Adjusting your Bug

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Section

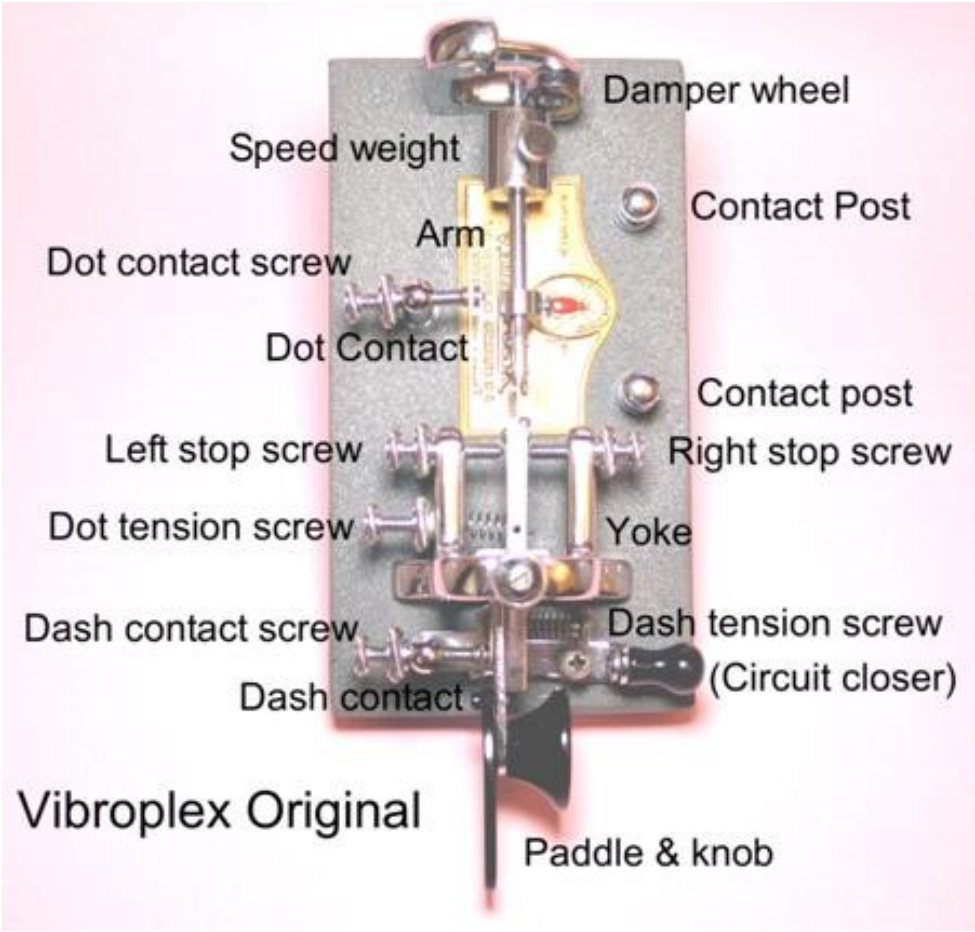
1 Introduction

"The performance one gets with a bug depends greatly on the adjustment and no amount of skill can make up for a poorly adjusted bug." – Brian Murphy, VE2AGO in QST February 1968. That statement is as true today as it was then. Have you tried to learn to adjust and operate a bug key and given up because it didn't sound "right"? If so read on.

Bug keys are perfectly capable of sending Morse which is correctly spaced and easy to copy – providing they're adjusted correctly. Following is the method that works for me and has been proven on bugs old and new. It draws on my own experience of using a bug since 1982, along with the advice of Brian Murphy VE2AGO, US Army Technical Manual TM11-459 (September 1957), and the late Dave Ingram K4TWJ.

I'm going to use the Vibroplex Original to explain the operation and how to set it up. It takes longer to explain how than it does to set up a bug. The layout of other bugs may vary a little but the basic principles of operation are exactly the same. Others may disagree about how I set up a bug but it's the end result on the air that counts.

2 Parts of the Bug & How it Works



Bug parts

At one end of the ARM there is a rod carrying the SPEED WEIGHT. At the other there is a lever carried on a trunnion which pivots in the YOKE. The

rod and the lever are connected by the mainspring, which is the heart of the bug. The DASH CONTACT is carried on a secondary lever which is also mounted on the trunnion but can pivot independently of the lever. The DOT CONTACT is mounted on a hairspring fitted to the rod.
So how does it all work? When you push the PADDLE to the left the DASH CONTACT closes with the other contact mounted in the DASH CONTACT SCREW. Just like an ordinary key except the motion is sideways instead of up and down.
Now for the clever bit! When you push the PADDLE to the right the lever strikes the LEFT STOP SCREW and can't move any further but the rod with the SPEED WEIGHT on it oscillates making and breaking the connection between the DOT CONTACT on the hairspring and the other contact mounted in the DOT CONTACT SCREW. This continues until you release the PADDLE or the mainspring doesn't have enough energy left to keep the rod moving. Newer bugs tend to have stiffer mainsprings and can be a bit fast on the dots. They also tend to need a bit more "oomph" to make them "play". Older bugs tend to have softer mainsprings and therefore a "friendlier" action.

3 Basic Checks

There are some checks we need to do before we start the set-up proper.

3.1 Check that the arm is free to rotate with just the slightest trace of up and down movement. To adjust the Original: If the arm is too loose or too tight, slacken the locknut and adjust the top trunnion screw in the yoke. Don't forget to tighten the locknut again and re-check that the setting is still correct. If not, do it again until it's right. You may want to apply a tiny drop of oil or light grease to the top and bottom pivots and also the dash lever where it pivots on the trunnion. Remember a tiny drop!

3.1a If you have an Original Deluxe or Presentation (jewelled bearings like the one shown on the right):

Vibroplex Original Deluxe

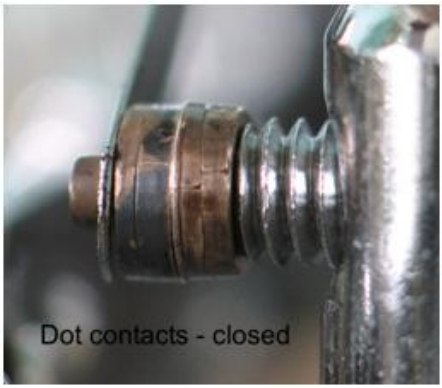
Then the trunnion adjustment has to be done from the underside of the bug. Slacken off the holding screw at the bottom of the yoke, shown on the right:

Vibroplex Original Deluxe Bearing Lock Screw

Adjust the bearing from the bottom of the bug and don't forget to tighten the lock screw when you're finished. IMPORTANT: Make sure you leave a tiny bit of play. If you don't, you may crack a jewel – you have been warned.

3.2 Confirm that the posts which carry the dot contact screw and dash contact screw are tight on the base. If they're not, tighten the fixing screws on the underside of the base.

3.3 Check that the dot and dash contacts are exactly aligned and parallel to each other like these:



Dot contacts - closed

Dash contacts – open

If they're not exactly aligned then loosen their fixing screw and adjust the dot contact and/or dash contact until they're closing in perfect alignment and re-tighten the fixing screws. You may also have to rotate the respective contact posts slightly to get perfect alignment. It helps to put a piece of white paper behind or underneath the contacts to see just how accurately they're closing. Getting this right makes life a lot easier later on when you come to make the adjustments.

3.4 Now check that the contacts are clean and shiny. I use a strip of bond writing paper or a piece cut from a blank page of a pulp fiction paperback. Close the contacts together and draw the paper back and forth between them. Did the contacts leave a black mark on the paper? If so, use a fresh strip of paper and repeat until the contacts leave no marks on the paper and the contacts are clean and shiny.

4 Initial Adjustments

Start off by slackening their locknuts and loosening the RIGHT STOP SCREW, LEFT STOP SCREW, and DOT CONTACT SCREW. Now make the basic adjustments ***in the following order***:

4.1 Lever Rest Position: Adjust the RIGHT STOP SCREW until the arm is just touching the DAMPER WHEEL but not moving it from its resting position and tighten the locknut. Check that the setting is still correct and readjust if necessary. Do NOT make any further adjustments to this setting.

4.2 Initial Lever Dot Travel: Adjust the LEFT STOP SCREW so that the gap between it and the lever is 0.015 inch or 0.4 mm measured with a feeler gauge and tighten the locknut. Check that the setting is still correct and adjust if necessary. If you don't have a feeler gauge, use four thicknesses of 80gm/M^2 laser/inkjet printer paper (= 0.016 inch).

Checking gap between left stop screw and lever

This is one of the critical adjustments and we'll revisit it in section 5.2 (Fine Adjustments). If the gap is too small the mainspring won't have enough momentum to make long slow dots. If it is too big then the tran-

sition from dashes to dots may be too long at high speed.

4.3 Initial Lever Dash Travel and Tension: Check how far the paddle moves from the rest position to the right until the lever is stopped by the LEFT STOP SCREW. Now adjust the DASH CONTACT SCREW so that the PADDLE has to move the same amount to the left from the rest position for the DASH CONTACTS to make and tighten the locknut. Check that the setting is still correct and re-adjust if necessary. Check that the dash contacts are still closing in perfect alignment. If not you may have to rotate the dash contact post slightly or re-adjust the dash contact position.
Now adjust the DASH TENSION SCREW until it feels comfortable for you.

4.4 Initial Dot Contact Position: Adjust the DOT CONTACT SCREW so that the dot contacts are just closed when the PADDLE is moved to the right and the arm has completely stopped oscillating. Tighten the locknut and check that the dot contacts still close in perfect alignment. If not, you may have to rotate the dot contact post or re-adjust the dot contact position.

4.5 Initial Dot Spring Tension: Adjust the DOT TENSION SCREW until it feels comfortable for you. We'll come back to this later in the fine adjustments.
Now the fun begins!

5 Fine Adjustments

5.1 Using a VOM & Basic Continuity Checks: The fine adjustments are best carried out using an analogue meter, like an Avo meter, set to its x1 Ohms range. Short the meter leads together and confirm that the meter reads 0 Ohms (full scale deflection). If not, adjust the meter's Ohms Zero knob until the meter reads exactly 0 Ohms.
Now connect the meter leads to the bug's Contact Posts. Make sure that the circuit closer switch is open if your bug has one, and check that the meter reads open circuit. If not, your bug has a short circuit that needs to be found and fixed before you carry on.
Next, push the PADDLE to the left to close the DASH CONTACTS. The meter should show a short-circuit (0 Ohms). If not, your bug has an open or high resistance that needs to be found and fixed before you carry on.

5.2 Fine Dot Contact Position: Move the SPEED WEIGHT as far as it will go to the end of the ARM without fouling the DAMPER WHEEL and tighten it. Push the PADDLE to the left and then quickly to the right to make a string of dots. The meter needle will rise then start to hover as the dot contacts make and break.

Checking the dot contact spacing

The meter needle should hover around the 50% of full scale mark (1:1 dot:space ratio) and then increase to full scale (short circuit) as the mainspring runs out of energy and the contacts close. If it's less than 50% the gap between the dot contacts is too large and the dots will be too light. If it's more than 50% the gap between the dot contacts is too small and the dots will sound "mushy". Keep making strings of dots and adjust the DOT CONTACT SCREW so that the meter reads 50% of full scale before the mainspring starts to run out of energy and tighten the locknut. You should get 15 to 20 or more clean solid dots before the mainspring runs out of energy.

If the mainspring runs out of energy too quickly and you don't get enough dots then the gap between the LEFT STOP SCREW and the lever is too small. Go back to 4.2 and increase the gap between the LEFT STOP SCREW and the lever to, say, 0.020 inch or 0.5 mm and continue the adjustments from that point.

Perfect dot contact spacing (1:1 mark space ratio)

5.3 Fine Dot Tension: Push the paddle to the right to make a string of dots and release it. The arm should move back to its resting position against the DAMPER WHEEL and stop moving completely without bounc-

ing. If the ARM does bounce then you need to screw the DOT TENSION SCREW in a little to increase the tension. If the ARM flies back and crashes into the DAMPER WHEEL then you need to unscrew the DOT TENSION SCREW a little to reduce the tension. It's important that the ARM settles quickly against the DAMPER WHEEL to prevent scratchy dots, particularly on letters like "x". In my experience, scratchy dots are more likely to be caused by incorrect dot tension than by vibration of the hairspring so it's worthwhile spending a little time to get this adjustment right.

5.4 Dot Speed Range Check: Move the SPEED WEIGHT as close as it will go to the dot contact without fouling it and make a string of dots. The meter needle should still read 50% of scale. You may have to compromise a little on the dot contact spacing if you want to use the full speed range of the bug.

5.5 Fine Dash Travel & Tension: I prefer the paddle movement from the rest position to be the same for both dots and dashes. You can adjust the dash travel and tension to suit you but do NOT adjust the dot contact or tension.

6 Final Checkout

Connect the bug to a practise oscillator and check that the dots and dashes are clean, especially on the letter "x". If the arm isn't being properly damped it will still be vibrating when you make the transition from the first dash to the dots and you'll have scratchy dots so go back and adjust the DOT TENSION SCREW until it's right.
Check the lowest speed (and the highest speed if you're able). The bug I used for this write up goes from 22 WPM to higher than I can send properly. If the slowest speed is still too high for you, add some extra weight like a blob of Blu Tac or a nut stuck to the SPEED WEIGHT to slow it down.
When you're happy that the bug is set up correctly, get on the air and enjoy using it, and remember:

"ACCURACY TRANSCENDS SPEED, COURTESY AT ALL TIMES"

7 Addenda

The dimensions of the working parts of other bugs are a little different compared to the Original so the starting point for the gap between the LEFT STOP SCREW and the lever are different. The following suggestions are based on experience of the bugs which I have and use.

7.1 Vibroplex Lightning and its clones: (Champion, J-36, and Lionel J36): The initial setting for the gap between the LEFT STOP SCREW and the lever can be a little less, perhaps 0.012 inch or 0.3 mm, and can be increased to, say, 0.018 inch or 0.45 mm if necessary during the fine adjustments.

7.2 Early Vibroplex Blue Racers ("U" damper): The initial setting for the gap between the LEFT STOP SCREW and the lever needs to be a little more, say 0.020 inch or 0.5 mm, and can be increased to perhaps 0.025 inch or 0.51mm if necessary during the fine adjustments.