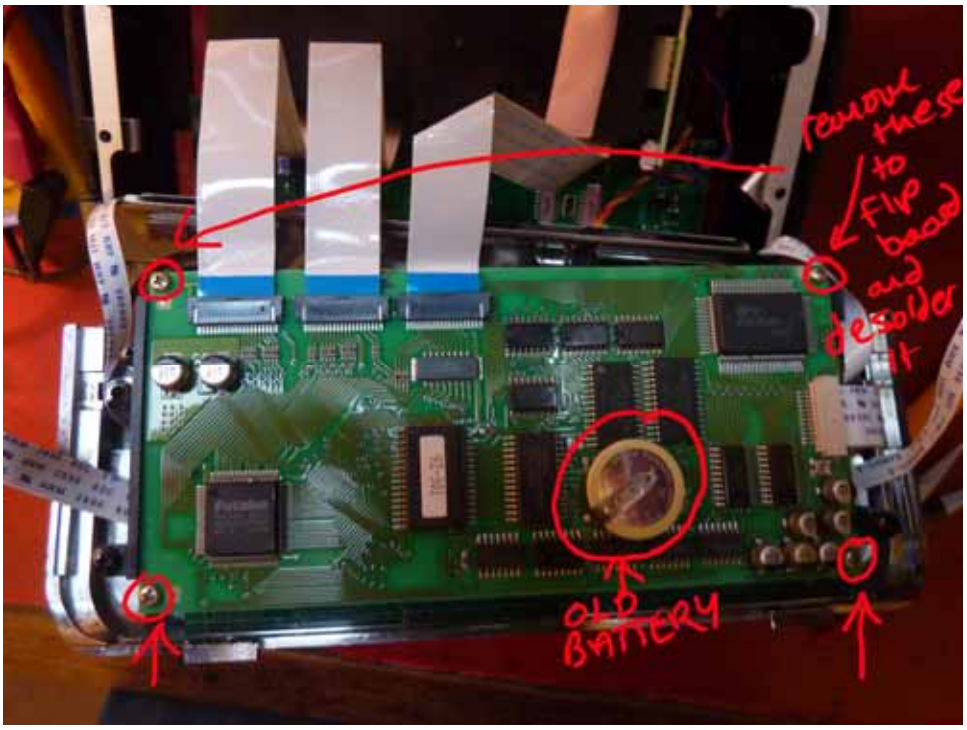


Figure 25 Removing the top PCB of the LCD Assembly

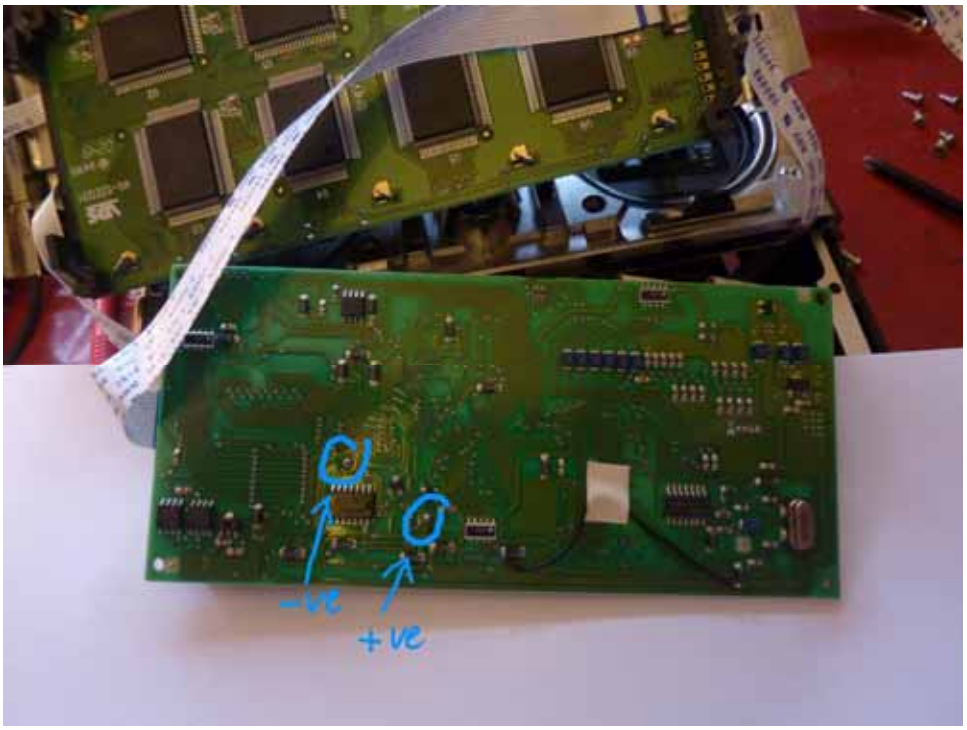


Figure 26 Top PCB 'Flipped' and Battery Terminals Exposed

8. Desolder and remove the old battery terminals using your iron and pump, being careful to note which terminal is +ve and which is –ve (see Figure 26)
9. Double check you are going to place your new battery the right way round and, once you are sure, solder it in.

10. Reassemble the transmitter
11. Fit the Service Menu Enabler, turn on the transmitter and access the Service and Test Menu (Section 6.2)
12. Recalibrate and test everything using the Service and Test Menu as described in Section 6.
13. Turn off and remove the Service Menu Enabler, and re-load any saved settings.
14. Put a label (with the date on it) on the inside of the battery hatch to remind you when you did the replacement.

3.8. Cleaning the LCD Screen

Note: *I have not directly tested this procedure. Also note that this procedure requires the removal of the LCD's PCB assembly. Make sure you are earthed and protect your tools so you don't damage ribbon cables etc., again see Section 2.3.*

1. Disassemble the 9Z's case to Stage 4 as described in Section 5 (Disassembling and Reassembling the 9Z's Case).
2. Remove the 2 black screws retaining the LCD assembly (see Figure 27)
3. You should now be able to flip the whole LCD assembly out to clean it (see Figure 28 in Section 3.9). Note that ribbon cables will still be attached so be careful not to stress them.

Figure 27 Removing the LCD Assembly

3.9. Replacing the LCD Screen

Note: *I have not directly tested this procedure. Also note that this procedure requires the removal of the LCD's PCB assembly. Make sure you are earthed and protect your tools so you don't damage ribbon cables etc., again see Section 2.3.*

Whilst it is possible to replace a cracked or damaged 9Z LCD screen, the cost is usually prohibitive as Futaba charge $100's for the replacement part. This usually means that it is cheaper to buy a replacement transmitter or live with the damage. However, after market replacements from a generic component supplier like Farnell, RS Online or Digikey are likely to be much, much cheaper. You can either try to source a generic replacement from these companies or purchase a second hand 9Z and swap the LCD.

Futaba supply the complete assembly so there is no need to do more than disconnect the ribbon cables (see APPENDIX C for part numbers), although it may be possible to purchase the individual components from them. The procedure detailed below is for replacement of the component LCD panel **alone** (i.e. without replacement of the original PCB boards). This can reduce the cost to a fraction of the Futaba "full assembly" price. Though please be warned – replacing an LCD is probably the most difficult procedure in this manual. However, if you want to replace your screen follow the procedure below:

1. Follow the procedure in Section 3.8 to remove the LCD Assembly
2. Remove the corner screws of the LCD Assembly and partially disassemble it (see Figure 28). Be careful not to damage the ribbon cables linking the assembly to the 9Z – if in doubt remove any that get in the way.

Figure 28 LCD Assembly removed and partially disassembled

3. Remove the PCB holding the LCD screen and metal shield
4. Remove the metal shield by carefully bending the retaining lugs (see Figure 29)
5. Very carefully flip the exposed LCD over to one side so it is off the PCB. It will still be attached to the PCB by a short ribbon cable at one end, be extremely careful not to damage this cable (see Figure 29).
6. Disconnect the short ribbon cable and replace the LCD.
7. Reassemble the LCD Assembly being careful to ensure a good contact between LCD and PCB contacts (Lines will appear on your LCD if a bad contact is made)
8. Reassemble your transmitter enough to test the new LCD. Do not fully reassemble as it is likely that you may have a bad contact in the LCD (see above).
9. If everything is working fine, clean the LCD with a soft cloth to remove finger marks and then fully reassemble the transmitter. Reassembly is a reversal of disassembly.

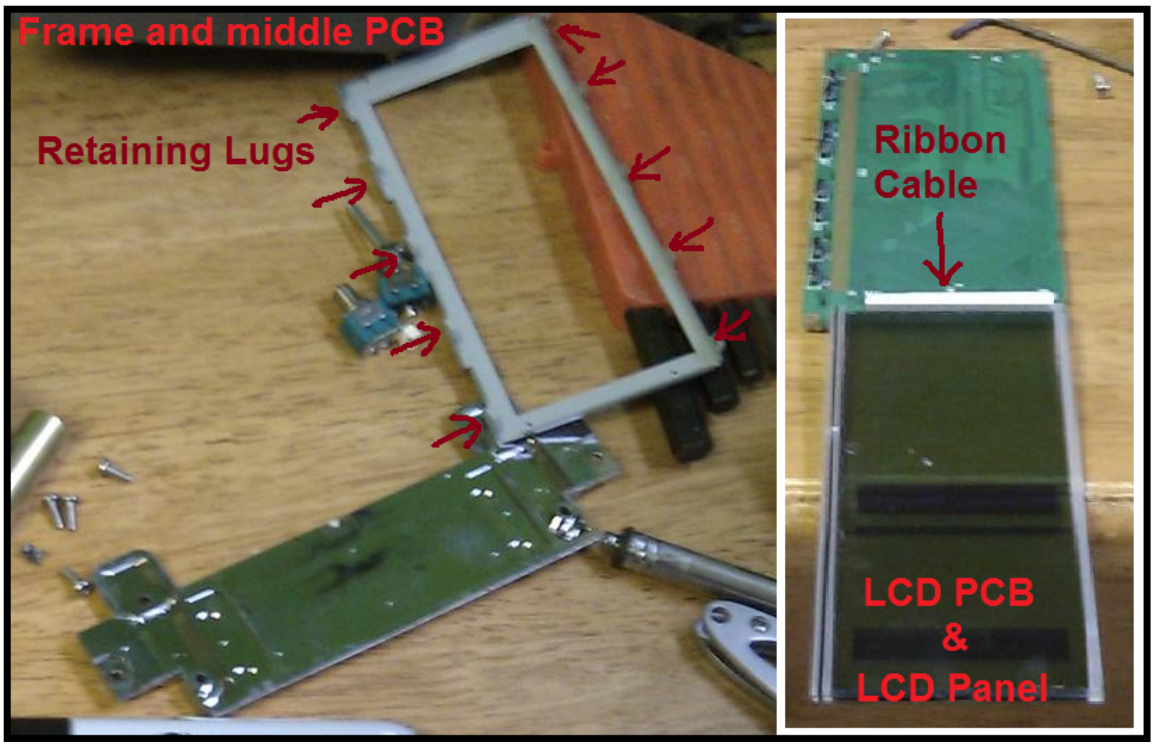


Figure 29 Complete disassembly of middle PCB and LCD Panel

3.10. Transmitter battery pack

Note: *The inclusion of a diode within the pack limits your safe charging rate to 300mA without a special diode 'jumper' and prevents your digital charger from sensing battery voltage or cycling the pack. It is recommended that you make a simple diode "jumper" and upgrade your pack using the instructions in Section 4.7.*

The 9Z's transmitter battery pack is somewhat different from the usual transmitter packs you can buy readily from the internet or your local model shop. It is a cartridge style pack with an in-built PCB and 0.1" single row receptacle connector (PCB header style) that connects to the transmitter. This has allowed Futaba to sell replacement packs at a ridiculously high cost as, in bulk, the unit must cost very little to make. Despite its

oddities, under the skin it is almost exactly the same as any other transmitter pack. So before spending serious cash replacing it, why not just service it?

The battery cartridge is very simple and consists of only 4 components:

1. The battery cartridge case top (Part No. 1M10E17801 “UPPER CASE NT-8A”)
2. The battery cartridge case bottom (Part No. 1M10E17901 “BOTTOM CASE NT-8A”)
3. The battery (a standard transmitter pack)
4. The mini-PCB (Part no. T56800 “PCB 9V T982 BATT ASSY”, which is very simple and has 1 x 400mA Schottky diode, 1 x 0.1” receptacle and 1 x standard charge socket)

There are two common things that happen with 9Z battery packs that require servicing:

1. The NiCad battery becomes exhausted and needs to be replaced.
2. Fast charging above 400mA blows the diode and the battery will not charge through the main charge socket (there will usually be some melting of the case at its end). Figure 30 shows a blown diode on the battery’s mini-PCB.

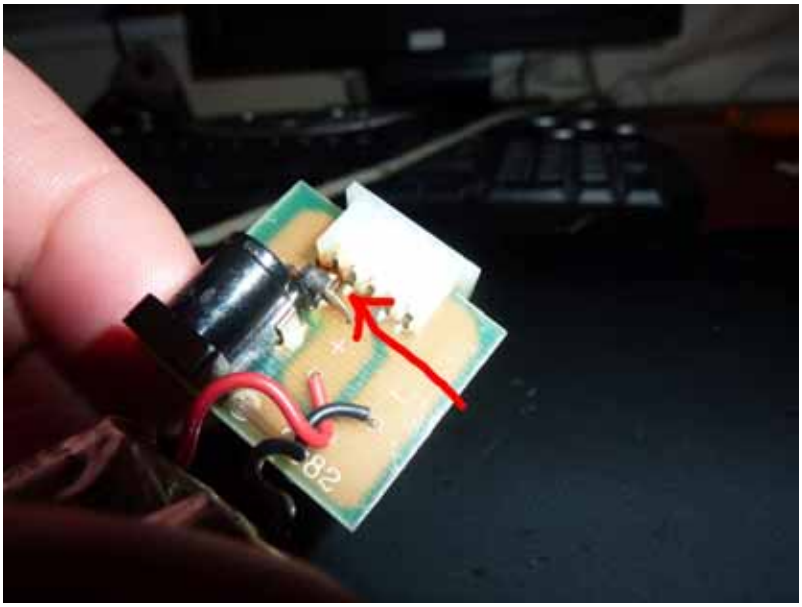


Figure 30 Blown Schottky Diode on Mini PCB

To replace the NiCad battery the operation is simple, although I’d recommend you replace it with a higher capacity Nimh pack and preferably with your own DIY pack made from Sanyo Eneloop batteries (the only currently available low self discharge batteries that live up to their promised performance). Do not bother with Lipos, you get very little increased performance over Eneloops and you will not be able to do a like for like replacement. To replace the battery follow the procedure below and refer to Section 4.7 for additional recommendations:

1. Open up the battery case by unscrewing the retaining screws.
2. Either purchase a standard battery pack or make one up from Eneloops
3. Slide out the mini-PCB and old battery pack
4. Desolder the old battery pack

5. Solder in the new battery pack
6. Reassemble

You can test for a blown diode on the mini-PCB during the above operation just use the diode test facility on your multimeter to make sure it passes current in only one direction. However, as the stock diode is only 400mA and far too small for bullet proof charging using modern equipment, it is suggested that even if the diode is functional you should replace it by upgrading to a larger 3A version (see Section 4.7 for the procedure).

3.11. RF Module

The RF Module in the 9Zap is a TK variant, rather than the TP variant used in 8u's and 9c's. Although there are some posts on the internet suggesting otherwise (some even from Futaba), to all intents and purposes these seem to be interchangeable for PPM operation and a Futaba agent even confirms this in one positing. Certainly, I have used both TK and TP variants in my 8u's, 9c's, 9VAP and 9ZAP without issues for PPM operation. So whilst I'm not 100% certain, you can probably swap any one with any other without issues as long as you're using PPM. For PCM operation, you should probably stick with the appropriate module for the transmitter.

One of the main issues with both TK and TP modules (and with aftermarket 2.4GHz conversions), is the sudden loss of the 'On Air' LCD message and associated alarm light. Futaba modules use the RF Pin-out shown in Figure 31 which is more fully described in APPENDIX B.

Figure 31 Futaba RF Module Pin-out Numbering

Pin number 3 is the RF Output Indicator. This pulls to ground (Pin number 4) when RF is detected. Connecting these two pins together tells the radio it is transmitting and causes it to show the "On Air" LCD message and associated alarm light.

Figure 32 Weak solder joint in RF Module

There is a weakness in the TP and TK models related to their internal metal shielding. The socket for Pin 4 (ground) is directly soldered onto this metal shielding and this connection is structurally weak (see Figure 32). When it breaks, the “On Air” message and alarm will fail to be displayed. The solution is simple:

1. Undo the 2 retaining screws on the module’s case
2. Slide the bottom part of the case upwards to release it from its retaining clips and then lift it off
3. You’ll now see the metal shielding case around the PCB. Locate the RF Pin-out socket (Top end on the back of the module).
4. Locate Pin 4 and see if it is still connected to the metal shielding. Wiggle the shielding a little to check for a broken connection.
5. Resolder the connection if necessary

If you are using an aftermarket replacement and you want to have the “On Air” message and alarm, you can attempt to reproduce this same behavior by directly connecting Pin 3 and Pin 4.

3.12. Hard Resetting the 9Z Back to Factory Settings

Note: *I have not tested this procedure myself, but there is a lot of information on the internet suggesting that the following will hard reset a 9Z. You will need to access the Futaba Service Menu which requires a Service Menu Enabler (see Section 6)*

Whilst removing the back-up battery in a 9Z will hard reset the transmitter, there is an easier way to return your set to factory defaults without disassembling it. This involves shorting two contacts beneath the battery compartment for several seconds. After any hard reset you need to recalibrate your set. The following procedure will hard reset your 9Z:

1. Disassemble the 9Z's case to Stage 1 as described in Section 5 (Disassembling and Reassembling the 9Z's Case).
2. Open the now empty battery compartment and locate the two access holes shown in Figure 33.
3. Beneath these access holes are 2 solder pads that need to be shorted for several seconds to hard reset the transmitter (e.g. connected together with a jumper through the access holes).
4. Reassemble the transmitter and turn on to check that a hard reset has been performed.
5. Fit the Service Menu Enabler, turn on the transmitter and access the Service and Test Menu (Section 6.2)
6. Recalibrate and test everything using the Service and Test Menu as described in Section 6.
7. Turn off and remove the Service Menu Enabler.

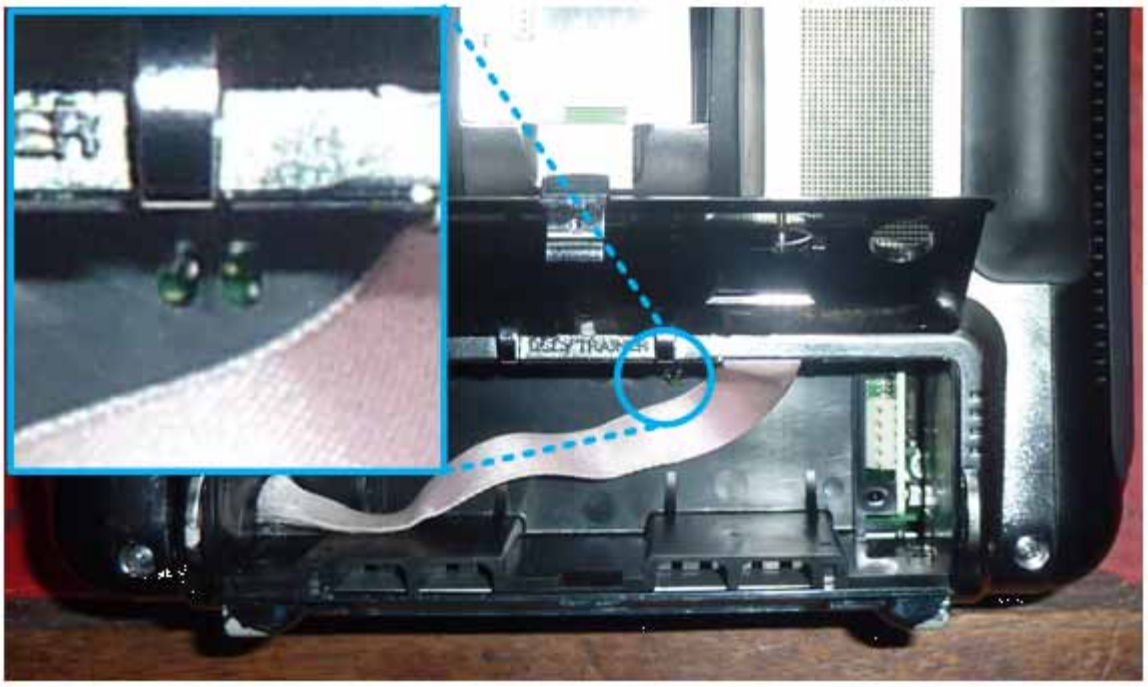


Figure 33 Access holes for hard resetting a 9Z

4. UPGRADING AND TAILORING THE 9Z

4.1. Adding extra 3 position switches

You can upgrade your 9ZAP WC2 into a hybrid 9ZAP/ZHP for glider or helicopter flying by changing the existing 2 position Switch E into a 3 position switch. Equally well you can add extra 3 position switches to a 9ZAP or 9ZAP WC1 and upgrade it to WC2 status. In fact the options are endless; with any 9ZAP you can change and arrange 3 position, 2 position or Momentary (hold for on) switches to suit your flying style. You will however need to gain access to the Service and Test Menu so first refer to Section 6.

To upgrade or change a switch type follow the procedure below:

1. For corner switches replace as detailed in Section 3.3
2. For front face or top face switches disassemble and gain access for replacement as detailed in Section 3.4 and then refer to Section 3.3 for the actual switch replacement process
3. After reassembly enter the Service and Test Menu as detailed in Section 6.2
4. Go to the Switch Settings screen and make the changes to reflect your choice of switches (see Section 6.3)
5. Test the switches using the test menu (see Section 6.4)

4.2. Tailoring the Reference Plane of Joysticks

Not only can you tailor the length and angle of the joysticks, but you can also tailor their reference plane (see Figure 34). This can be very useful in setting up the right ergonomics on the set as our thumb joints do not operate on an X/Y plane with 0 degrees of rotational offset when we hold transmitters. I find getting this rotational offset right to be of most benefit when I'm flying 3D Helicopter manoeuvres; everything seems to come together more tightly and more easily.

Figure 34 Changing the Rotational Position of Joysticks

The procedure for changing the reference plane of the joystick is simple and does not require you to open the set:

1. Loosen the 4 Allen key screws around the joystick you wish to alter.
2. Rotate the joystick to the correct plane.
3. Retighten the screws.

4.3. Strengthening and Repairing the Joysticks

The "official" Futaba 9Z joystick and gimbal assemblies are ridiculously expensive (e.g. £150++), but damage can often be repaired permanently and easily if caught early. However, if you leave a crack to develop, it will progress until it meets the joystick or gimbal axis and you may be replacing the entire joystick assembly at significant cost. Always inspect a crack and if you can replace or repair the parts.

Joysticks sometimes crack at the base, either through fatigue or from mechanical damage (i.e. being dropped). When a crack occurs this almost always introduces significant play into the control and for safety reasons the joystick must be repaired or replaced before the set is used again (see Figure 35). As an older set, the 9Z appears to be particularly susceptible to this sort of damage through fatigue. As fatigue damage occurs spontaneously, you should periodically inspect your joysticks for cracks.

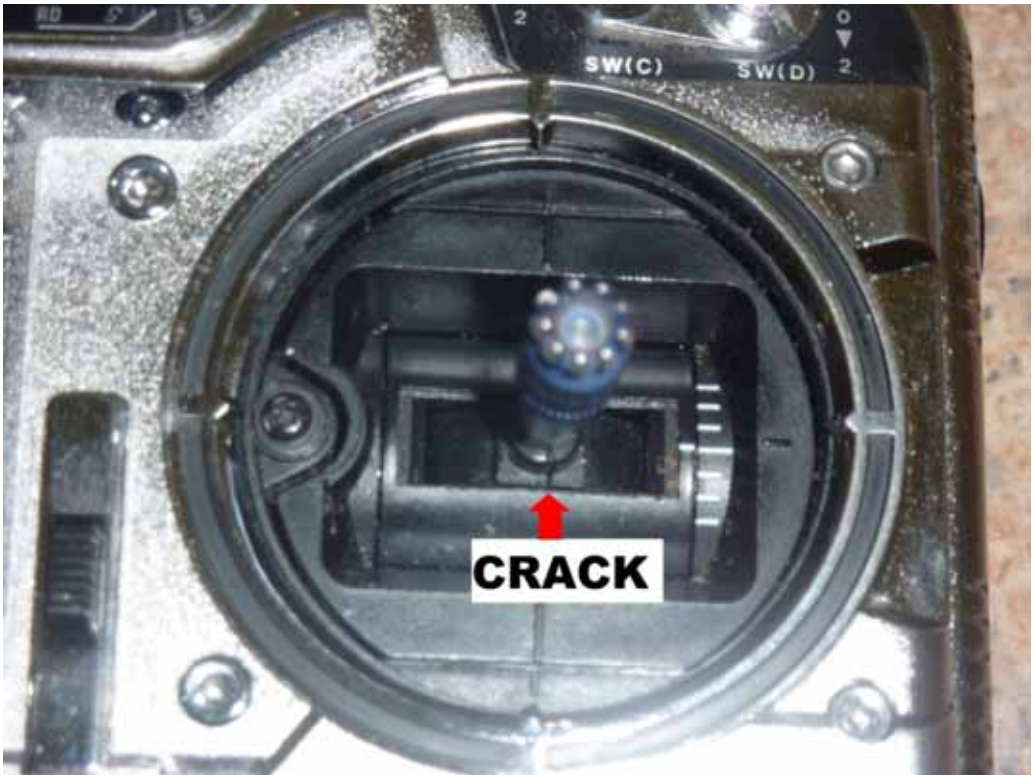


Figure 35 Crack in the base of a 9Z joystick adding significant play to the control

For this type of crack, you can cheaply replace the stick and base with a new part (see the procedure in Section 3.4.2). However, one simple way of preventing or repairing stick cracks is to add a collet to the joystick (see Figure 36). If you fly aggressive aerobatics which cause you to really bang the sticks of your 9Z from corner to corner, I'd

suggest you fit collets to your joysticks regardless of whether you have a current crack – they will really help prevent one occurring. If you do fit a collet, for whatever reason, remember to continue to periodically check for play in the joystick as the collet will "hide" any future damage from view.

Figure 36 Metal joystick strengthening collet

A simple collet can be made from stainless steel or brass tube and glued into place using epoxy. Stainless steel is preferable due to its higher strength, but is harder to obtain. Never be tempted to use aluminium tube as it is not strong enough and will snap during use. To manufacture the collet, simply measure the outside diameter of the joystick's plastic base and purchase a tube that will ensure a very tight fit. Slice a "collet" from the end of the tube, remove the joystick's metal stick heads and slip it on before gluing into place (see Figure 37).

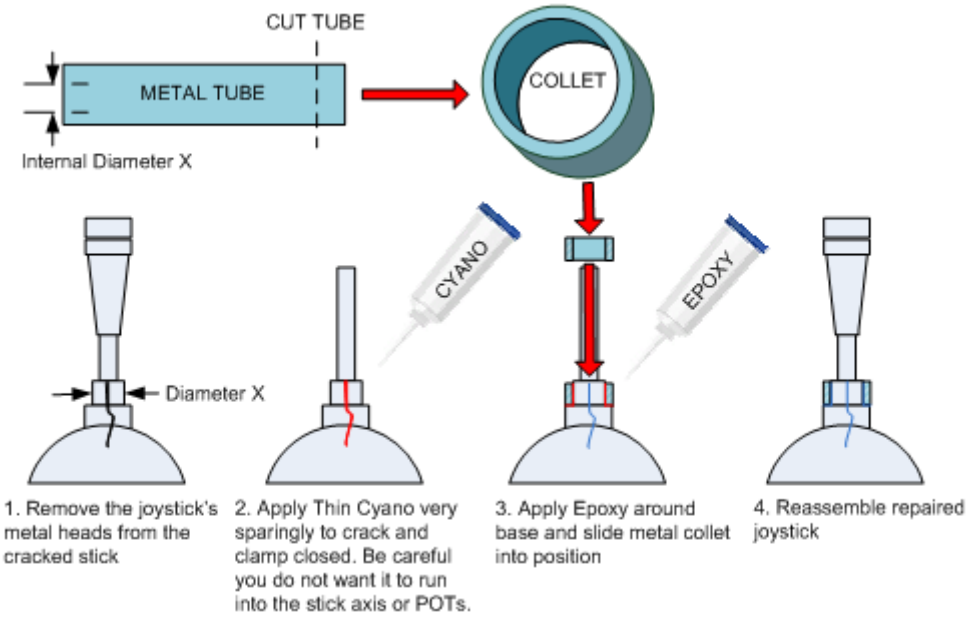


Figure 37 How to repair a cracked joystick with a collet

4.4. Backlit LCD Display

Note: *I have not directly tested the below procedure. It is sourced from third party information.*

A word of warning about backlighting your 9ZAP, there is very little space available and LED backlights do not produce a satisfactory effect. This means that EL Panels are the way to go (see Figure 38). An 'EL Panel' is an electroluminescent 'card-like' panel that glows when the right voltage/current is passed through it. It can be bought in several colours and can be cut to size with scissors. However, EL Panels require the use of an inverter to deliver the correct voltage to light the panel. Inverters are noisy, both audibly and electronically. Personally, I would not have one anywhere near a transmitter operating on 35MHz and I'd think very hard about putting one in a 2.4GHz set. As a result, I have thought hard and I won't be doing it, even though it looks cool! You need to come to your own conclusions.

Figure 38 A Backlit 9Z using the 'EL Panel' solution

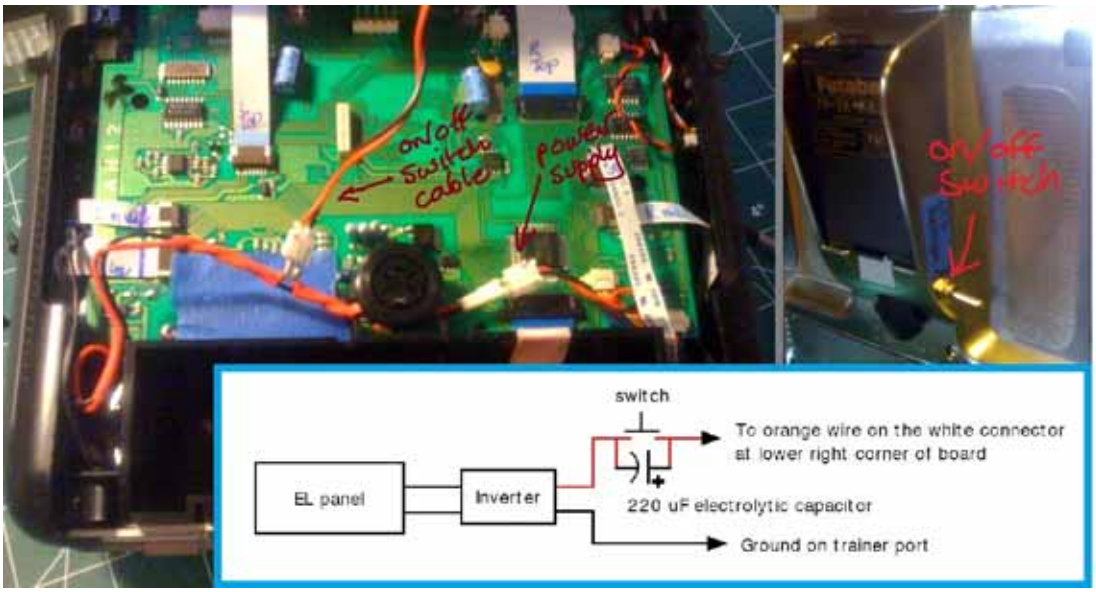
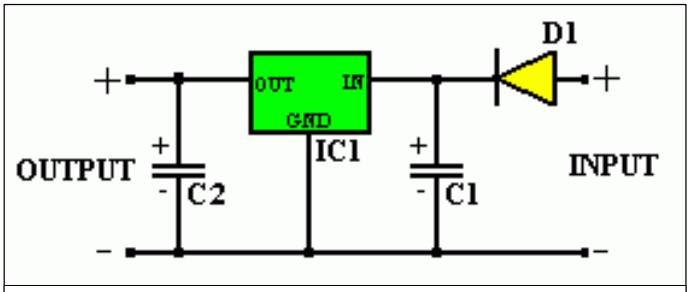


Figure 39 Wiring in the EL Panel, voltage regulator and switch

You will need to source and purchase a suitable inverter and an EL Panel. Also you will need to have a switch for turning the backlight on and off – think where you want to site this (see Figure 39). Another thing you need to think about is powering the backlight.

There are a lot of posts about connecting it to the Trainer Port voltage pins, but personally I'd move it further away from the guts of my transmitter and draw power straight from the transmitter battery port. Remember your transmitter pack runs at 9.6v and so you'll also probably need a voltage regulator to supply the standard 5v inverter. There are lots of options for a voltage regulator, personally I'd find out the current drawn by the inverter and use something like the circuit in Figure 40 as it's small, cheap (~£3) and easy to create. Another option is to use a standard ESC and connect to the RX wire.



- IC1 = 78L05 / 7805 (5v Voltage Regulator)
- D1 = 1N4007
- C1 = 100uF
- C2 = 10uF

Figure 40 Example Voltage Regulator (Check current handling capacity of 78L05)

Once you have your EL Panel, regulator and inverter you can access the LCD like this:

1. Follow the procedure in Section 3.9 to remove and disassemble the LCD Assembly, but do not disconnect the short ribbon cable from the LCD. You do not need to remove the component LCD panel to complete this procedure.
2. Carefully remove the silver backing foil from the LCD. Do not use a blade as this will scratch the LCD.
3. Once the foil is removed use your finger to carefully rub off all the adhesive film that still remains on the LCD. If this is left in place it will be very visible!
4. Clean the LCD with a soft cloth
5. Cut down and attach the EL Panel in place of the silver foil you removed
6. Reassemble the LCD Assembly being careful to ensure a good contact between LCD and PCB contacts (Lines will appear on your LCD if a bad contact is made)
7. Partially reassemble the transmitter, connect the EL Panel and test (see Figure 39).
8. Locate the position you want to have your backlight switch and fit it (see Figure 39).
9. Fully reassemble the transmitter.

4.5. 9Z Mode and Version Change (e.g. ZAP to ZHP)

Note: *I have not personally tested this procedure and, considering the damage that could be done if an error was made, I would attempt it lightly.*

The 9Z can have its stick mode and default version (helicopter or aircraft) changed through the modification of a resistor on the main PCB (see Figure 41). However, an

effective stick mode change can be achieved through the 9Z's software as the controls are fully assignable.

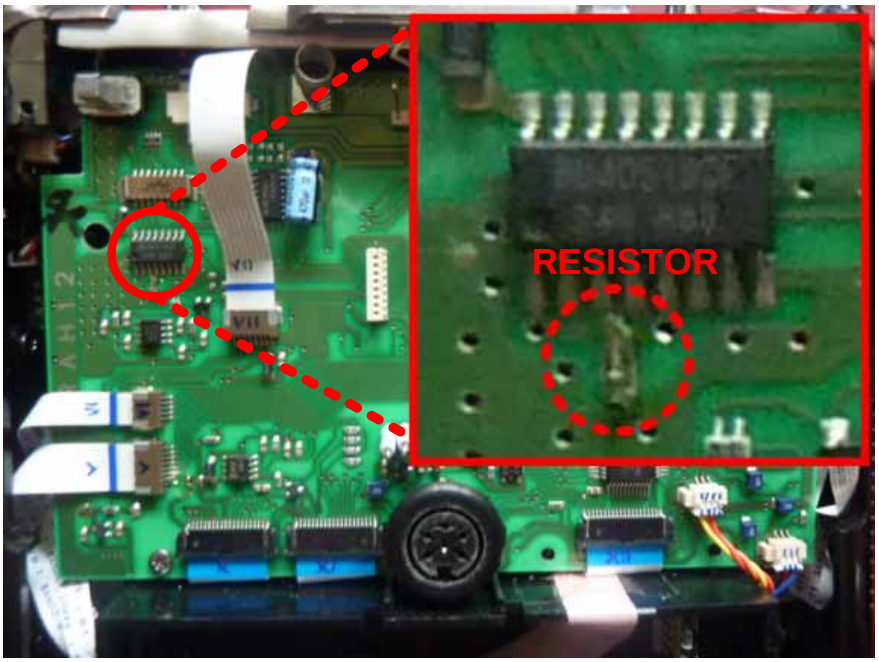


Figure 41 Resistor or short for Mode/Version change

The resistor in Figure 41 can be changed as below to ensure the transmitter defaults to correct version and stick mode:

1. No Resistor (open circuit), results in stick mode 1, T9ZHP (helicopter)
2. 68K Resistor (labelled 683), results in stick mode 2, T9ZHP (helicopter)
3. 18K Resistor (labelled 183), results in stick mode 1, T9ZAP (air)
4. Short (labelled 000), results in stick mode 2, T9ZAP (air)

A complete hardware reset is required to effect the change (see Section 3.12) and, in addition, you will need to swap the ratchet and restrictors on the throttle stick if changing mode (see Section 3.4 "Front face controls, gimbals, and POTs"). The restrictors limit the travel of the throttle stick and therefore, you must remember to swap these over. Whilst it is possible to add "Snap Roll" switches to the back of a 9ZHP to effect a full hardware conversion to 9ZAP, this is complex and beyond the scope of this manual. However, a simple solution exists. It is suggested that you refer to the 9Z operation manual and emulate this behavior using the 9Z software mixes and the existing 9Z toggle switches.

4.6. Upgrading to 2.4GHz and Telemetry

There are many different aftermarket solutions for upgrading your 9Z to 2.4GHz and telemetry. The most important thing when choosing your 2.4GHz upgrade is the price of the associated receiver. You'll only need one 2.4GHz transmitter module, but you'll be buying that make of 2.4GHz receiver again and again (there is no real compatibility between manufacturers), so you want the receivers to be as inexpensive as possible. I have always bought Futaba (£60 a receiver) and I used to be very nervous about the "Chinese" 2.4GHz offerings (£5-£15 a receiver). Now I would never recommend paying

Futaba or Spektrum prices as I have used a “Chinese” 2.4GHz module for the last five years without a single glitch and in at least one instance it has performed far better than my Futaba equipment. I would never go back to the silly prices of Futaba or Spektrum and my equipment has now been sold. The “Chinese” 2.4GHz upgrades that I would recommend are shown in Table 3. These recommendations may not be the best that’s out there, but I (or modellers I personally know) can vouch for each model in the table.

Manufacturer	Model	Compatibility	Details	Recommendation
FrSky	DHT-U	Compatible	I have this system fitted and have never had any issues or glitching with my 9Z WC2. Range and features are excellent.	1st Choice
Corona	CT8F (V2 DSSS)	Partial	I have this system fitted and have never had any issues or glitching with my 9Z WC2. However, others have found it not to work well (or at all) with a 9Z.	= 2nd Choice
Assan	X8	Compatible	This system reputedly works well with the 9Z.	= 2nd Choice
FrSky	V8FT	Partial	Servo glitching has been experienced by a significant but limited number of users	Not recommended

Table 3 Upgrading to 2.4GHz - Compatibility & Recommendations

Personally, if you don’t mind some very simple DIY, I would not bother with any 2.4GHz set than the FrSky DHT-U. You get full telemetry, an open-source system that others design against, free software upgrades and flawless operation. At the date of writing, FrSky “Email” support has also been excellent – although if you want any other support, then forget it.

For “plug-and-play” simplicity, choose Corona or Assan. Although I really rate the Corona set (which I have used for the last 5 years), others have had issues with the 9Z. As a result, think about the Assan offering which most people like with the 9Z.

4.6.1. IMPORTANT: Antenna positioning for maximum range

In the good old days AM and FM sets needed big long aerials to achieve the maximum range. As a result aerials were placed at the top of transmitters, sticking straight out where they would be kept out of the way.

Actually, in most cases maximum range for RC flying is achieved with an aerial horizontal to the ground. This is because the radiation distribution is not uniform, but instead is shaped like a “donut”. Think of your antenna being slipped into the hole in this “donut” and that’s exactly the pattern you get. This means a horizontal antenna is best for most RC flying purposes (see Figure 42), but this was never practical with the old AM/FM sets – but now with short 2.4GHz antennas it is! The trouble is that most flyers have now been conditioned into thinking “antennas stick up” and so I’ve lost count of the

number of times I've seen short 2.4GHz aerials in the wrong position and sticking straight up.

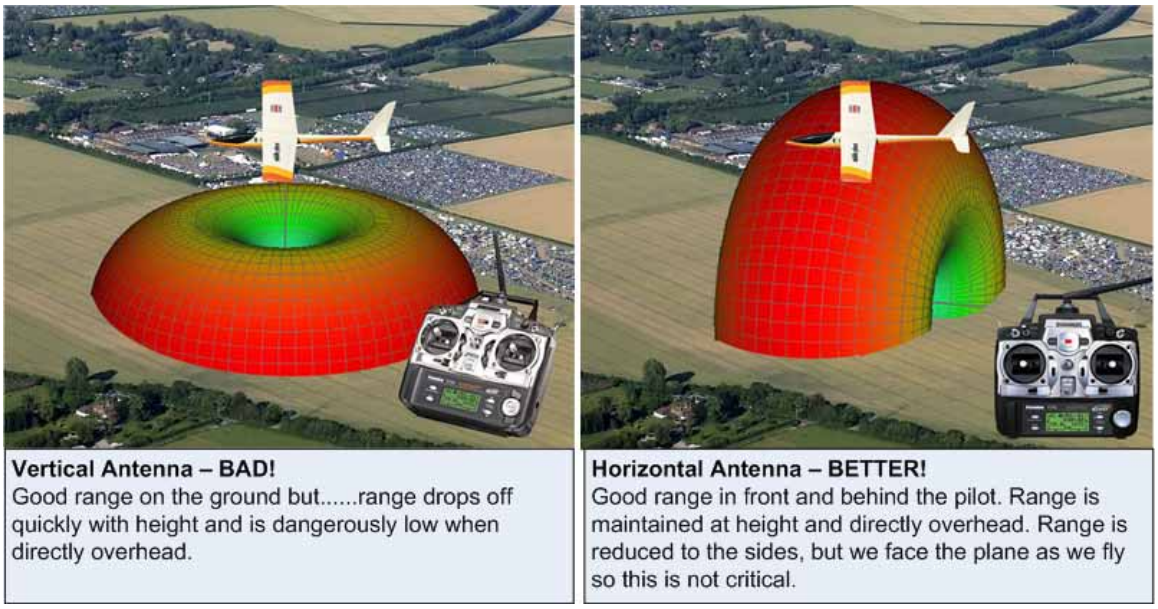


Figure 42 Optimal antenna position for 2.4 GHz

There are a few upgrade modules on the market which position the aerial on the top of the transmitter without the ability to change its angle to the horizontal. These are setups to avoid when selecting your 2.4GHz upgrade. There are some range advantages in 2.4GHz from having the antenna positioned at the top of the transmitter (rather than the back) and the corresponding "line of sight" connection to your receiver. However, these advantages are insignificant when compared to the disadvantages of having a vertical antenna. In other words, never select a 2.4GHz system that cannot have its antenna positioned horizontally just because it locates the antenna at the top of the transmitter.

4.6.2. Upgrading to 2.4GHz using the FrSky DHT-U

Recommended Option: *This is my setup and it has performed flawlessly. It is slightly more difficult to fit than other options, but the functions, cost and performance easily make up for this.*

My recommendation would be to use the popular FrSky DHT-U if you wish to upgrade to 2.4GHz. The DHT-U is a hack module that can be wired into your trainer/DSC port or RF module pin-out. Although the DHT-U comes with everything you need to connect it to the 9Z transmitter at the RF Module port, the proposed solution by FrSky is visually messy and spoils what is otherwise an excellent 2.4GHz solution. As supplied the DHT-U has individual connectors to attach to three of the pins on the Futaba RF Module Pin-out instead of encapsulating the connectors in a separate RF Module case to plug into the back of your 9Z.

Figure 43 The DHT-U upgrade with connections through DIY RF Module

Although you can hack the connectors of the DHT-U and connect to the DSC port, for reasons of robustness I prefer using the RF module port (as that is what it was designed to do!). This also gives you the benefit of your transmitter still displaying the “On Air” message and warning light. So if you want to retro fit an RF module case and have a tidy and professional looking solution then try the approach below and refer to Figure 44 and Figure 44:

1. Purchase a FrSky Futaba compatible RF module case, they’re about £3.
2. You can purchase special 0.1” extended PCB headers for the connectors, but these are difficult to come by, so you can also use a standard 5 pin x 2 rows 0.1” IDC Socket from a PC. These can be purchased just about anywhere and the double row allows you to get better adhesion when you stick it to the module case.
3. Purchase a 3 pin single row shielded 0.1” header and receptacle, or any other small 3 pin plug and socket.
4. Purchase a small vector or PCB board.
5. Glue the 5 pin IDC socket to the bottom of the RF module case, first aligning it so it will accept the 5 RF module pins from the transmitter when it’s pushed into place.

6. Once glued and you're sure it is aligned correctly, use 'bridging compound' (a chopped glass fibre compound for automotive repair) to surround it and fully secure it into place.
7. Connect the IDC socket pins together that relate to RF Module pin-out pins 3 and 4 (see APPENDIX B)
8. Cut a small hole in the top half of the RF module case to accept the 3 pin header and receptacle you purchased (see Figure 43). Ensure that the PCB board with the 'header' part fitted will fit easily below this hole.
9. Site the 3 Pin 'header' portion on the PCB and temporarily solder into position.
10. Connect up the appropriate pins on the IDC socket to those on the 3 pin header and once complete, glue the PCB with the header on it into position.
11. Assemble the RF Module and test the fit in the back of the 9Z's case.
12. Fit the 3 pin 'receptacle' onto the correct lines of the DHT-U.
13. Recheck everything, connect and power up.

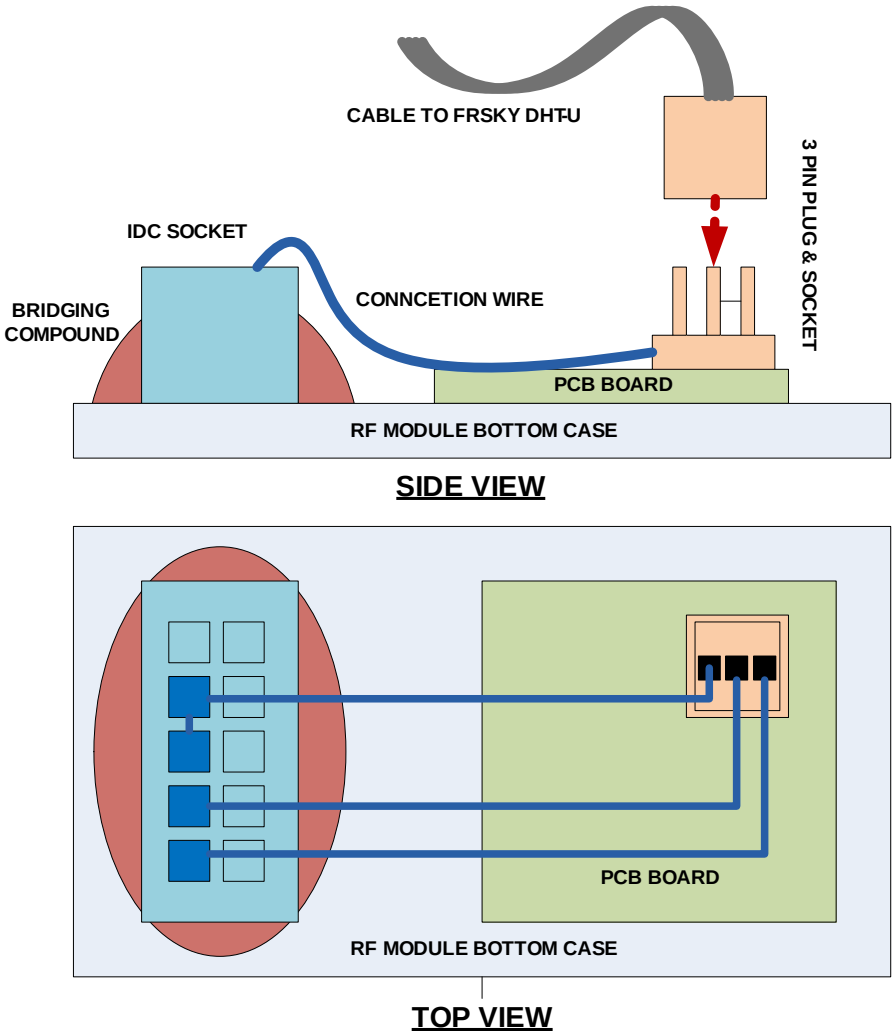


Figure 44 Modified RF Module for an FrSky DHT-U

4.6.3. Upgrading to 2.4GHz using the Spektrum DM8 module

This is a popular upgrade to make use of the DSM plug-and-play models currently available on the market. However, I personally think there are serious design flaws in this module, it is overpriced and there are DSM compatible Chinese modules out there at a fraction of the cost. That said, I'm probably prejudiced as there are 1000s of happy Spektrum customers and I have never owned or operated a Spektrum setup.

The module is relatively simple to set up (see Figure 45), but not as simple as those 2.4Ghz conversions that place the antenna at the back of the transmitter on the module. A lot of people choose this setup because it locates the antenna "where an aerial should be" straight up on the top of the set. Whilst this is aesthetically pleasing, it is not a great position for achieving maximum range when flying if the antenna cannot be positioned horizontally (see Figure 42 and Section 4.6.1). This was certainly the case with early Spektrum modules and it is something to check on in the later versions. My advice: if you can't rotate the antenna to the horizontal then play it safe and go for another setup.

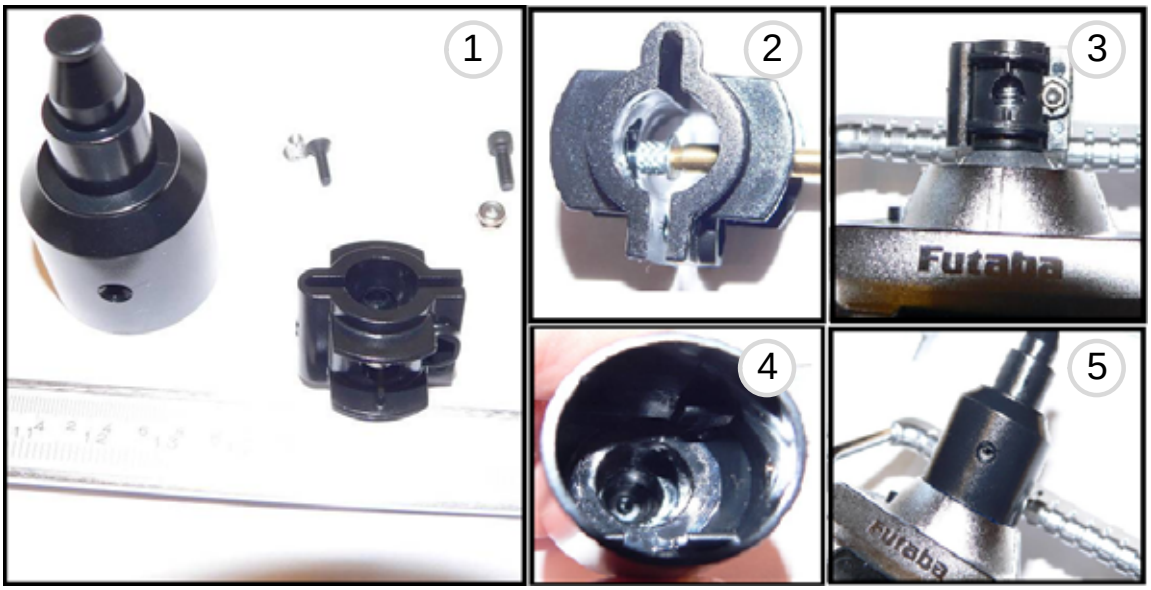


Figure 45 Fitting a Spektrum DSM module antenna

Another reason why I do not like this setup is the design of the antenna wire connection to the module. This connection is exposed and sticks out from the back of the transmitter. As a result the connection can be very easily damaged, especially if the set is knocked over as it extends far enough to hold the set off the ground when the 9Z is laid on its back (see Figure 46). This is dangerous as a model could well be lost as a result of a loose connection caused by such damage.

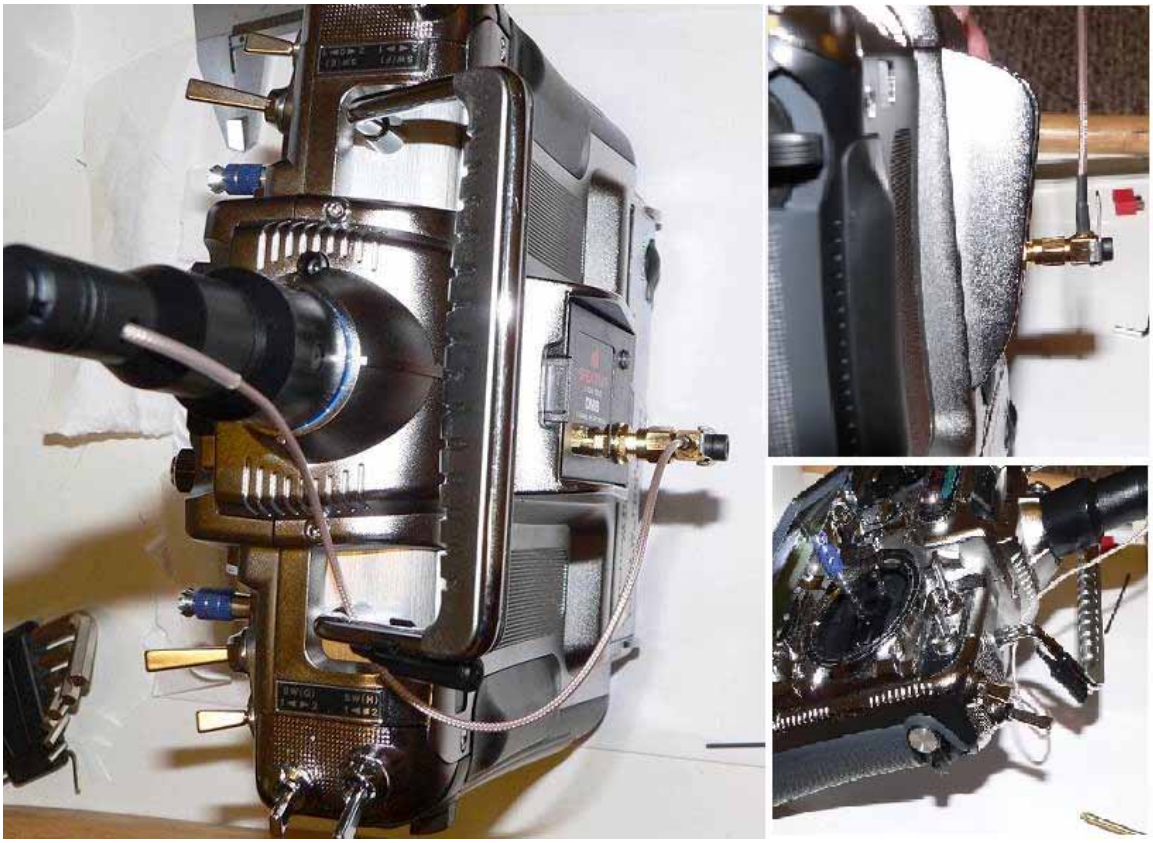


Figure 46 Poor design of the connection on Spektrum DSM module

4.7. Cycling and Fast Charging the Transmitter Battery Pack

The 9Z transmitter battery cartridge contains a diode to provide reverse polarity protection for your transmitter. This is very unusual as these diodes are usually placed within the transmitter, not the battery pack. As a result, it is not possible to cycle the pack without ‘jumping’ this diode. Further, most modern chargers ‘sense’ the amount of charge to put into a battery through monitoring its voltage during charging. With this diode in the charge loop this is not possible, and so most modern chargers will ‘error out’ using this pack. Finally, if you’re unlucky enough to have a charger that does work with the 9Z’s pack and you decide to charge at above 300mA, the result will be some melted plastic and a non-functional pack, because the 9Z’s diode is only rated to 400mA (i.e. about 1/2C of the original pack or 1/5C of a modern pack).

For all these reasons it’s a very good idea to upgrade the 9Z’s battery pack with a bigger diode and build you a simple diode jumper. The total cost will be about £2. If you always use the jumper for fast charging, the larger diode is not really needed. However, most policemen would tell you that if they were faced with a gun they’d hands-down prefer a “bullet proof vest” over “an almost bullet proof vest” for protection and I’d urge you to feel the same way about the 9Z’s pack.

You can construct a simple diode jumper from 0.1” PCB header (cut to length) for the 9Z’s transmitter pack as shown in Figure 47. This is slotted into the five pin port on the back of the transmitters battery pack during charging and shorts out the internal diode.

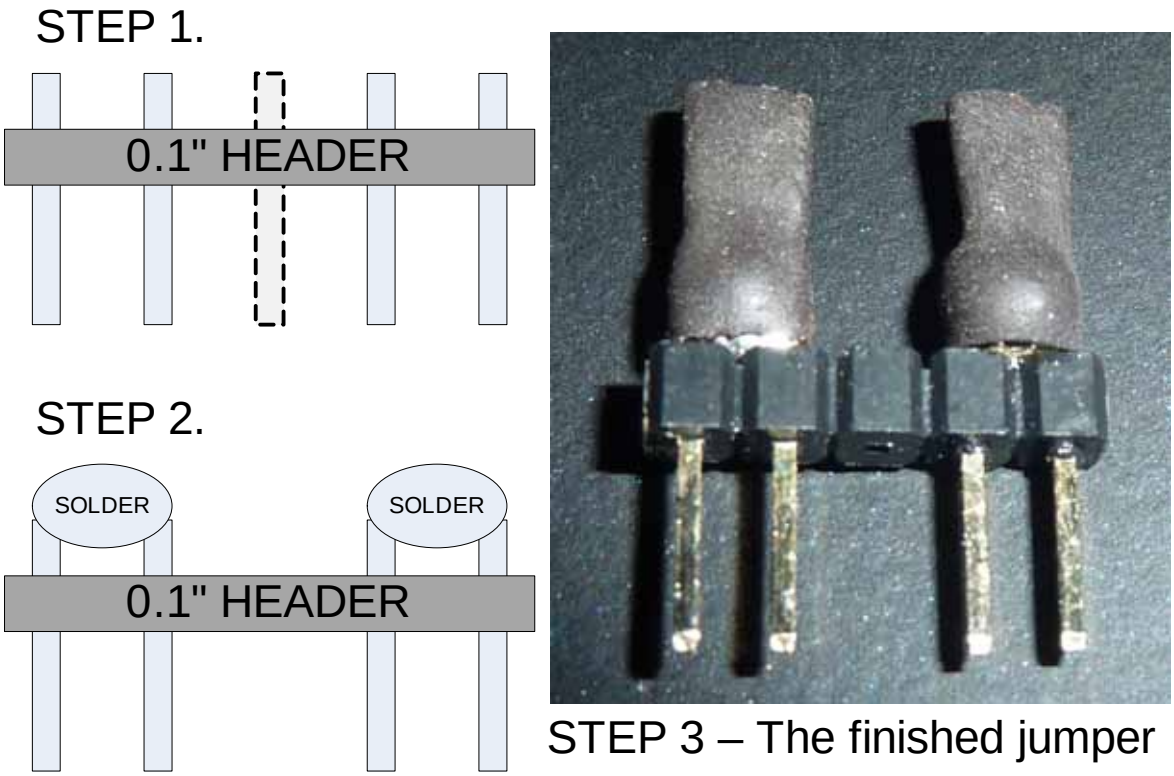


Figure 47 The 9Z transmitter pack diode jumper

To upgrade the original battery cartridge's 400mA diode to a more bullet proof version follow the procedure below:

1. Purchase a 3Amp Schottky diode rated at 20V or higher
2. Open up the battery case by unscrewing the retaining screws.
3. Slide out the mini-PCB and old battery pack (see Figure 48)
4. On the mini-PCB locate and note the direction of the existing 400mA diode (see Figure 49)
5. Desolder the existing 400mA diode and note the 'diode symbol' on the PCB showing the correct orientation for the new diode.
6. Solder in the new diode, protecting its exposed 'legs' with heat shrink or tape (see Figure 50).
7. Reassemble

Figure 48 9Z Transmitter Battery Disassembly

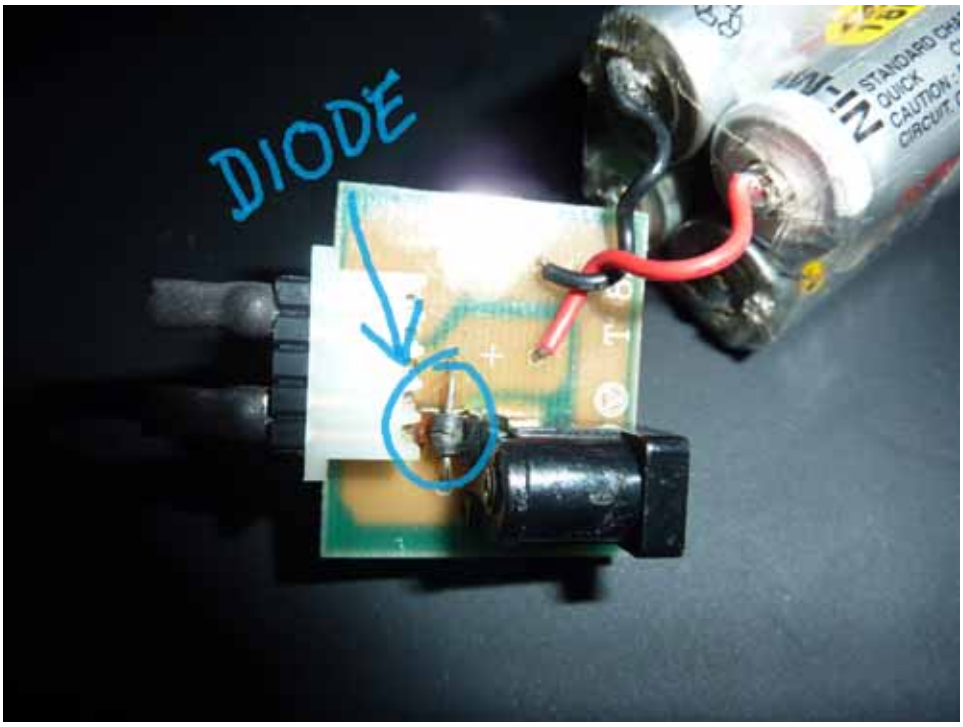


Figure 49 400mA diode on the mini PCB

Figure 50 New 3A diode soldered to PCB (Note: Silver line on diode indicating orientation)

4.8. Building a DSC Cable for Direct Servo Control

A DSC cable will allow you to control servos directly if you are using a PCM receiver, and with any receiver you will be able to read the receiver battery voltage directly on the 9Z's LCD display, this can be very useful!

First, you should refer to APPENDIX B for information on the Pin-out numbering. Then, to make your own DSC connector cable, you need to:

1. Purchase a standard 6 PIN DIN connector for plugging into the transmitter (available through audio or electronic component suppliers)
2. Purchase a servo connector for plugging into the receiver.
3. Connect the DSC control line (servo white wire) to the signal output line of the transmitter (DIN Pin 2).
4. Connect the receiver ground (servo black wire) to the ground of the transmitter (DIN Pin 0).
5. Connect the receiver voltage (servo red wire) to the +5v Input of the transmitter (DIN Pin 6).
6. Last, you need to jumper the transmitter battery to the switched power circuit. (DIN Pin 4 to DIN Pin 5).

4.9. DIY CAMPAC's and "backing up" model memory to a PC

CAMPACs allow you to add additional model memory to your 9Z. The original Futaba CAMPACs are insanely expensive so there are a number of CAMPAC clones that have sprung up. You can either make one yourself or buy one from an aftermarket supplier.

CAMPACs come in different sizes – 16K, 64K, 128K and 256K. Unfortunately only 64K and larger CAMPACs will work with the 9Z. This is annoying as the only simple-to-make

CAMPAC clone on the market is limited to 16K due to Futaba's enhanced protocol for accessing the larger CAMPACs. Therefore, if you are going to build your own CAMPAC for the Futaba 9Z you'll need a PIC programmer (~£9 for a Chinese clone). Actually programming the PIC chip and making up the circuit is simple, but the cost of the programmer normally means it is not worth it unless you are going to programme other projects.

Table 4 below shows a list of CAMPAC clones and tools, simply plug their names into google to get to the authors pages. Of particular interest is Toolpac – this is not a CAMPAC, it allows you to read and backup CAMPAC memory on your PC. I've built one of these and it really is a nice piece of kit.

Name	Description	Cost
Clonepac	16K simple CAMPAC. No PIC programmer needed. Quick and easy to make up, but not compatible with the 9Z series of transmitters.	Free – just search the web to find the circuit schematic. The author's website is no longer available.
Mempak	64K CAMPAC. PIC programmer is required to load the provided code onto the PIC chip in the circuit. Compatible with the 9Z.	Free – download circuit schematic and PIC code from author's website
CampacSL	64K CAMPAC. PIC programmer is required to load the provided code onto the PIC chip in the circuit. Compatible with the 9Z.	Free – download circuit schematic and PIC code from author's website
Ultrapac	64K to 256K CAMPAC with "menu enabler" (see APPENDIX A for a DIY version). This is the no hassle option if you do not wish to build one yourself. Compatible with the 9Z.	See manufacturers website for current pricing.
ToolPac	Excellent piece of kit that allows you to read the contents of your CAMPAC. Simple and very cheap to make and does not require a PIC programmer. It uses the parallel or serial port interface (there are circuits on the web for both). However, a cheap USB port emulator can be bought from ebay to simulate this old-school technology.	Free - download circuit schematic from author's website

Table 4 Available DIY CAMPAC clones

4.10. Building a Training Cable for Buddy Boxing

A training cable or buddy box lead will allow you to buddy box two Futaba transmitters for training purposes. Some transmitters work well together and some do not, check out compatibility for the models you are using.

First, you should refer to APPENDIX B for information on the Pin-out numbering. Then, to make your own Training cable, you need to:

1. Buy two standard 6 Pin Dins from an audio or electronic component supplier (we'll call these DIN-A and DIN-B).

2. Connect both 0 Pins (Shields) of DIN-A and DIN-B together.
3. Connect both 1 Pins (+V) of DIN-A and DIN-B together.
4. Connect Pin 3 of DIN-A to Pin 2 of DIN-B.
5. Connect Pin 2 of DIN-A to Pin 3 of DIN-B.

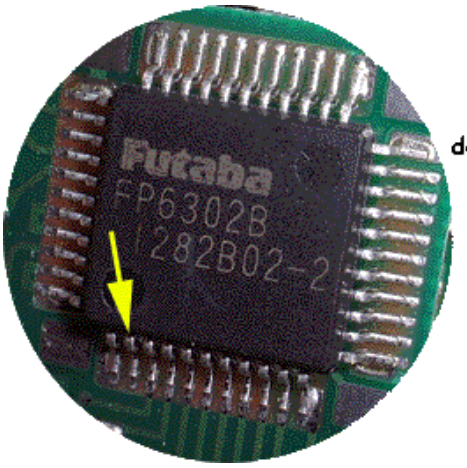
Note: *This will give you a fully reversible Trainer Cable with power being transferred from master to slave. If you do not wish power to be transferred, do not connect Pins 1 together on DIN-A and DIN-B.*

4.11. Futaba 10Z upgrade - Adding a 10th Channel to the 9Z

Note: *This has only been tested on a 9Z WC, but will probably hold true for the WC2 and earlier 9Z model.*

The 9Z WC transmits a hidden 10th channel by default. Channel 10 is non-proportional (just like Channel 9) and is permanently assigned to switch-D. The signal for channel 10 is produced by the PCM decoder chip (FR6302B) and is available inside a PCM 9 channel receiver from one of the pins on the chip (see Figure 51). As a result you will not be able to access the 10th Channel on PPM or 2.4GHz receivers. However, on Futaba PCM 9 Channel receivers it can be accessible externally with an easy and inexpensive modification. Once you have access to this channel you can reassign the switch for Channel 9 and you have a Futaba 10Z!

To make the modification you will need to purchase a 470 Ohm resistor, a 470pF capacitor and a servo socket. The electronic components are widely available and extremely cheap (25p) but if you have issues try Digikey, RS Components or Farnell. Next you need to construct the circuit shown in Figure 51. Finally, connect the circuit to the pin inside the PCM receiver indicated in Figure 51. This circuit provides the signal line to the servo (white wire); you will also need to connect the power (red wire) and negative (black wires) of the servo connector lead to the appropriate connections inside the receiver. Alternatively simply connect the red and black wires to an existing red or black servo wire outside the receiver using a servo splitter cable (although this is not very attractive or practical!).



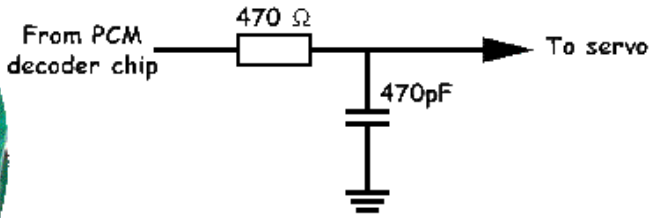


Figure 51 Adding a 10th Channel to the 9Z

5. DISASSEMBLING AND REASSEMBLING THE 9Z'S CASE

One of the main concerns people seem to have with this radio is its complexity. There seems to be a lot of posts on internet forums about how difficult it is to disassemble the set to replace switches, antenna, lithium back-up battery etc. You can be confident that this is not the case; these 'difficulties' seem to have arisen because of the 9Z's "Puzzle Box" case. Having completely disassembled my own 9Z, I can say that as long as you are relatively competent at 'household' DIY, exactly follow the procedures laid down in this document to disassemble the "Puzzle Box" in the right order, are careful and do not rush things then you'll be fine. However, each procedure in this manual has a difficultly rating based on my own experience – so if you're worried, look at this first, you'll find it's overview in Section 2.

Most maintenance, servicing or upgrade procedures for the 9Z require some level of case disassembly. As any procedure that exposes PCBs or electronics should be conducted with the transmitter battery pack removed, I have included this in the breakdown of disassembly procedures. To simplify disassembly the procedures have been broken down into "Stages" and this overall process is shown in Figure 52.

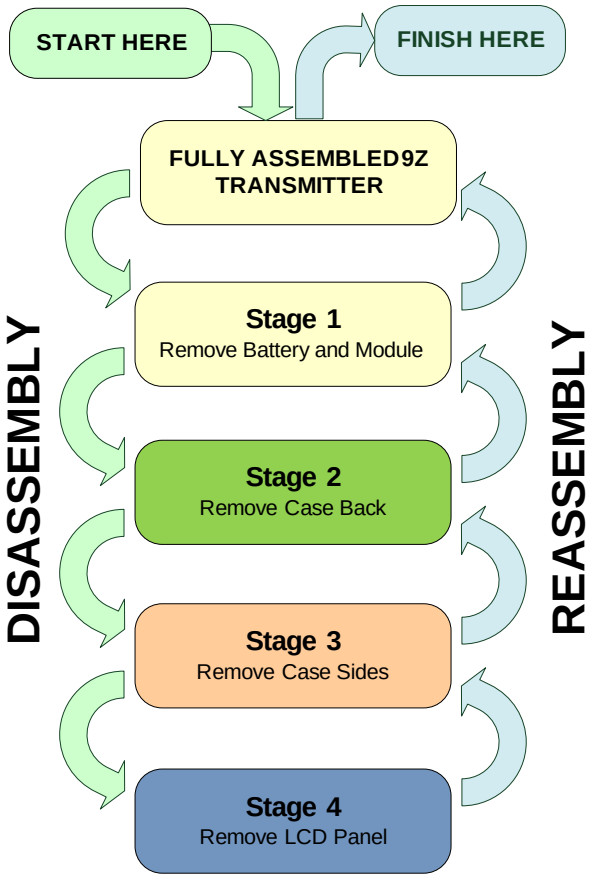


Figure 52 9Z Disassembly and Reassembly Process

COMPLETE THE STAGES IN ORDER: To reach each stage you must have completed each preceding stage. For example to disassemble to Stage 3 (Remove Case Sides) you must have already disassembled Stage 1 (Remove Battery and Module) and then Stage 2 (Remove Case Back). It is possible in some cases to skip stages, but I recommend against it as this is where others have run into issues.

DISASSEMBLE TO THE CORRECT STAGE: Specific maintenance, servicing or upgrade procedures are allocated to a stage. For example: To replace a corner switch you will need to disassemble to Stage 3, and to replace the lithium back up battery you will need to disassemble to Stage 4. The stage you'll need to disassemble to for carrying out procedures is shown in the Servicing and Upgrade Matrix in Section 2.2.

FURTHER DISASSEMBLY IS POSSIBLE & SOMETIMES REQUIRED: The stages detailed in this manual only deal with the 9Z's case. For many procedures you'll also need to disassemble a PCB board, these procedures are detailed at the relevant Servicing or Upgrade section in this manual. In addition, it is possible to completely disassemble the 9Z's case (i.e. beyond Stage 4) if required.

An overview of 9Z case disassembly is provided in Figure 53 below.

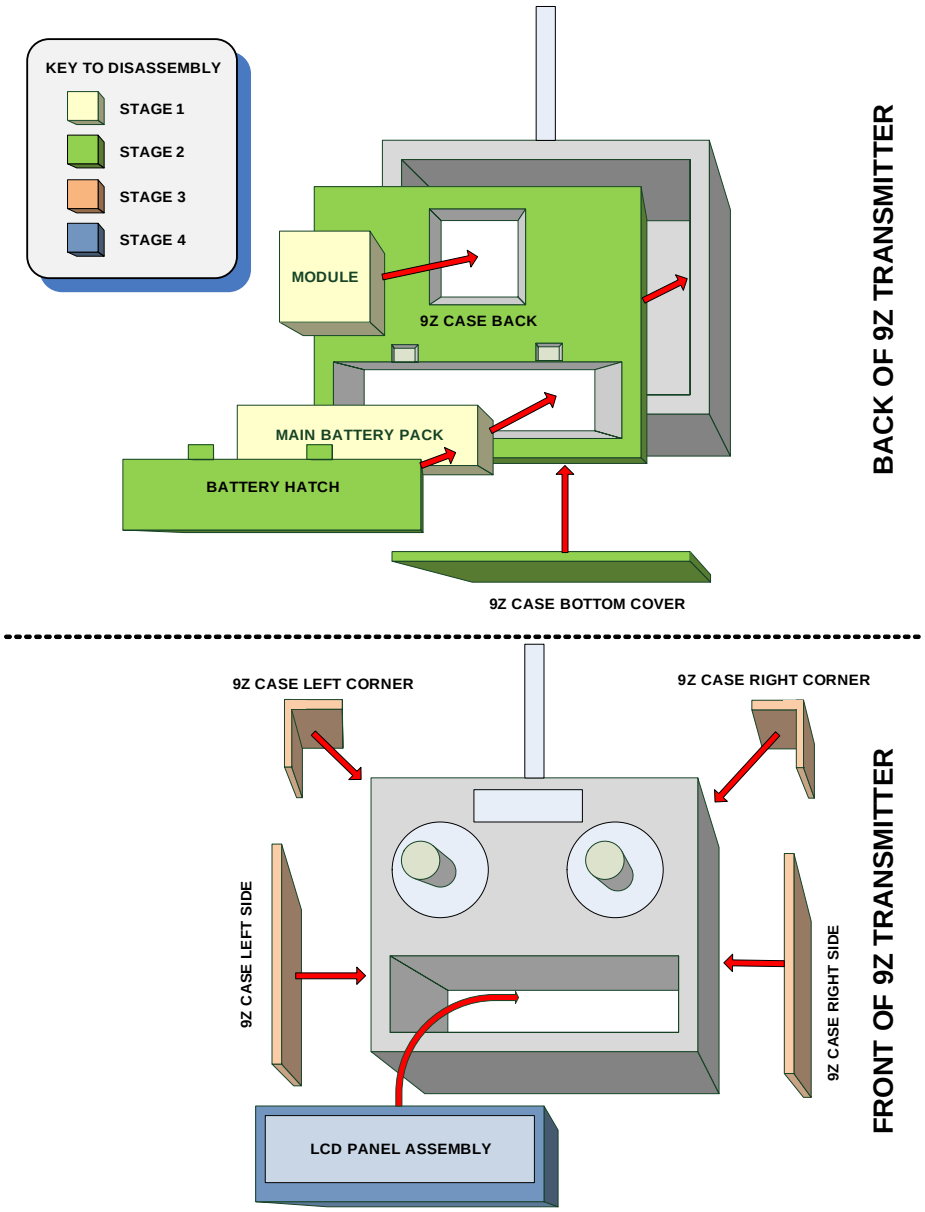


Figure 53 Overview of 9Z Case Disassembly

5.1. Stage 1 – Module and Battery

Stage 1 Disassembly:

1. Open the battery hatch and slide out the 9Z's transmitter battery back. Pull on the ribbon that slides under the battery to remove it safely without bending any battery pins.
2. Pinch both retaining clips on the transmitter module (top and bottom) and withdraw it from the back of the 9Z's case.

Figure 54 Stage 1 Complete - Module and Battery Removed

This completes Stage 1 disassembly

Stage 1 Reassembly:

1. Reassembly is the reverse of disassembly. Complete the disassembly steps in reverse order.

This completes Stage 1 reassembly

5.2. Stage 2 – Case Back

Stage 2 Disassembly:

1. Remove the comfort grips these just pull off.

Figure 55 Removing the comfort grips

2. Remove the case bottom cover

   Warning: *Do not skip this step. Failure to remove the bottom cover is one of the primary reasons why people find reassembling the 9Z case back such a nightmare!*

Figure 56 Removing the bottom cover

3. Loosen the case top cover retaining screws

   Warning: *Do not skip this step. Ensure you loosen these top cover screws as this will allow the case back to easily snap back into position on reassembly. This and failure to remove the bottom cover are the primary reasons why people find reassembling the 9Z case back such a nightmare!*

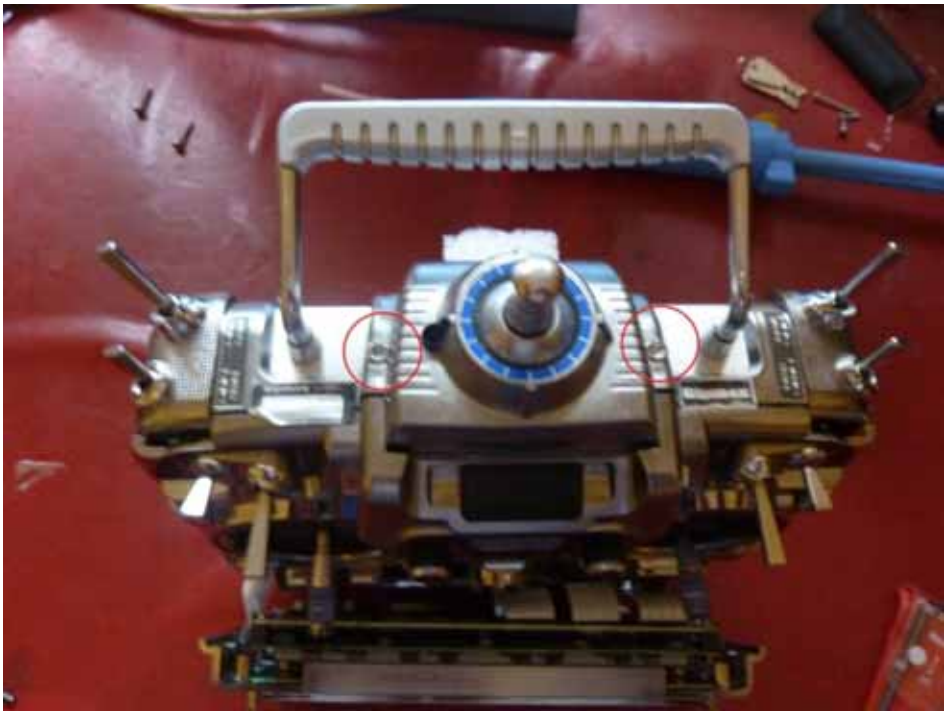


Figure 57 Loosen these screws on top cover

4. Undo the case back retaining screws and carefully lever up the cover from the bottom. You will find the battery cover drops out as a separate piece at this stage.

Warning: *Be careful not to bend the Module pins as you lever up the case; it's ok if they bend a little, but keep an eye on them! Cover the exposed Module pins with a piece of foam or polystyrene to protect them, and be careful not to bend them by laying the transmitter on its back.*

Figure 58 Lever up back cover

5. As depicted in Figure 59, label all ribbon cables on the main PCB that is now exposed. You should know where and how to refit each and every one so take a photo with a camera.

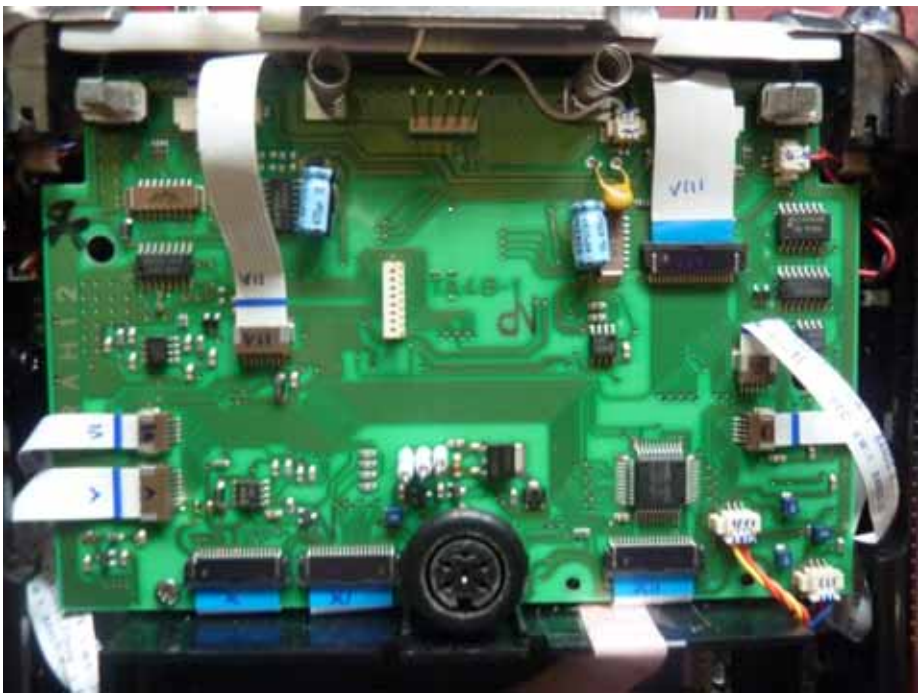


Figure 59 Label all ribbons and cables on the PCB

This completes Stage 2 disassembly

Stage 2 Reassembly:

1. Complete in reverse order to disassembly.
2. Before proceeding you may find it useful to loosen the case sides a little (see photo below) to provide a tiny amount of slack to allow the case back to snap in more easily. Be aware that if you loosen the sides too much the top corner covers may become unseated or fall out. If this happens see Stage 3 instructions.

Figure 60 Screws to loosen to allow play in case sides

3. Slide the case back over the Module pins in the same way it came off, and slip it under the top case's lip. As shown in Figure 61, you may need to lever this lip up slightly with a screwdriver (protect screwdriver end with tape) and this is why we loosened the top case screws in disassembly. Do not refit or tighten any screws at this stage!

Warning: *Note the position of some large components on the main PCB, the case back module compartment fits between these so be careful not to crush them. Once the case back is in place replace its screws.*
Warning: *Do not pull up on the carrying handle of the 9Z as recommended by some posters on the internet. The carrying handle is attached to the 9Z metal case frame not the top panel and will just bend the whole 9Z out of alignment.*

Figure 61 Protect a screwdriver and lever case top up to refit case back

4. Refit the battery hatch by sliding it under the bottom edge of the back cover (see Figure 62). You'll need to lever the back cover up a little to do this. Once complete you can refit and tighten the back cover screws.

Figure 62 Refit battery hatch

5. Fit the case bottom cover
6. Retighten the case sides if you loosened them and check that the top corner covers are pushed back into the right position before tightening.
7. Retighten the top cover screws

This completes Stage 2 reassembly

5.3. Stage 3 – Case Sides and Corner Switches

Warning: *There are some ribbon cables that can become caught during disassembly and reassembly. Keep a sharp eye out and poke them back into place with a non-metallic object or a screwdriver whose tip has been protected with insulating tape. Also be very careful that no ribbon cables become lodged over screw holes. Putting a screw through a ribbon cable is the fastest way to trash your transmitter.*

Stage 3 Disassembly:

1. Undo and remove the top and bottom Allen key screws on the front of the transmitter. The LCD panel will now be loose (though it will not fall off) so be careful and hold it in place when you handle the transmitter (see Figure 63).

Figure 63 Allen key screws to remove

2. Lever the sides a little bit outwards and slide out the corner covers. These will still be attached by ribbon cables so be careful (see Figure 64 & Figure 65).

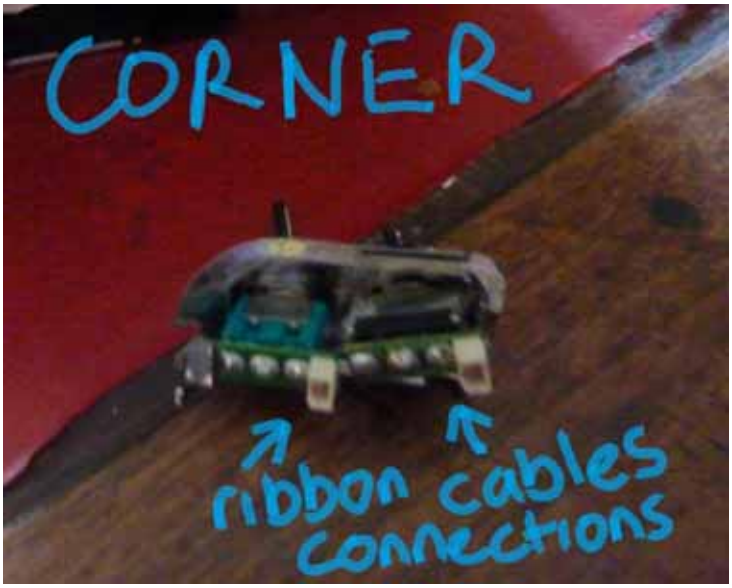


Figure 64 Case corner removed and ribbons detached

3. Take a photo of the ribbon cables for the corner covers – you need to know which one fits which socket (see Figure 64).

Figure 65 Case sides slid outwards and removed

Stage 3 disassembly is complete when both sides and corners have been removed (see Figure 64 & Figure 65)

Stage 3 Reassembly:

1. Complete in reverse order to disassembly.
2. Fit the side(s) being careful not to trap ribbon cables, but do not tighten the retaining Allen key screws.
3. “Snap-Slide” the corner covers into place. The corners first “snap” into place by pushing them down, and then you slide them forward into position (see Figure 66).

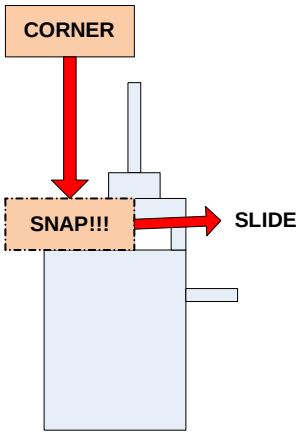


Figure 66 How the corners "Snap-Slide" into place

4. Hold the case together checking the fit of parts and then tighten the Allen key screws.

Stage 3 reassembly is complete when both sides and corners have been refitted.

5.4. Stage 4 – LCD Panel

Warning: *There are some ribbon cables that can become caught during disassembly and reassembly. Keep a sharp eye out and poke them back into place with a non-metallic object or a screwdriver whose tip has been protected with insulating tape. Also be very careful that no ribbon cables become lodged over screw holes. Putting a screw through a ribbon cable is the fastest way to trash your transmitter.*

NOTE: Stage 4 is an example of a stage where you can partially complete Stage 3 if desired. You need only remove the bottom Allen screws retaining the sides in Stage 3 if you wish, and then partially lever out the sides as in Figure 67. However, better access is provided if both sides are removed and Stage 3 is completed.

Figure 67 - Partial Step 3 Disassembly Option

Stage 4 Disassembly

1. Label all ribbon cables on the main PCB if you have not already done so. You should know where and how to replace each and every one so take a photo with a camera.
2. Pull out the two ribbon cables that prevent full access to the LCD Panel. Be careful not to pinch or kink them and apply pressure as near to blue line on them (close to the socket) as possible (see Figure 68). Remove using your fingers or a pair of pliers protected with masking tape.

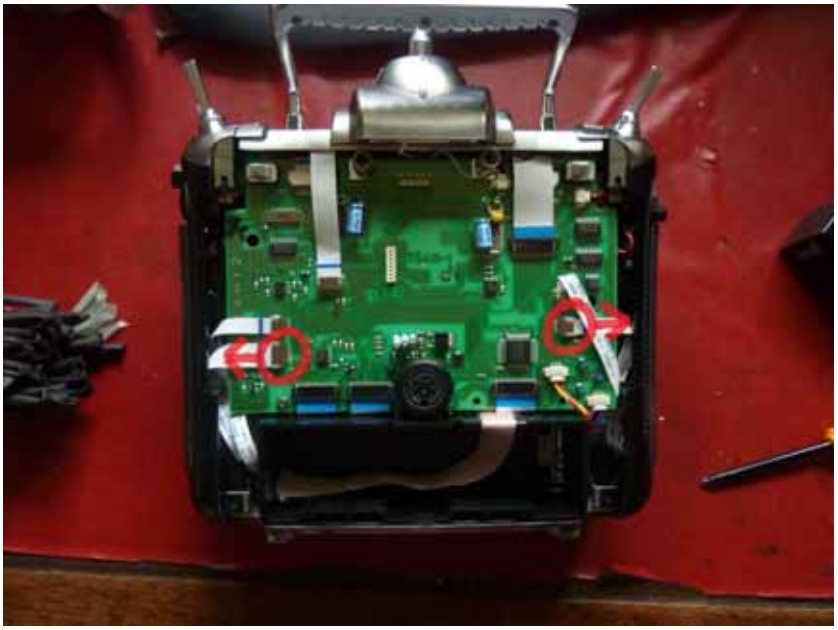


Figure 68 Remove these cables to access LCD panel

3. Turn the transmitter over and remove and loosen the following Allen key screws shown in Figure 69.

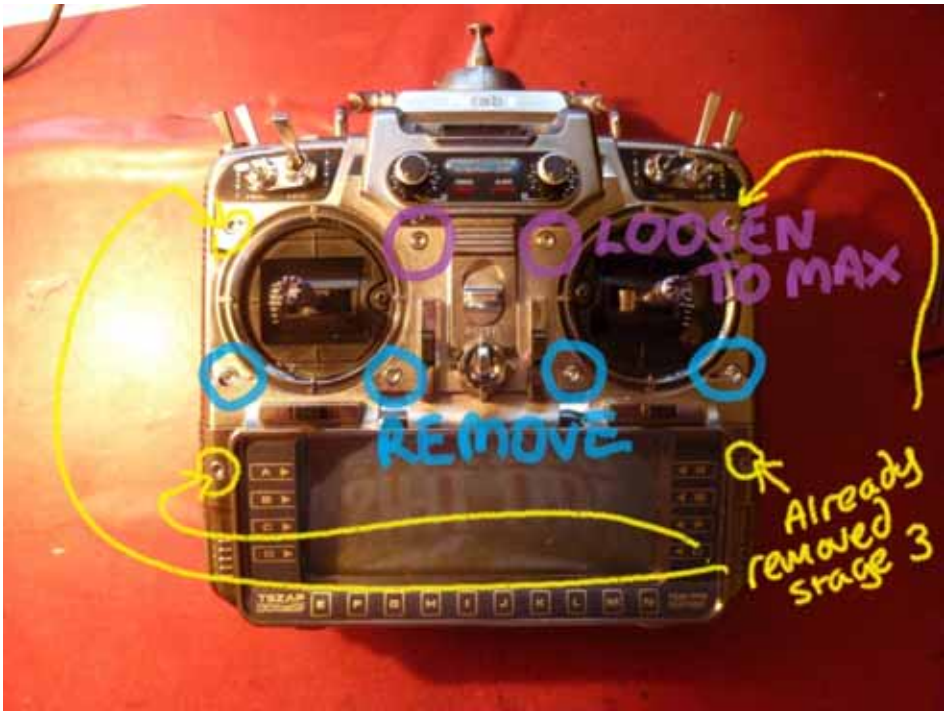


Figure 69 Remove and loosen these screws (note those already removed in Stage 3, if they are still present remove them)

4. Lever up the upper front panel and flip up the LCD panel before carefully levering it out (it is retained by a plate with lugs on the upper side, see Figure 70 & Figure 71).

Figure 70 Lever up PCB panel

5. Once the LCD panel is out you can flip it over backwards, carefully pulling the two ribbon cables you undid in Step 1 through the case. It will still be retained by some ribbon cables so be careful (see Figure 72).

Figure 71 LCD Panel now completely removed (retaining plate/lugs on top)

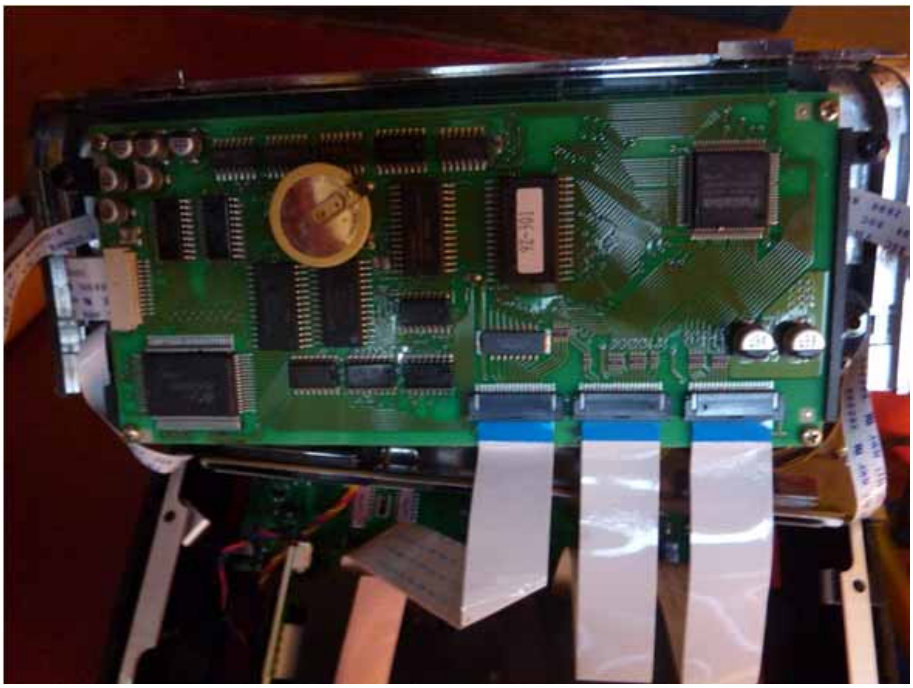


Figure 72 LCD Panel flipped over backwards for access

This completes Stage 4 disassembly

Stage 4 Reassembly

1. Complete in reverse order to disassembly.
2. Feed the two ribbon cables you removed back through the case. Use low tack masking tape to protect them and aid reassembly (see Figure 73).

Figure 73 Ribbon cables with masking tape fed back through case

3. Re fit the LCD panel being very, very careful not to trap any cables (see Figure 74).

Warning: *There are cables on each side that can become lodged over screw holes in sides of the main cases body. Check for these as you will put a screw through the middle of them if they are missed when you refit the sides.*

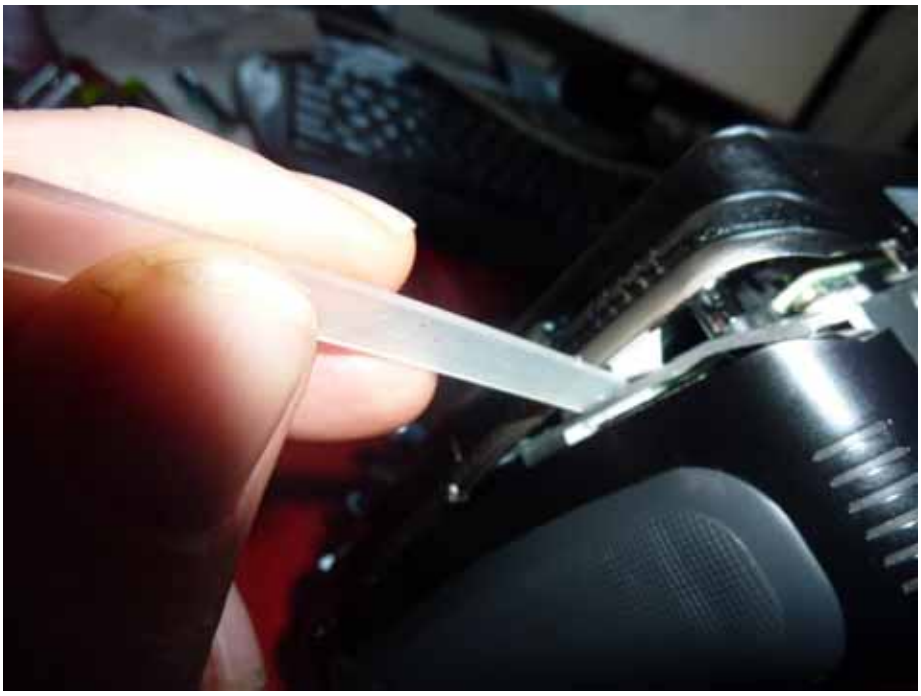


Figure 74 Cables at sides of LCD Panel that get trapped

This completes Stage 4 reassembly

4. Refit all upper case screws you removed in this stage but do not tighten them fully.
5. Hold the case together checking the fit of parts. Also note that your joysticks may have rotated slightly, if so rotate them back into place. Finally, once all is correct, tighten the Allen key screws for the upper case panel.

6. THE FUTABA SERVICE AND TEST MENU

6.1. Overview

Many Futaba Radios have a hidden test and service software built into the firmware by Futaba. Accessing these Test and Service Menus usually requires some simple hardware based procedure rather than a key press. However, do not be put off by this, these menus are very useful and being able to regularly calibrate your own transmitter will really improve your flying experience as hardware settings drift as your set ages.

6.2. How to Access and Use these Menus on the 9Z

The 9Z's Service and Test Menus can be accessed by connecting 3 pins on the CAMPAC port. You have two options to do this:

1. Connect CAMPAC Pins numbers 3, 2 and 7 together manually with wire (see APPENDICIES for CAMPAC Pin-Out numbering)
2. Build my (Almost) Universal Service Menu Enabler shown in APPENDIX A.
3. Buy a ready made Service Menu Enabler like the UltraPac.

I would really recommend you choose option 2 and build the enabler; it's easy, cheap, quick and safer than option 1. If you do decide to choose option 1 make sure you have a good connection on the CAMPAC Pins. Intermittent or bad connections have been known (rarely) to brick the 9Z. Option 3 is only a cost effective choice if you already have a need for a new CAMPAC, as a Service Menu Enabler is very easy and cheap to make.

Whichever option you've chosen, the following procedure will access the Service and Test Menu:

1. Turn off the 9Z transmitter
2. Connect the CAMPAC Pins with the Enabler, UltraPac or manually
3. Double check everything is connected the right way
4. Turn on the 9Z transmitter and the first service menu item (Main Menu) is displayed on the LCD (see Figure 75)
5. You can now cycle through the Menus using the "NXT" and "PRE" soft-keys.

The Service and Test Menus for the 9Z can be split into 3 main groups:

1. The Service Menus – for calibrating your 9Z's controls and functions
2. The Test Menus – for fault finding and checking calibration of controls and functions
3. The Upgrade Menus – for changing and viewing your 9Z's system settings

The overall flowchart for cycling through the menus is shown in Figure 75. Note that you will have to choose between the Service and Test Menu loop and the Upgrade Menu loop at the Main Menu. Once you have chosen you'll need to power off the transmitter if you wish to enter the other menu loop as there is no way to return to the Main Menu screen.

The Service and Upgrade Menu Loop is described in Section 6.3 with details on utilising the various calibration and upgrade functions. The Test Menu loop is described in

Section 6.4 with details on what each test item does and how it can be employed for fault finding and checking your system.

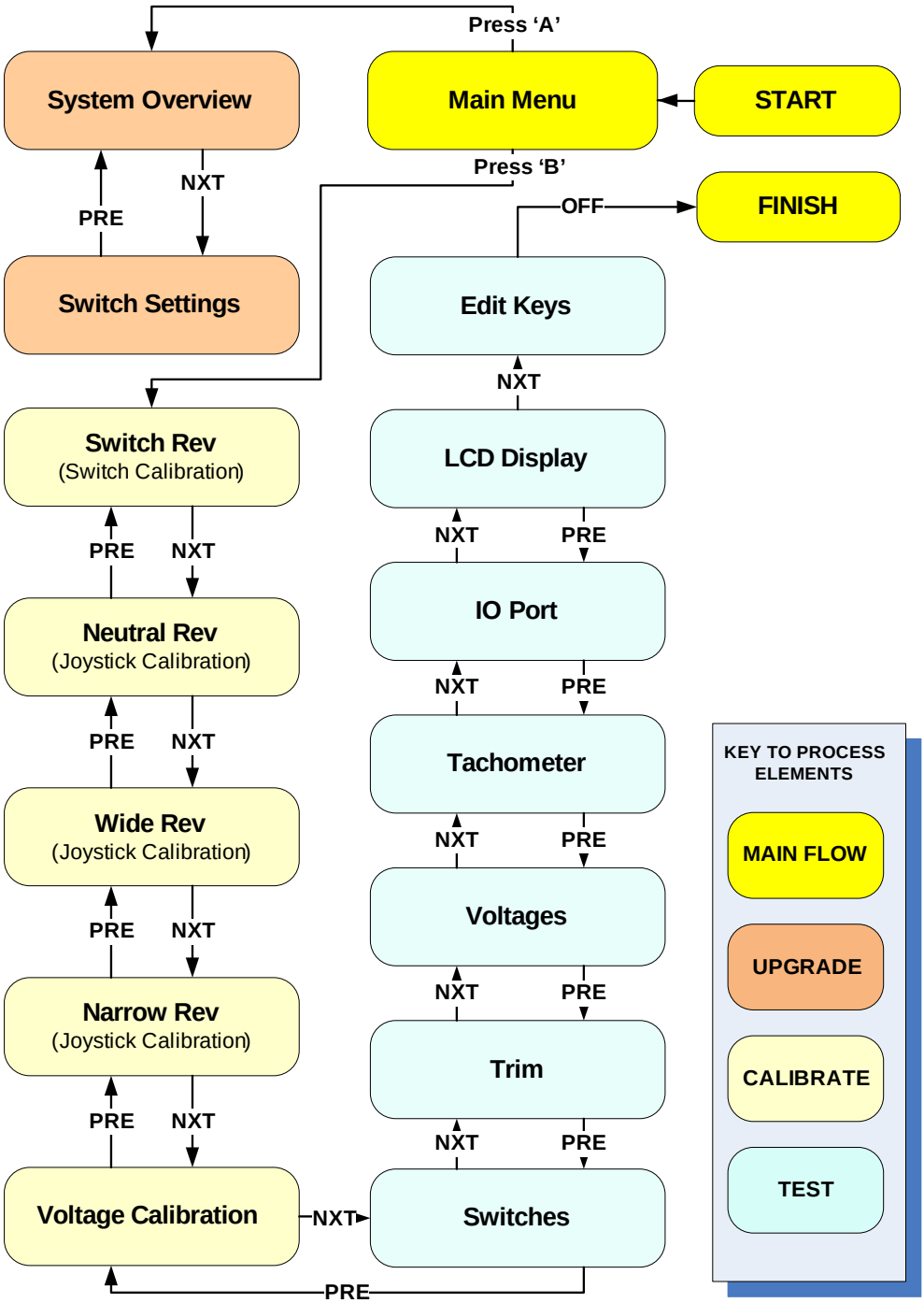


Figure 75 Overview Flowchart for Futaba 9Z Service and Test Menus

Note: *if you would like to see an "Easter Egg" personal message from the developers of 9Z go to the voltage screen and press [L] and [M] simultaneously. Once the first message appears you may press [L] and [M] again which brings a second message up.*

6.3. Service Menus (Calibration and Upgrade)

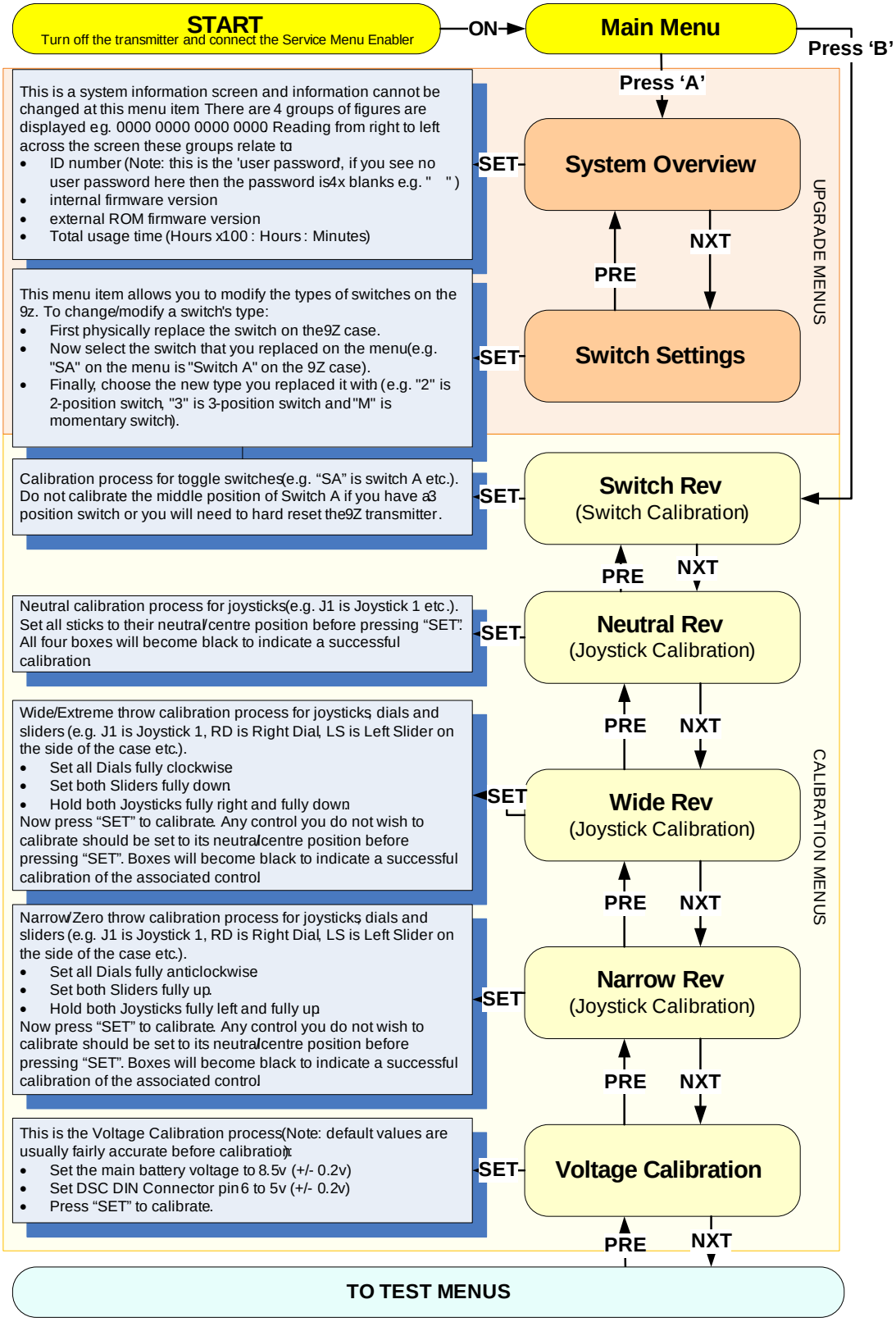


Figure 76 Futaba 9Z Service Menus Flowchart

6.4. Test Menus (Fault Finding & Checking)

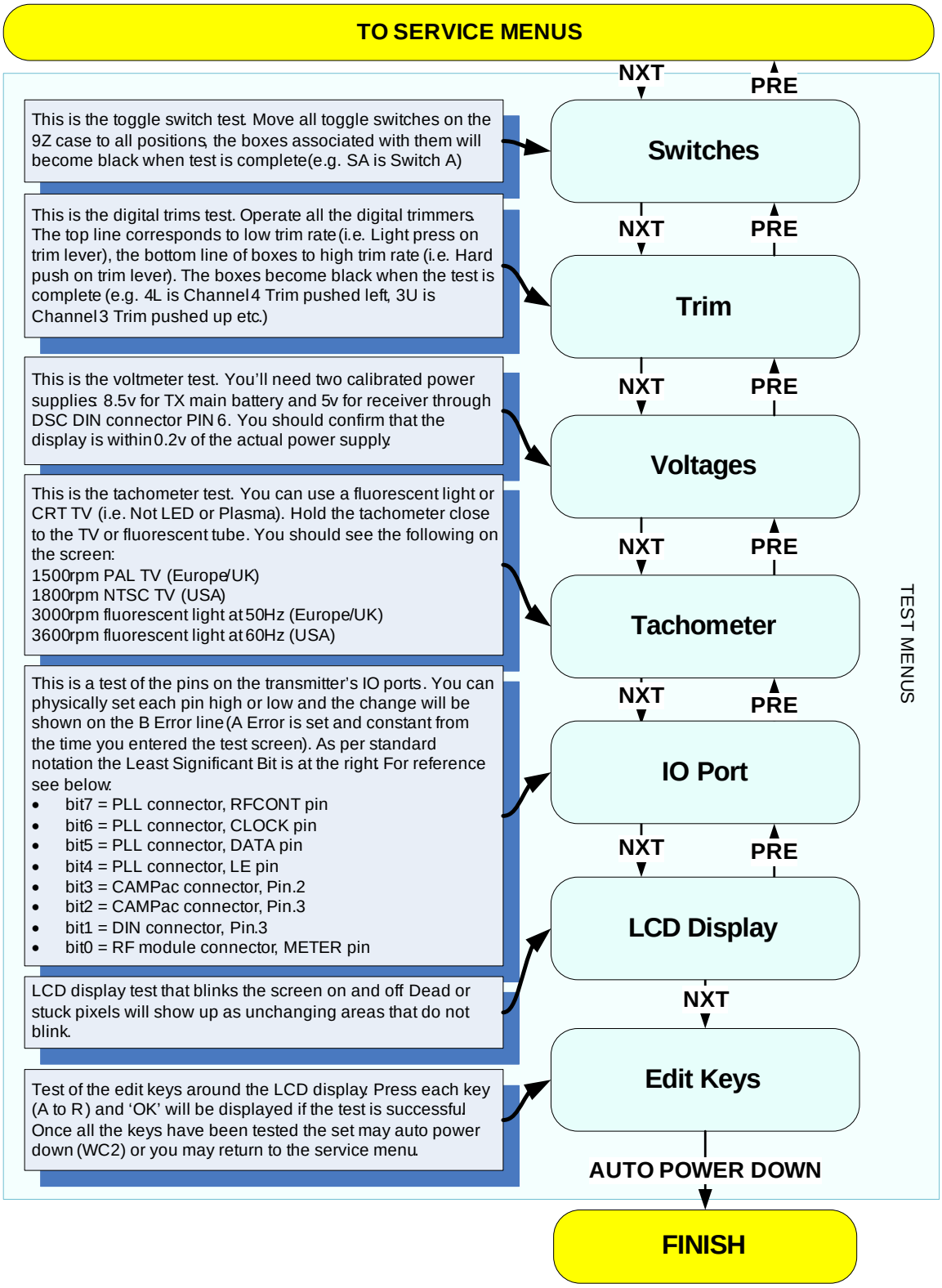


Figure 77 Futaba 9Z Test Menus Flowchart

APPENDIX A. THE (ALMOST) UNIVERSAL SERVICE MENU ENABLER

Compatible with FUTABA 9z, 9c, 10c & 8u Series

Designed by Quincross

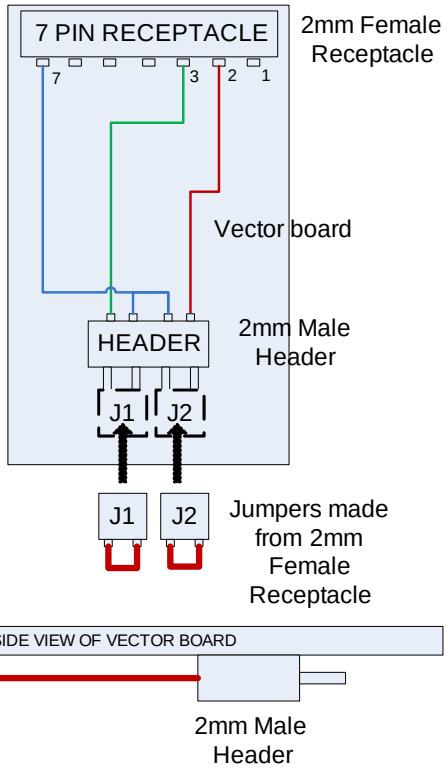
CAMPAC PINOUT

This is the Campac pin numbering as you look at the radio

WARNING: Double check a everything as you could screw up your radio if you get the wrong pins!

PARTS CAN BE BOUGHT FROM DIGIKEY:
2 X Female Receptacle (part no. 2063S-07-ND)
1 x 2mm Male Header
1 x Vector (Perf) board

If you can no longer obtain these parts from DigiKey, RS and Farnell both do 2mm headers & receptacles



Jumper positions to obtain futaba service and test menus for 9z,9c , 10c and 8u Txs				
		Known Futaba Transmitters		
J1	J2	9z	9c & 10c	8u
OFF	ON	???	Service Mode	Short Test Mode
ON	OFF	???	Test Mode	Full Test Mode
ON	ON	Full Service Menu	???	Full Service Menu
OFF	OFF	Nothing!	Nothing!	Nothing!

WARNING:
It shouldn't be possible to screw up your radio with other jumper positions but you never know!

APPENDIX B. CONNECTION PORT PIN-OUT INFORMATION

This Appendix contains information about the various ports used on Futaba transmitters to transfer information. The Pin-Outs described are fairly universal and do not just apply to the Futaba 9Z series. However, on very old transmitters predating the original 9Z you should be careful to check that the information supplied is still applicable. For example, the 9VAP series uses a 7 pin DIN for DSC rather than the 6 pin DIN described in this appendix, whilst the RF Module Pin-Out is laid out in exactly the same format. Please note that the Pin-Out numbering is laid out as shown in the exact orientation of the photos; get the orientation correct or you will end up swapping the 1st pin with the last.

B.1. 9Z Transmitter Battery Cassette Pin-out Information

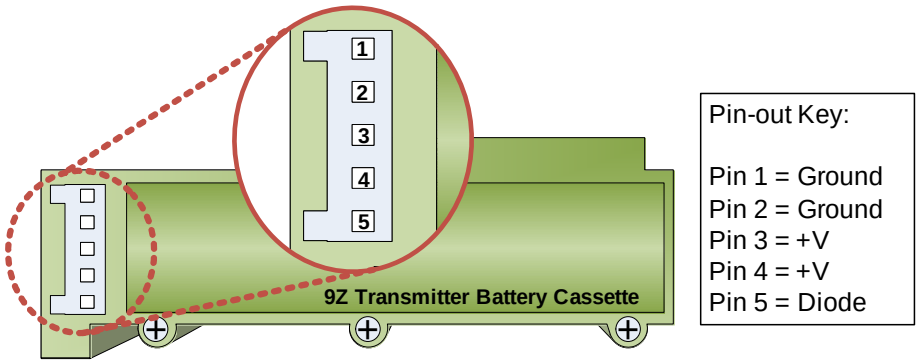


Figure 78 Futaba 9Z Transmitter Battery Pin-out

The transmitter battery cassette is specific to the Futaba 9Z series and contains a diode. For reference the pin-out information is shown in Figure 78, but for further information on modifications, charging and servicing you should refer to Sections 3.10, 4.7 and 6.3 of this document.

B.2. Futaba RF Module Pin-out Information

The connector in Figure 79 is an extended pin 0.1" single row PCB header and will fit a 0.1" PCB receptacle, which are readily available from most electronic component providers.

Figure 79 Futaba RF Module Pin-out Numbering

Pin-out functions:

1. PCM/PPM Signal from Radio
2. V+
3. RF Output Indicator (Pulls to ground when RF is detected)
4. GND
5. RF Out

B.3. Futaba DSC/Trainer Pin-out Information

The connector in Figure 80 is a standard 6 pin DIN which is readily available from most audio equipment and electronic component providers

Figure 80 DSC/Trainer Port Pin-out (6 pin DIN)

DSC/Trainer Port Pin-Out configuration:

0. (i.e. the metal shield) Ground
1. +V batteries (Switched)
2. Signal output
3. Signal Input
4. +V output
5. +V Input (for powering up without RF Transmission)
6. +5v Input (and is used by DSC-cable for receiver voltage information)

Note: *Connecting pin 4 and 5 to each other will cause the transmitter to power up without RF transmission when it is switched on. This is necessary for correct operation of DSC and simulator cables.*

B.4. CAMPAC Pin-out Information

It is important to note that CAMPAC Pin-out is reversed from the normal layout you might expect with Pin 1 on the right hand side (see Figure 81). Also note that the communication protocol used is I2C.

Figure 81 CAMPAC Pin-Out (Note: Reversed pin numbering)

The CAMPAC Pin-out configuration is:

Pins 7 & 6 = These are directly tied together in the radio and are connected to Ground.

Pins 5 & 4 = These are tied together in the radio and are connected to +5 volts.

Pin 3 = Serial Data clock

Pin 2 = Address / Data IO line

Pin 1 = Unknown (see Note below)

Note: *Be careful not to short this Pin 1! It probably enables/disables write protect on the built in EPROM. This would allow Futaba to put the latest code into a radio without replacing the surface mounted (SIP) EPROM.*

APPENDIX C. COMPONENT PART NUMBERS

Note: *Table 5 is provided as a guide. You should always verify part numbers with the listed supplier.*

Table 5 below provides a list of the key component part numbers used in the procedures detailed in this manual.

9Z Model	Component	Supplier	Part No.	Notes
Hobby Services *(Note: Futaba direct part number in brackets, some suppliers exclude the "Y-")*				
9Z WC2	Gimbal / Joystick	Futaba	HSP73839 ST-22B (R) (Y-TFT1500020)	9ZAW throttle gimbal inc. aircraft version ratchet (i.e. 9ZAW left hand side gimbal)
9Z WC2	Gimbal / Joystick	Futaba	HSP73840 ST-22B (B) (Y-TFT1500021)	9ZHW throttle gimbal inc. helicopter version ratchet (i.e. 9ZHW left hand side gimbal)
9Z WC2	Gimbal / Joystick	Futaba	HSP73841 ST-22B (S) (Y-TFT1500019)	9ZHW and 9ZAW gimbal - sprung only (i.e. right hand side gimbal)
9Z WC2	Potentiometer	Futaba	HSP73870 VR ST-22B (Y-2M41A01602)	Elevator and throttle axis
9Z WC2	Potentiometer	Futaba	HSP73871 VR ST-22B (Y-2M41A01702)	Aileron and Rudder axis
9Z*p & WC1	Potentiometer	Futaba	HSP53710 VR 133-19 (Y-2M41A01701)	Elevator and throttle axis
9Z*p & WC1	Potentiometer	Futaba	HSP53709 9Z VR 133-18 (Y-2M41A01601)	Aileron and Rudder axis
9Z All	Joystick Shafts	Futaba	(Y-SO1777)	Pair of shafts (buy with Y-SO1773)
9Z All	Joystick Inner Gimbals	Futaba	(Y-SO1773)	Pair of gimbals (buy with Y-SO1777)
9Z WC2	Buttons Label	Futaba	HSP73853	Bottom middle
9Z WC2	Buttons Label	Futaba	HSP73855	Right side

9Z WC2	Buttons Label	Futaba	HSP73856	Left Side
9Z WC2	Futaba 9Z Display PCB (LCD & PCB)	Futaba	HSP39007	Very expensive! Expect approx $400.
Farnell, DigiKey and RS Online *(Note: likely to use the same part codes)*				
9Z*p, WC1 & WC2	Back-up Battery	Farnell	BR2032/HEN	Lithium back-up battery

Table 5 Selected component part numbers used in this manual

Thanks for Reading
I hope you found it
useful - Happy Trails!!!
Quin Cross

"It is not the length of life, it is the depth"