The "KEA"
a simple paddle keyer project kit by Branch 05 Christchurch

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Instructions to be included in the kit.

Diagram:
1. Circuit diagram
2. Overlay of PCB with no negative keying option.
3. Detailed overlay of negative keying option components

Introduction
This club project was the result of a desire to utilise the Galbraith paddle assembly and build it into a cheap electronic keyer circuit. The prime object was to keep the cost to a minimum, but performance had to be glitch free and iambic. Many circuits were tried but most of them had problems with lack of dot/dash memory or glitches when things were done in the wrong order. Although more expensive than the others, the Curtis 8044ABM keyer chip was found to be the best for the job.
The 8044ABM chip includes a built in sidetone oscillator, but it was decided this option would not be normally used in practice as most amateur rigs have a side tone facility, so the speaker for this has not been included in the kit to reduce costs. The sidetone oscillator components have been included as the oscillator IC connections need to be terminated.
To keep the kit price to a minimum, the negative keying option was thought to be rarely used, and increases the operating current slightly, so components for this have been omitted, but can be easily obtained from component suppliers (Ref 1)
The chip also includes a built in speed meter, but no provision has been made on the PCB for this.
All components are fitted on the PCB to minimise the amount of wiring. The only wiring needed is the three wires to connect the Paddle contacts, and the two wires of the battery clip. The case has been left floating and can be connected to the Key output jack grounds if required.
Two key jack outputs have been provided so a straight key can be connected in parallel, for tune up and other fun activities.

An explanation of IAMBIC "A" and "B" operation.
When both paddles are closed an alternating series of dits and dahs is produced. This series can be started with either a dit or dah depending on which key was closed first.

This chip can support both types of iambic operation. Iambic “A” and “B” Both are iambic but differ when a squeeze is released. Standard Iambic (A) will finish the element it is sending then stop. “B” style iambic will finish the element it is sending then send an opposite element. In other words if you release a squeeze on the “B” iambic during a dah, a dit will automatically issue after the dah finishes. Similarly, visa versa. Its OK if you are used to it! This circuit has been laid out for type “A”, but can be changed using the method found in the section *Variants and options.*

Speed control.

The front panel speed control ranges from approx 8 to 35 WPM.
Calibration of the front panel markings has been left up to the builder, as it was found the resistivity of the pots varied over a wide range. The easiest way to measure the speed of the keyer is to use an oscilloscope connected to the output with the radio also connected to provide an observing voltage. With the Dit paddle pressed, measure the pulse width of the dits, the speed in words per minute is then:

Speed (WPM) = 1200 divided by pulse width in milliseconds

Specification

Supply voltage	4-12vDC (5 to 9v recommended)
Quiescent current	<50uA at 5vDC
Operating current	Depends on Sidetone & +\- keying Approx 10mA
Speed range	Approx 8 to 35wpm
Dit-Space-Dah ratio	1:1:3 standard
Features	Dot Dash memory, Weight control, Sidetone, IAMBIC A or B

Kit contents

Designators	Part Type	Qnty
C1	10UF	1
C2 C3	10NF	2
C4	220NF	1
C5	4N7	1
C6	150NF	1
D1 D2	1N4148	2
IC1	8044ABM	1
J1 J2	Jack Sckt	2
Q1 Q2	BC337	2
R1 R2	470R	2
R10	150K	1
R13	220R	1
R3 R4	1M	2
R5	120K	1
R7	100K	1
R6 R8	5K6	1
R9 R11 R12	47K	3
VR1 Weight	470K trim pot	2
VR2 Speed	470K pot	2
SKT1	20pin IC socket	1

Mechanical parts	Qnty
Printed Circuit board	1
Case 2 part enclosure	1
Base plate	1
Self tap screws	4
Knob with 6BA grub screw.	1
M3 screw x 20mm CSK	4
M3 screw x 30mm CSK	1
M3 nut	5
Spacer M3x10mm	1
Rubber feet	3
Front panel sticker	1
Battery connector	1
Paddle assembly	1
Instructions	1

Parts needed for -ve keying option		
R15	5K6*	1
R14	47K*	1
Q3	MJE350*	1

Building the kit
The kit is easily built using the following tools and extra materials :

Screwdrivers	pliers	sharp knife	soldering iron	wire cutters	flexible wire	Allen key for the knob.

There have been a few changes to the design since the article appeared in Break In magazine. These are the position of the link and the value of R8, both making the battery current lower and extending the battery life. These benefits are a perk of buying the kit!
As there are a few options when building this unit, it is best to read the Variants and Options section in the instruction to decide whether any modifications are needed to the Printed circuit board or case, eg cutting tracks or clearing paint for earths. It is much better to do these things before you start building, or you will find half your wires have fallen off!
The first job is to carefully attach the sticker to the front panel and then cut out the square and round holes using a sharp knife or scalpel, making sure the paddle hole is clear of any overlap.

Printed Circuit Board (PCB):
The printed circuit board is the next item to build. Place all the resistors first and do not try to load too many before soldering and cutting, because the forest of legs becomes impregnable. There are a few polarity conscious components on the board, so double check the diodes, transistor and electrolytic capacitor. Glue the jack sockets to the board with araldite before soldering, as these will take alot of strain over the years. A socket has been provided in the kit for the Curtis 8044ABM chip, so most of the board can be built with no static damage worries. The Curtis chip can be inserted last, make sure you earth yourself to the PCB to prevent static damage. The Dit Dah weight ratio is controlled by a link on the PCB, for standard or increased weighting the link is inserted between the centre hole and the hole nearest R8, to decrease the weight move the link to the opposite hole, ie link the centre to the hole nearest R7. A small 3 pin header plug could be used for the link, allowing easier changing of the weight once installed in the box. Please note the original article in *Break In* magazine showed the link in the other position. With the link in this ‘decrease’ position, the standby battery current is higher and the keyer may require an on/off switch. A quirk not mentioned in the Curtis information!

Final assembly
Once the board has been completed, the battery connector is attached to the PCB, and the board can be connected to the paddle assembly with three 100mm wires, a really bad mistake is to have the battery connected to the paddle inputs, so check it twice! The paddle common ground connection is made to the brass spigot underneath the paddle assembly. This may prove too difficult to solder due to its thermal mass, so it may be necessary to remove the spigot by releasing the countersunk screw on top. It is a good idea to give the brass post a clean while you have it out too, as this forms the common contact. The dit and dah paddle connections are found inside the

rear of the paddle assembly, the convention is to make the left hand paddle the dit.
At this stage it is probably best to test the unit to discover any faults before fitting them inside the case.

The first test.
A little tip: for extra safety when connecting the battery for the first time, include a 6v torch bulb in series with the supply. This will limit the current under fault conditions to something safe, and if there is a fault the lamp will light up. You may find it helpful to fit a speaker during test, even if is not to be eventually fitted, as there is nothing like a bit of noise to tell you it is working (or not).
With the weight link inserted nearest R8, the dit/dah weight ratio can be increased using the trim pot VR1. To setup standard weighting rotate the trimpot wiper to the end nearest the edge of the board.

Fitting the assembly into the box.
Once the PCB has been tested, it is the paddle key assembly that is first fitted to the case with four M3x20 screws, passing through the base plate and holding it to the heavy steel plinth. Tighten them by hand, align the paddle key assembly square to the case and the base plate, then tighten them fully.
Fitting the PCB into the case is a bit tricky, and can be accomplished by first inserting the speed control shaft into the front panel hole with the PCB vertical, then carefully rotating and lowering the PCB into position and down into the horizontal position. Slide the spacer under the PCB and bring up the M3x30mm screw through the hole in the base. Fasten the pot nut first, then the rear M3x30mm screw.
Finally, the battery is secured inside the case with a blob of RTV sealant or double side tape, as it will have a very long life in this circuit. This also stops you stealing the battery to get the stud-finder going in a DIY panic!
Connect the battery, radio key input lead and paddle away! If the key output or side tone fails to work, the instructions include a section on Fault Finding.
The project is finished off by fitting the case cover with the self tapping screws provided and adding the rubber feet to the base, two in the front and one in the centre along the back edge.

Fault Finding
Any fault will benefit from these checks:

Check IC1 in backwards?
Diodes or transistors in backwards?
Component values, tick them off the layout when checked.
Visual inspection of the PCB solder side, check for shorts.
Visual inspection of the PCB solder side, check for unsoldered legs.

Types of fault:

No keyer output from the jacks or sidetone output.

Dead battery?
Open circuits around D1. Check supply voltage on IC1 between pins 1 and 2. Pin1 should be +8.3v for a 9volt battery.

No keyer output from the jacks but sidetone OK

Diagnostic check : remove IC1 and short pin 18 to pin 1, if this does not key the transmitter, check for shorts around Q1 and the jack sockets.

Constant key down output but no sidetone:

D2 backwards.
Short circuits around output jacks.
“Weight” Link missing.

Constant key down output and constant sidetone:

Bad connections around the speed control pot.
Open circuits around C6, R11.

No sidetone output but keyer output from the jacks OK

Diagnostic check : remove IC1 and short pin 17 to pin 1, if this does not click the speaker, check for short or open circuits around Q2. Check for short or open circuits around R9, R10 or C5.

Dit but no Dahs or visa versa

Wrong connections to the paddles.
Common line swapped with paddle connection.
Bad connection around R1 or R2.

Variants and options.

Case grounding.

In this unit no connection has been made to the case earth, but in some cases RF feedback may cause a constant key down condition. If required, the easiest way is to solder a wire between the speed pot case and the paddle common PCB pad.

Iambic A or B?
This circuit has been laid out to utilise the iambic “A” style, but can be changed to “B” by cutting the track to pin 8 and connecting that pin to ground.

Negative keying or Positive keying?
Before starting the construction of this unit it is important to ascertain whether your radio needs the negative keying option to be implemented. This can be done by measuring the voltage across the key input to the radio with a DVM, with the black lead on the chassis contact. If the voltmeter reads negative, the radio requires a keyer with negative keying output, and the specified MJE350 transistor will handle up to 300v. If the voltmeter reads positive the standard keyer will suffice, however if the voltmeter reads more than 50v you will need- to use a higher voltage output transistor for Q1 or a relay, as described in the following section Relay Output.
Some minor changes are required for the negative keying option, involving an extra three components, drilling out pads and inserting two links. The protection diode D2 must also be reversed, otherwise the radio will be constantly keyed on. It should be noted these changes make the positive battery connection common to the keying input pin of the radio, but that is not a problem in most cases.
Units supplied ready built will not have this option installed, but it can be added by the owner.

Relay Output
If the voltmeter tests on the key input read more than 50v either way you will have to revert to using a 9v reed relay, as the transistors will breakdown above this voltage. This requires breaking P11 and P10 and connecting the relay coil between Q1 collector and +ve supply. Make sure a diode (1N4148) is connected across the relay coil with the cathode connected to supply. Connect the normally open relay contacts to P9 and P13 and remove diode D2.

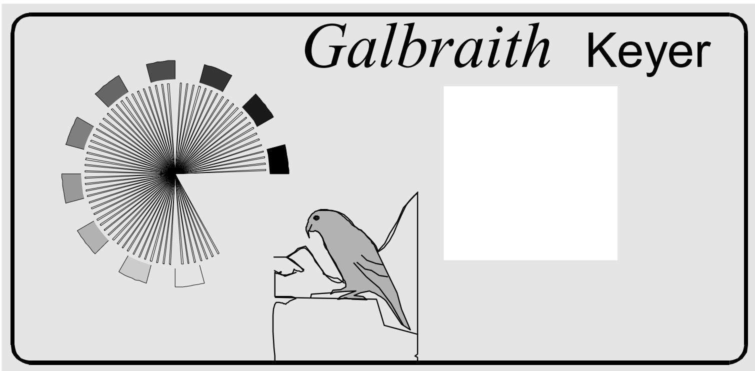
Side tone option.
All the parts for sidenote have been supplied in the kit except for the speaker. This can be a standard 8ohm radio type, or a high impedance earphone. Even a piezo tweeter can be used, its up to the builder tho choose the quality of sound. A volume control can also be included in series with the speaker and fitted to the rear of the case if required. A louder sidetone can be obtained by lowering the value of R13.
The side tone circuit can be disabled to save battery current by removing R9,R10, R12, R13, C5, Q2 and connecting a 150K resistor from pin 16 of IC1 to the +ve rail in the holes provided. Sorry, no refunds on unused components, but keep a lookout for new Branch 05 projects using 3 resistors, a capacitor and a transistor!

Conclusion

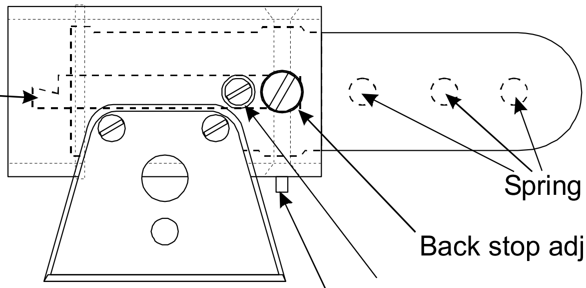
We at the “Brass Pounders” section of Branch 05 decided New Zealand needed its own electronic keyer, and here is the result of our efforts. What else could we call it but the “KEA”? Only a parrot can give perfect copy.

Units built and tested by the Brass Pounders are available at an additional cost of NZ$30, a little more than a pound of brass.
If you find it difficult to build this kit, return it to Branch 05 for building and testing by the Brass Pounders.

References
1. DF components. Tel 09 537 6370 P.O.Box 82-272 Highland Park, Auckland.
2. South Island components. Tel 03 379 8833 P.O.Box 4206 Christchurch.



The Galbraith Keyer Paddle GKII
as used in the Galbraith KEA keyer



Galbraith Keyer Paddle GKII

The GKII paddle assembly has been precision engineered for maintenance free long life and reliable precise handling. While the unit is of rugged construction, abusive or rough handling may effect the delicate feel.

Electrical connections.
The electrical design of the GKII allows for it to be ideal for use within the Galbraith KEA keyer. The paddle contact connections are to be found inside the rear of the unit, and the earth connection is made via the small brass spigot underneath the unit. This common connection is isolated from the chassis of the KEA. If the GKII has been stored for some time, it may be advisable to remove the brass contact rod and clean the surface with a mild abrasive of kitchen cleaner. This can be done if the rod needs to be removed for wire soldering.

Mounting.
Although the GKII can be mounted on the back of a front panel, the KEA keyer has been designed to take the GKII mounting brackets as in the shown position. The GKII is fixed to the KEA baseplate with four M3 screws and nuts.

Adjustment:
By adjusting the position of the contacts, back stop screws and the spring, the paddle may be set to your liking for feel and movement. Moving the spring closer to the contacts will make the paddle pressure lighter.
The Backstop screws determine the paddle spread while the contact screws regulate the travel. Three pairs of nipples on the inside of the paddles allow for repositioning of the spring. The further the spring is mounted from the body the greater the pressure.