8044 Series Keyer-on-a-Chip: Application Note

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The story of the 8044 really began in 1973 when its predecessor, the 8043, was first introduced. It was the first integrated circuit designed specifically to perform the electronic Morse keyer function. It included debouncing circuitry for the key paddles, a clock oscillator, the divider and logic to produce dashes and iambic mode (alternating dots and dashes when both paddles are closed), a sidetone oscillator, weighting circuitry (to lengthen dots or dashes at the expense of the intervening spaces) and finally, an output stage capable of driving an NPN keying transistor.

All devices in the family utilize CMOS metal gate technology for noise immunity and low power consumption. An 8044 typically draws less than 1 microampere from a 9V supply when at rest. When operating, nearly all of the power consumed is used for driving the sidetone and output transistor.

Then the 8044

In 1975, an improved version of the 8043 was introduced. This new 8044 chip, a close pin-for-pin substitute for the 8043, included two major improvements. It did not require a symmetry adjustment to equalize the length of dots and spaces and it added dash memory for true iambic operation (dashes could now be inserted reliably). Because of the redesigned clock circuit, the 8044 required a clock capacitor (C1 in figure 12) of one-half the value used for the 8043. Also, the 1 megohm symmetry trimmer necessary for the 8043 could (and should) be removed.

It also turned out that 1 megohm and 0.01uF were better values for the debouncing circuits and these values are now recommended. The problem with the previous values was that the 0.1uF capacitor specified (with 100K) sometimes caused substrate current spikes which interfered with the dash generating flip-flop inside the chip. This interference occasionally caused dashes to generate with the wrong length. In later production, design changes reduced the susceptibility but the new values are still recommended for consistency.

Next the 8044M

In 1980, the “M” versions of the 8044’s were added. These devices added a speed indicating function to the circuit. The 8044 and 8044M were kept reasonably compatible by adding the required two new pins to the end of the package. This allowed the “M” version to sit in a socket designed for the plain 8044 just by allowing two pins on one end to overhang the socket. Or, an older keyer could have the speed indicating circuits added by finding a way to wire to the two extra pins while the other 16 pins enter the socket in the usual manner. The speed readout uses a 50 microampere analog meter. (more on this later).

Later the “B” versions

A year or so later, it became apparent there had developed two schools of iambic (squeeze) keying. Whether by accident or design, two completely different types of keyer circuits had evolved. We called the second type “B” since obviously ours must be type “A”. The difference is subtle and of importance only to those who “squeeze” key. More on this later too.

The “ABM”

In the spring of 1986, production of a new design began. It was called the 8044ABM. This 20-pin device rolled all the characteristics of the earlier models into a single IC. At the same time it added an often asked for feature, *negative* (reduced) as well as *positive* (added) weighting.

The 8044ABM is not pin compatible with the earlier designs. However, it offers switchable type “A” and “B” iambic, switchable negative or positive weighting, an output for an analog speedmeter plus the other usual 8044 keying characteristics. Since this IC is capable of “A” or “B” iambic and is “M”eter ready, we use the suffix “ABM”.

Notice: The 8044, 8044B, 8044M and 8044BM are no longer in production and should be used only for replacement, not new designs. The 8044ABM should be used for all new construction.

Electrical Specifications

Supply Voltage	4Vdc min., 12Vdc max. (5 or 9Vdc recommended)
Quiescent Current	Less than 50µA at 5Vdc
Operating Current	Depends on sidetone and keying arrangement. Averages 10-30 mA. keydown.
Speed Range	Unlimited using external R and C. Normally about 6 to 50 wpm.
Weight Control	Weight can be added or subtracted via the weight control pot.
Dot-Space-Dash Ratio	1:1:3 standard. A or B Iambic
Sidetone Oscillator	Internal using external R and C.
Key Debouncing	Internal using external R and C.
Package	20-pin DIP (J SM package available)

Figure 1 shows the pin functions and number assignments for the 8044ABM.

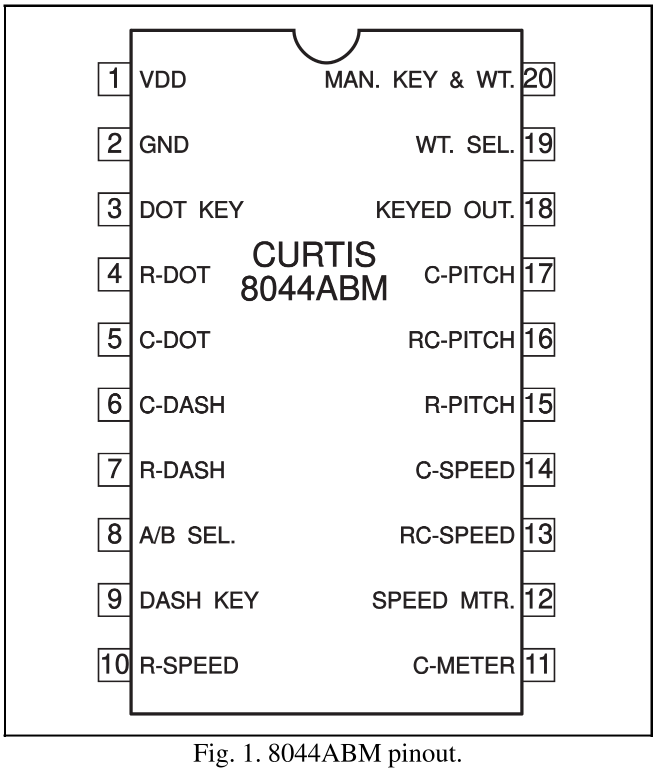

Fig. 1. 8044ABM pinout.

FUNCTIONS

At first glance, a keyer doesn't appear to be too complicated. After all, it merely generates dots when the paddle is pushed one way and dashes when it's pushed the other way.

A good start, but a bit oversimplified if one wants an instrument which will be easy to use and is capable of producing effortless and nearly flawless Morse. Let's look at all the interesting complications and how each is handled.

Single and double lever paddles

The first decision, what kind of paddle shall we use? In the early days of electronic keyers, the paddles were almost all single lever. In fact, many were converted "bugs", one of the first automated keys designed to produce a series of dots when the paddle was struck with your thumb. The dots were produced by a horizontal pendulum with an adjustable weight to control the dot speed. You made the dashes yourself with your index finger to suit your taste.

The name "bug" came from the trade name "Lightning Bug" used by Vibroplex, a maker of keys since 1890 and still at it today.

Many operators continue to use the mechanical bug, It is a vast improvement over the straight key in terms of ease of operation and when properly used, can produce excellent CW. It also has the advantage (?) of allowing a highly personalized and recognizable keying style. Also, it permits the transmission of land Morse which employs long dashes.

Back to the question of paddles. The single lever paddle is a single-pole, double-throw switch. It can be moved either to the right or the left, i.e., to produce either dots or dashes. See the dashed box in figure 2.

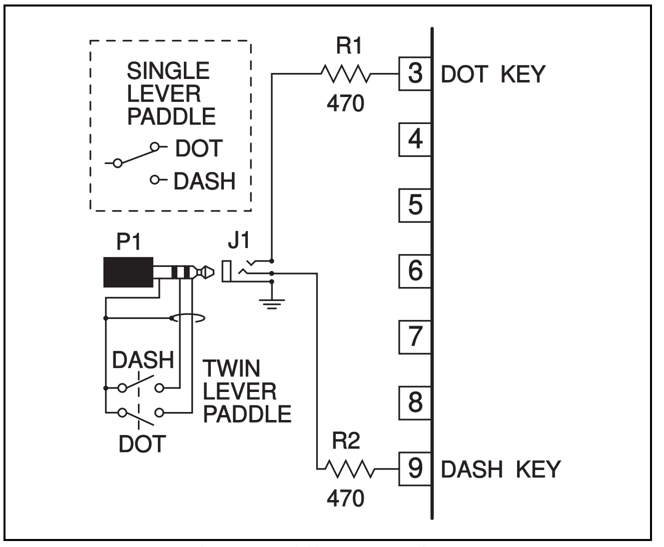

Fig. 2. Paddle connections.

The newer twin lever or "iambic" paddle consists of two independent single-pole single-throw switches. Each paddle is independent so that you may call for either dots or dashes by closing either or you can get an "iambic" string by closing both *(squeezing)*. Remember, the word squeezing as used here means closing both paddles at the same time. Since it is impossible to close both paddles simultaneously, one lever always precedes the other to signal whether a dot or dash is to be generated first. Figure 2 shows the connections for a twin lever paddle. R1 and R2 are static current limiting resistors. Note that the dot and dash wires in the paddle cable should be contained in a shield which serves as the common connection.

"Iambic" is a term used in poetry which means alternating short and long syllables. In keying, it means a string of alternating dots and dashes. The stream commences with the element (dot or dash) corresponding to whichever key was closed first.

Nearly all modern paddles are of the twin lever variety and most operators who learned on the single lever can use the twin lever without difficulty by simply never squeezing.

Squeeze keying

This brings us to the question of squeeze keying. Let's call keying without squeezing, "slap keying". Many old (really old) timers use this mode since it is easy to transition from the "bug" which, of course, is never squeezed. You simply move the single lever paddle to the right for dots and to the left for dashes.

But many new operators (and some old timers too) have learned the squeeze mode which is claimed to be faster and less tiring. In squeeze keying, you use the iambic property of the keyer to create a string of alternating dots and dashes when both paddles are squeezed.

For example, if you squeeze the key paddles, leading slightly with the thumb (dot paddle), you can easily produce the Morse "period", "di dah di dah di dah". Some other characters produced by releasing the squeeze earlier, are the "AR" (di dah di dah dit) or the "AA" (di dah di dah), the "R" (di dah dit) or the "A" (di dah). By starting the squeeze with a dash, we can produce characters like "N", "K" and "C". By squeezing during a letter, we can make other characters like "L", "Q" and so forth. Squeeze keying is fast and easy since it minimizes finger and wrist motion.

Type "B" iambic

The procedure described above is typical of what we call iambic type "A" or the original Curtis method. In type "B" iambic, a squeeze *released during* an element (dot or dash) will cause another *alternate* element to follow the one being produced.

For example, it you squeeze to produce a "period", then you must release during the third dit (or the space following). The last dah will automatically transmit. For another example, to make a "C", you must release during the second dah (or the space following) and the last dit will automatically transmit. Presumably, this further reduces the effort to produce some letters.

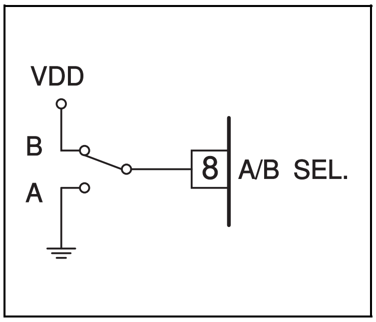

Fig. 3. Iambic A/B select.

But at high speeds, the necessity to release during the (very short) dit period may be difficult. The window for action on the "B" type is one-half that on the "A" type.

Figure 3 shows iambic switching circuitry for the 8044ABM. The A/B SEL. pin must always be connected either to Vdd or ground.

Which is preferred?

In the original Curtis method, when a squeeze is released, the element underway is completed and nothing else follows. There seems to be no clear advantage for one or the other method except that if you learned on one or the other, you are likely unable and unwilling to switch over.

Keyers such as the AccuKeyer, AEA, Heath, Nye, MFJ memory keyer and Ten-Tec use method "B". Of course, all keyers using the Curtis original 8044 are type "A". About 80-90% of Curtis consumer sales are type "A" although some dealers and OEM users tilt much heavier to the "B". Since the type "A" and "B" are exactly pin-for-pin equivalents except for the aforementioned iambic keying variation, it is easy to change from one to the other.

Self-completing dots and dashes

Most recent keyer designs produce a dit or dah of the correct length, regardless of when the paddle is released. Somewhat less universal, but still a requirement of any serious keyer, is that the space between elements must never be allowed to shorten by early key closure.

In fact, early closure is necessary to produce smooth keying because it allows the keyer circuitry to exactly govern the length of the element spaces. Some keyers have the option of automatic character and/or word spacing also. These options are almost always switch defeatable since not all operators find them comfortable.

Dot and dash memories

Dot memory is absolutely essential in any serious electronic keyer. Dot memory allows a keyer to remember that you hit the dot key even though you hit the key early and did not wait for the dot to commence. Send a fast "N" on any keyer to test this feature. You cannot hit the dot and dash key fast enough to prevent both transmitting. If you do not have dot memory, the dot will be lost in most cases.

Of less importance in ordinary sending is the dash memory. Because the dash, by its nature, seems to require dwell on the dash paddle, it seldom if ever is lost. To test for this feature, send an "A" as fast as you can move the paddles. You will always get the dit followed by the dah.

For true iambic operation, both dot and dash memories are required for reliable dot or dash insertion.

Key debouncing

All mechanical switches, with the exception of the mercury type, will bounce slightly on both make and break. Unless the response of the keyer is conditioned to ignore this bouncing, the circuit will think the operator is doing the switching and operate accordingly. The result is unwanted elements and can render an otherwise good design worthless.

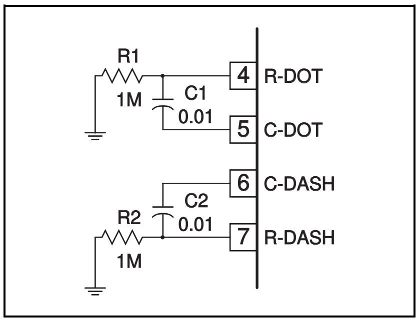

Fig. 4. Debouncing circuitry.

Often, the operator thinks the mistakes are self-generated, never realizing the keyer is at fault. To avoid this problem, the inputs must be conditioned to eliminate the effects of bounce. The bounce is usually on the order of 5-10 milliseconds.

While this may seem short, it begins to approach the length of a dot at high speeds. Dot length, at 50 wpm, is only 24 ms. The debouncing must not be so sluggish that it slows an operator trying to send at high speeds. C1, C2, R1 and R2 in figure 4 comprise the debouncing filters for the 8044.

Weight Control

Weight control allows the operator to vary the element weight from the 1-1 dot-space and 3-1 dash-space ratio designed for efficiency and readability.

On occasion, we have been asked if there is any possibility of changing the dash-space ration to 4-1. This is not possible with the 8044 as the 3-1 ratio is set by digital circuitry inside the chip.

At slow speeds, lengthening the dots and dashes with respect to the spaces sounds somewhat better. At about 15 wpm, added weight simply makes reception more difficult although some operators feel it adds strength to their signal. Of course, it will raise the average power but the *readability* of the received signal is of primary importance.

Some operators feel weight control has no place on a keyer because if misused it can degrade readability. On the other hand, many transmitters do not faithfully reproduce the keying input and therefore require adjustment of the keyer.

More often than not, it seems transmitters lengthen the elements, thereby muddying up the copy at speeds over 20 wpm. In this event, it would be nice to have a means in the keyer of *reducing* the weight.

Although this need was addressed in the design of the 8044ABM, it was not easily accomplished with the early 8044 series without adding another shaping stage to the output circuitry. With the earlier 8043, the symmetry control would do this trick but it is doubtful many tried it.

If you have the problem with your transmitter, you can be sure someone has found the same thing before and can give you a fix, usually a change in a resistor or capacitor value in the transmitter keying circuitry.

As noted earlier, in the design of the 8044ABM, this need for *negative* weighting was provided for. Positive or negative weighting can be switch selected.

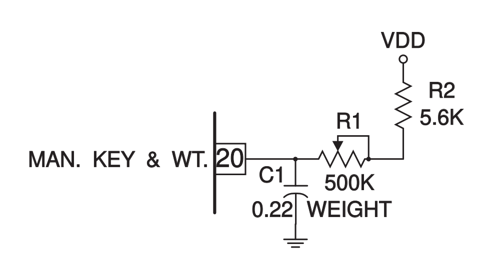

Fig. 5. Weighting circuitry.

In figure 5, C1, R1 and R2 determine the amount of weight added to the signal. The higher the value of each, the more weight is added. If a weight control is not desired, you should omit C1 but a (pullup) resistor of from 5.6K to 100K must be connected from the MAN. KEY & WT. pin to Vdd.

Using the storage of C1 and the decay time provided by R1 and R2, the circuit used here stretches each dot and dash by a constant amount regardless of what speed is being used. In other words, the weight added is not a constant ratio of the dot or dash length. In the case where the circuitry is configured to offer negative weighting, the circuit in figure 5 adds length to the spaces between the elements. This has the effect of shortening the elements, thus negative weighting.

Added weight for one speed setting will probably not be suitable for another weight setting. In fact, if you add a reasonable amount of weight for 10 wpm and then increase the speed to 50 wpm, you may reach a point where the code stream becomes a solid signal.

More than one keyer has been returned to the factory for service simply because the weight control has somehow been turned to maximum and forgotten.

An *audio taper* (semi-log [C3]) potentiometer should be used for the weight control.

Sidetone circuits

Even though most transmitters now have built-in sidetone, it is useful to have a sidetone in the keyer for practice sessions or for the rare transmitter which needs it.

The 8044 contains the sidetone oscillator function. An external R and C is required to complete the circuit. Output is taken from one end of the RC network since an additional pin just for this function could not be spared (and twenty-one pin packages never caught on).

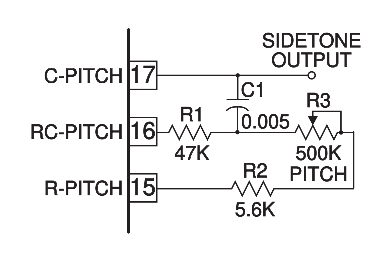

Fig. 6. Sidetone generator.

The frequency range of the sidetone with the components shown in figure 6 is from about 200Hz to 14kHz. The 47K resistor, R1 is required to limit substrate currents from C1 preventing malfunction of the IC.

You can tap into pin 17 (C-PITCH) with a high impedance load to extract the sidetone at a low level. For a really powerful sidetone amplifier circuit (which takes 100mA at full volume and drives a small 8 ohm speaker), see figure 7.

The most suitable sidetone pitch control is a *reverse* (right-hand semi-log [C3]) taper. If you substitute the more common audio taper, connect it backwards so full clockwise (maximum

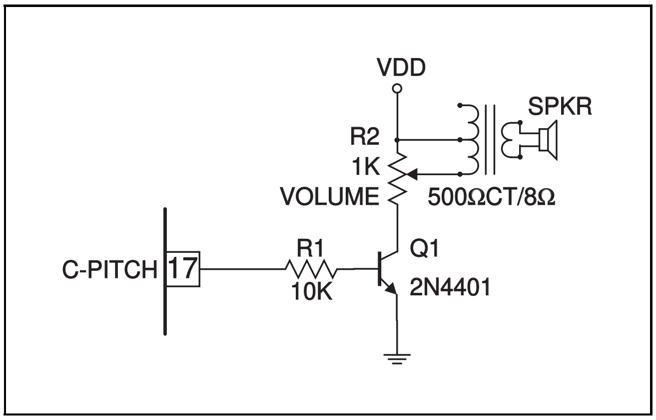

Fig. 7. Sidetone amplifier.

resistance) sets the *lowest* pitch. Otherwise, the settings will be very compressed at the high pitch end.

Output to the keyline

When a dot or dash is generated, the 8044 provides a high level, about equal to Vdd if the load is small. In most applications, this signal is used to drive an NPN transistor. Assuming a positive keyline potential and a transistor with proper gain and collector voltage and current ratings, this is all that's required. See figure 8 for an example of an output circuit

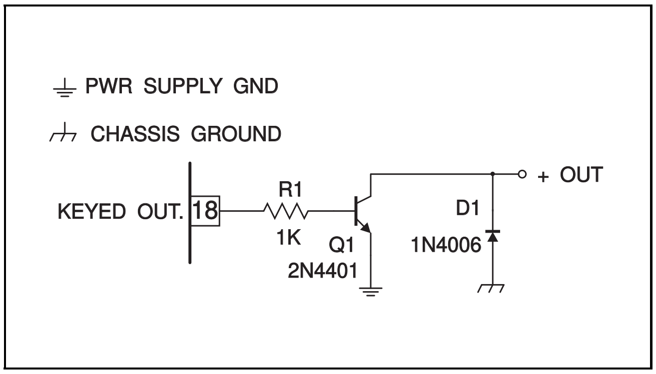

Fig. 8. QRP output circuit.

suitable for a low voltage, low current keying application such as a QRP rig. R1 may be as high as 10K if the keyline current is less than 50 mA.

D1 prevents damage to Q2 if a negative voltage is inadvertently connected to the output.

To key positive keyline rigs with higher voltage or current requirements, see the circuitry in figure 9. This circuit will key up to 300 Vdc at 100 mA if R2 is 1K ohms. It will key up to 200 mA if R2 is 330 ohms. These figures assume a Vdd of 9 Vdc. Figure about half the current if using 5 Vdc for Vdd.

D1 prevents damage to Q2 if a negative voltage is inadvertently connected to the output.

To key rigs with negative keylines or those finicky ones which require almost a dead short to key properly, you could use a relay driven from the above mentioned NPN. Or if you want

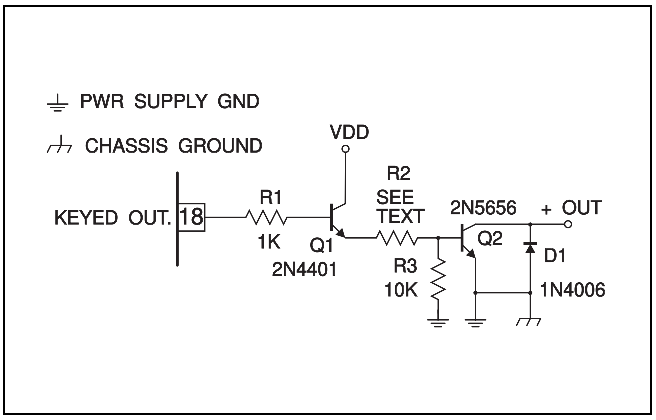

Fig. 9. Positive keying circuitry.

transistor keying for a negative keyline, you can use a PNP transistor driven from the NPN.

Figure 10 shows a typical circuit for keying a negative keyline.

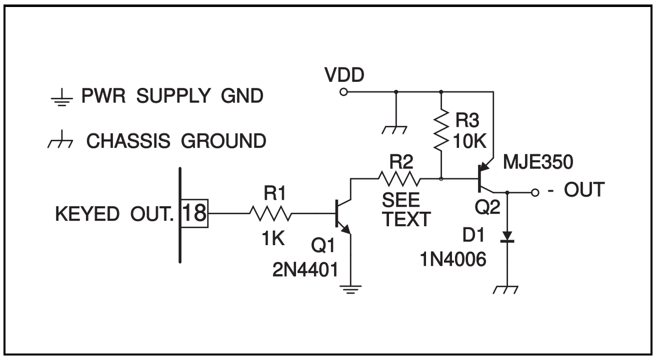

Fig. 10. Circuitry for negative keyline.

This circuit will key up to -300Vdc at 100 mA if R2 is 1K ohms. It will key up to 200 mA if R2 is 330 ohms. These figures assume a Vdd of 9 Vdc. Figure about half the current if using 5 Vdc for Vdd.

D1 prevents damage to Q2 if a positive voltage is inadvertently connected to the output.

All the output circuits here yield only one $V_{ce\ sat}$ from the output to ground when the output transistor is on. There should be no solid state amateur transmitter which will not key with this low voltage.

These circuits are also capable of keying archaic marine transmitters with outrageous (dc) current and voltage requirements. Although the circuit may sink close to the 200 mA limits shown here, special attention may need to be paid to insuring sufficient drive is available to the output transistor to lower $V_{ce\ sat}$. Otherwise power dissipation (keydown current times $V_{ce\ sat}$) may be more than the transistor can handle.

Stopping the turn-on transient

When a keyer using the 8044 Series IC is first turned on, it can key the keyline momentarily when the internal IC circuitry resets. Some transmitters and most operators do not like this. The circuitry in figure 11 was developed to prevent the turn-on

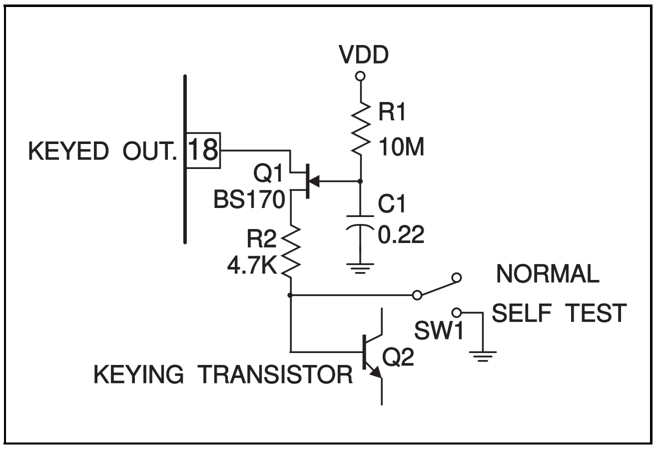

Fig. 11. Anti turn-on transient circuit.

transient by opening the circuit to the keying transistor with a FET (Q1) for a second or so when the power is switched on. R1 and C1 cause the RC time delay. The BS170 is a Motorola device. SW1 disables the keyed output for “self-testing”.

Some thoughts on the clock oscillator

Most keyers use what is called a triggered clock. That is, the code oscillator runs only when started by a paddle closure. Keyers have been made which run continuously and you must synchronize your keying to match.

This is difficult to do in practice but might produce accurate CW if mastered. In fact, the difficulty in using character and word spacing is in part due to the difficulty of knowing when to resume keying precisely enough to suit the keyer.

Many memory keyers use a free running clock during the time the memory is being loaded which makes accurate sending at that time more demanding.

Another property, not of the basic keyer but of the implementation, is the inclusion of a fixed resistor (R2 in figure 12) or trimmer in series with the speed control. This adjustment allows an operator to limit the speed which the keyer will attain at its maximum.

Most commercial keyers are made to go to 50 wpm. But this is higher than many operators need or want. An adjustment of the “max. speed trimmer” will limit maximum keyer speed and provide a narrower range of adjustment for the speed control.

A further concern in the implementation of the keyer is the type of capacitor used for timing (C1). Some of the small, inexpensive and unstable ceramic types can cause the first cycle of the oscillator to be of a different length (usually shorter) than succeeding cycles. This is easily seen on an oscilloscope and is detectable by operators with keen ears.

The solution is to use a high grade ceramic, or better yet, a mylar unit. Never use polarized capacitors such as tantalum or electrolytic for the clock oscillator as their leakage and instability can cause trouble in these high impedance circuits.

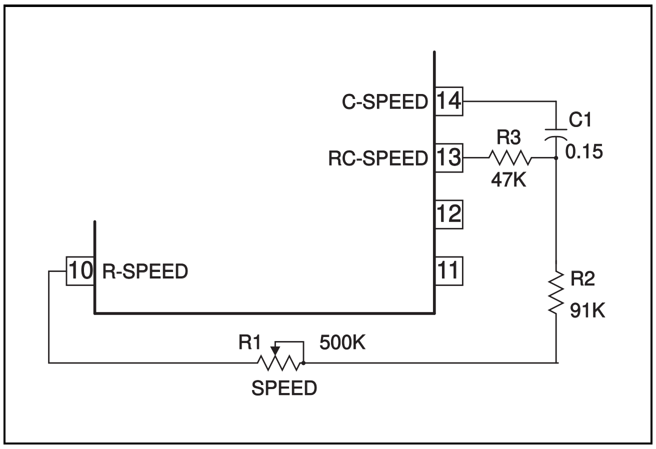

Fig. 12. Speed circuitry.

The 47K resistor, R3 is required to limit substrate currents from C1 preventing malfunction of the IC.

The speed control should be a *reverse* (right-hand semi-log [C3]) taper the same type and value as the pitch control.

Again, if you substitute the more common audio taper, connect it backwards so the lowest speed (maximum resistance) is when the control is full clockwise to maintain maximum ease of setting. With the reverse taper control, the lowest speed is full counterclockwise. If the controls are connected otherwise, the high end of the speed range will be extremely cramped.

The speedmeter

The speedmeter circuitry in the 8044M series takes advantage of the averaging property of a moving coil meter. When you send a series of pulses through this type of meter at a frequency just a bit higher than its “flicker frequency”, the meter pointer will remain stationary at some intermediate point on the scale.

For example, if you send a current of 100 microamperes which is on 50% of the time and off 50% of the time through a meter with 100 microampere full scale calibration, the meter will indicate 50 microamperes, the average value of the current. C2 in figure 13 is added to damp the meter so that it will remain nearly stationary for code speeds as low as 5 wpm.

The value of C1 attached to the C-METER pin of the 8044M in conjunction with the resistance value internal to the IC, cause the speedmeter pin to go low for about 1 to 1.5 ms. each time the keyer clock changes state. As the keyer is adjusted to go faster, the rate of pulses increases accordingly causing the average current to increase.

Since the speedmeter is connected to Vdd on the one end and to the low pulsing pin on the other, an intermittent current flows and the average of this current is indicated. By adjusting R1 and R2, the meter can be made to indicate the keyer speed directly in wpm.

A 50 microampere meter is the best choice since it suits the circuit and the scale is printed from 0 to 50. For speeds up to 100 wpm, use a 100 microampere meter. C1 should not be

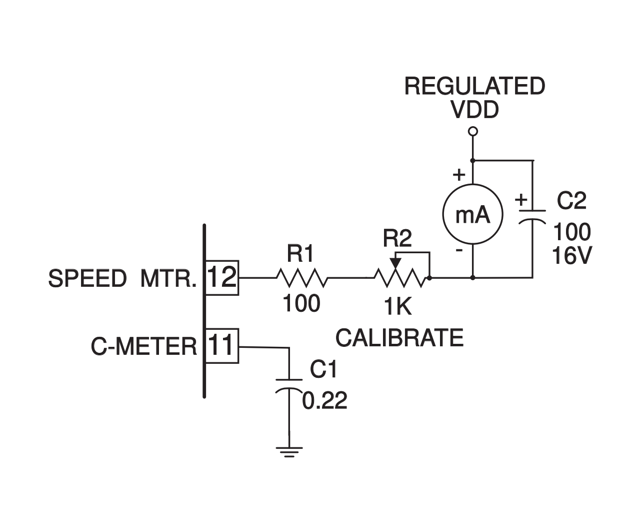

Fig. 13. Code speedmeter circuitry.

increased beyond 0.22uF in value to maintain accuracy and linearity.

Some meters, such as the (cheaper) "iron vane" variety, do not average properly when a smoothing capacitor (C2) is used. Use a moving coil, D'Arsonval movement to be safe. (If you can find one!)

It is possible to use a meter with a 1 mA movement however the meter face will say 0 to 1 when what you want is 0 to 5 or 50 or 500 to reflect your maximum desired speed of 50 wpm.

Please note that a regulated supply must be used to power the meter so that the indication is stable with varying power supply voltage. If the speedmeter is not required, the keyer chip does not require a well regulated voltage. Of course it should be free of rectifier ripple.

Connecting a Straight Key

Connecting a straight or manual key to the 8044ABM is not

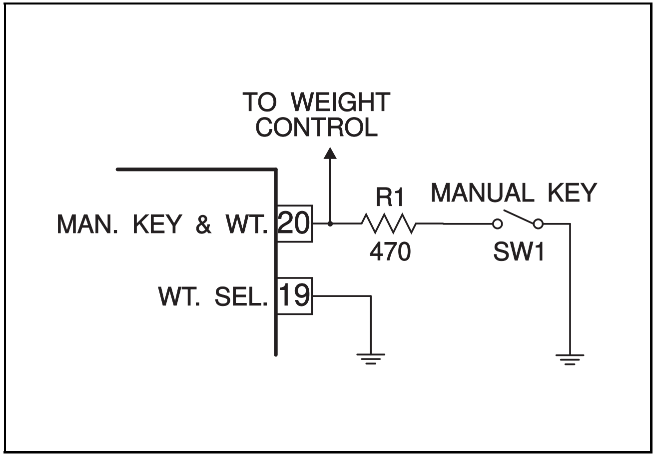

Fig. 14. Manual key with positive weighting.

quite straightforward because of the circuitry which provides for negative weight control.

The normal way to connect a manual key is from the MAN. KEY & WT. pin to ground. This works fine if the 8044ABM is *permanently* configured for positive weighting as shown in figure 14. Note that the WT. SEL. pin is permanently grounded.

However, if you plan to take advantage of the 8044ABM capability for negative *or* positive weight control, you must configure your circuit like figure 15. In this configuration, we retain the ability to switch from type "A" to type "B" iambic keying through the use of SW2. When pin 19 (WT. SEL.) is grounded, the weight control will add weight to (lengthen) the dots and dashes when the resistance is increased. When pin 19 is connected to Vdd, the weight control will subtract weight from (shorten) the dots and dashes when the resistance is increased. R2 is required to limit current when D2 grounds pin 19.

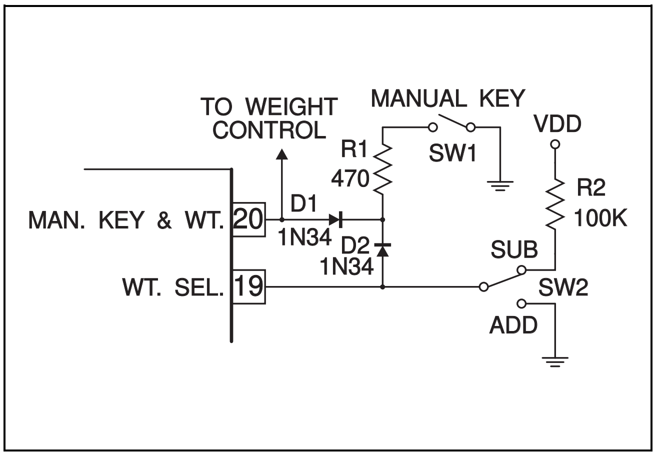

Fig. 15. Circuitry required for switchable weight control.

Note that when the manual key closes, D1 grounds the MAN. KEY & WT. pin as usual, but it also causes the WT. SEL. pin to go low through the action of D2. This shifts the 8044ABM back into the positive weight mode regardless of what mode it was in before the key closed. And we learned earlier that the manual key will work normally if the chip is in the positive weight mode.

The problem we have avoided is that the MAN. KEY & WT. pin has the sense of its output reversed when in the negative weight mode. That is, the pin is high when an element is underway. This is the opposite of the sense when in the positive weight mode where the same pin is low during an element.

The WT. SEL. pin must always be connected either to Vdd or ground. The MAN. KEY & WT. pin must always be connected to Vdd through at least a 5.6K resistor. If you are using weight control, the path is through R1 and R2 as shown in figure 5. If you are not using a weight control, use 100K to Vdd as shown in figure 19.

R1, the 470 Ohm resistor in figures 14 and 15 is required to limit static discharge currents.

Input protection

The 8044 series ICs are CMOS and therefore require protection for the high impedance gate inputs. A protection network is provided inside the device itself and consists of a series resistor and silicon diodes to both ground and Vdd.

Static charges of reasonable levels encountered during handling and before connection to a circuit (which is usually of lower impedance) are dissipated in the input structure without permanent harm. But if the applied voltage is too high and the capacitance of the pair too great, the resulting current can damage the IC. It may result in an immediate malfunction or it may lead to a very short operational life.

In the past, for additional static protection, we recommended *germanium* diodes be added outside the IC from the dot and dash lines to both ground and Vdd. The lower forward voltage drop of the germanium, relative to the silicon diodes inside the IC, results in most of the applied current draining through them. *Silicon* diodes added externally provide no protection. We now believe the series resistors in the paddle and manual key lines are the best form of static discharge protection.

For maximum protection, series resistors of from 470 Ohms to 1K added to the dot, dash and manual key input lines are now recommended to limit input currents from external voltages. If these resistors are added, the external diodes may be omitted. Note: *Never stick CMOS ICs in styrofoam!*

Keyline Output Characteristics

For those of you interested in the driving characteristics of the keyline output transistors in the 8044 Series, please refer to figures 16 and 17.

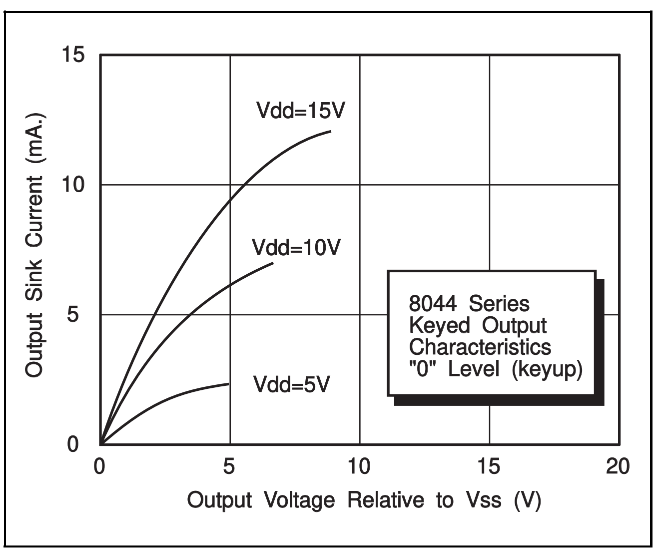

Fig. 16. Keyline output sinking characteristics.

Figure 16 shows the output characteristics when the output sinks current, that is it pulls current from the load to ground. (For example, a load resistor from Vdd to the output pin.)

Figure 17 shows the output characteristics when the output sources current, that is when the load carries current to ground. (For example, a resistor from the output pin to ground.)

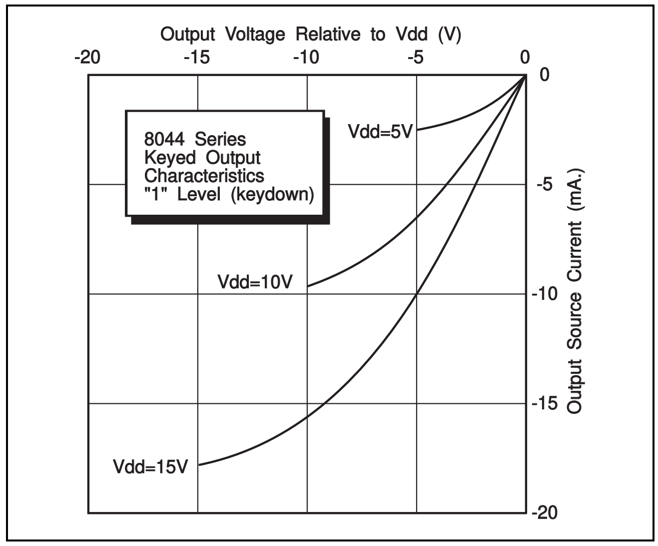

Fig. 17. Keyline output sourcing charactistics.

Controls for Speed, Weight, Pitch and Volume

For the best results, you should try to obtain potentiometers correctly suited to the function. For example, the pitch and speed controls should be what is called reverse (lefthand) log taper. Controls with this taper are not easily found these days however they serve to make the speed and pitch adjustments much more linear (easy to adjust). A linear taper or audio taper will make the adjustment very cramped at one end.

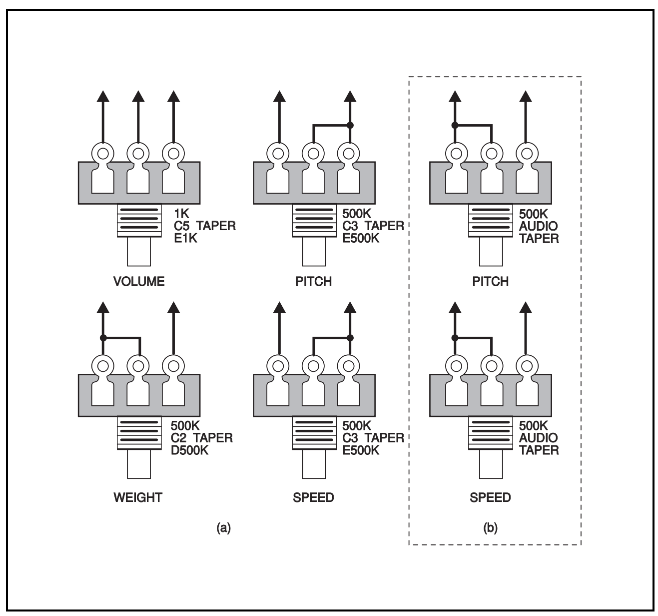

Fig. 18. Control wiring.

The weight control should be of audio taper (righthand log). This control is easily found. The volume control should be linear taper. This control is not too hard to find either.

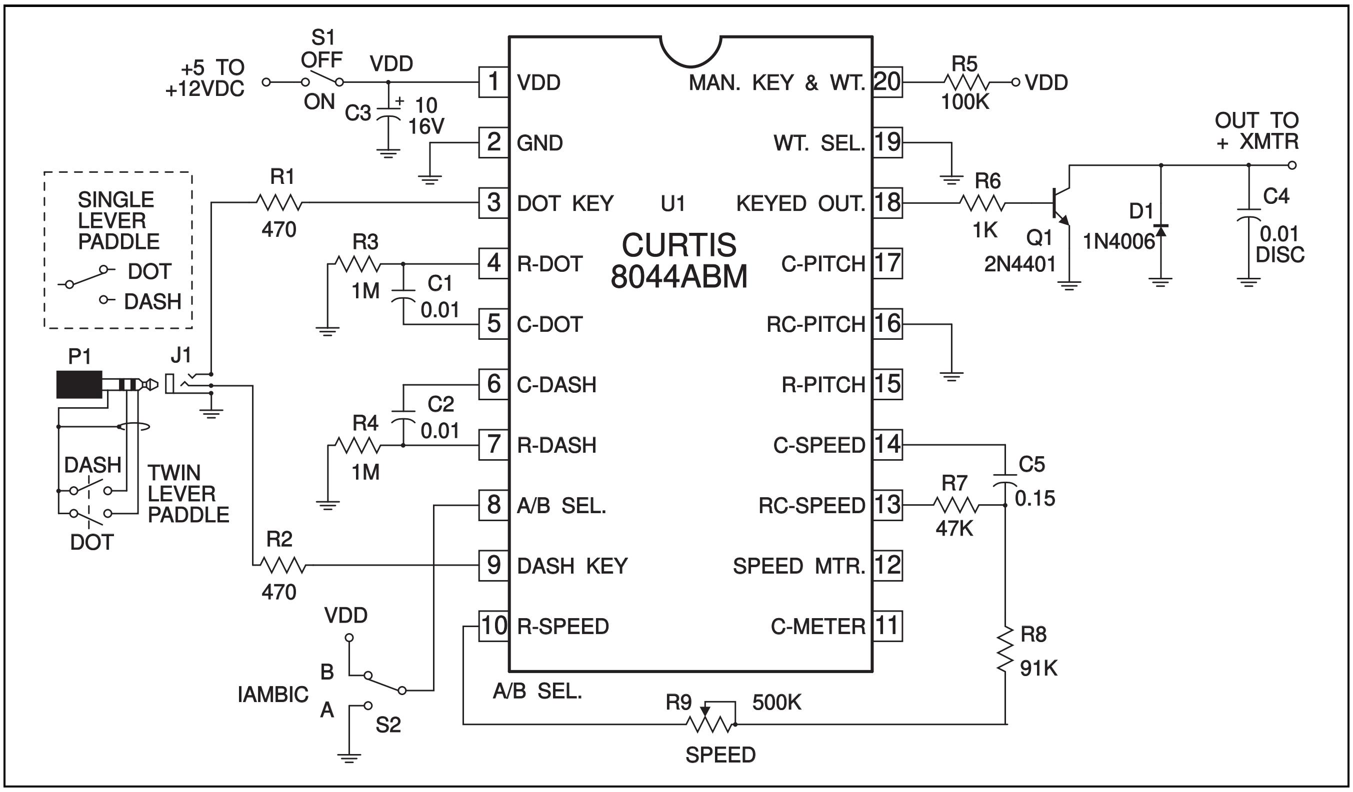

Fig. 19. Simplest Possible Keyer Circuit.

If you find the correct controls you will wire them as shown in figure 18(a). If you use audio taper (righthand log taper) potentiometers for speed and pitch, wire them as in figure 18(b). But, remember for this trick to work you must reverse the usual sense of the controls.

In other words, turning the speed control clockwise must slow code speed down and turning the pitch control clockwise must result in lower pitch. This is the opposite of what you will obtain with the proper (reverse log taper) controls wired as shown in figure 18(a).

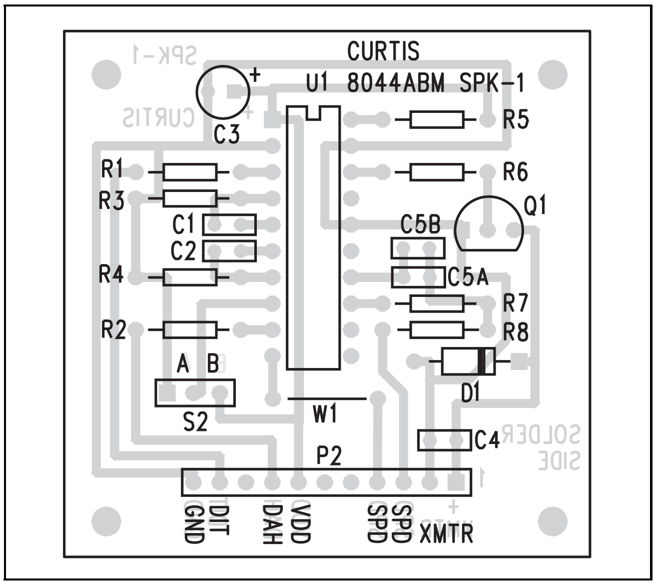

Fig. 20. Pictorial of printed circuit card.

Simplest Possible Keyer Circuit

Figure 19 shows the minimum number of parts for a very basic keyer. The keyer has no weight control, no sidetone generator and an output circuit capable of driving only a solid state transmitter with a positive voltage keyline. An A/B switch is included however the A/B SEL pin could be wired either to Vdd or ground if only A or B iambic (but not both) will be used.

Figure 20 is a suggested PCB layout for the Simplest Possible Keyer. Figure 21 shows the copper pattern and can be used to make a single sided PCB for the keyer. Holes should be 0.035" in diameter except for D1 which should be 0.040" in diameter. Four mounting holes for 4-40 screws should be 0.125".

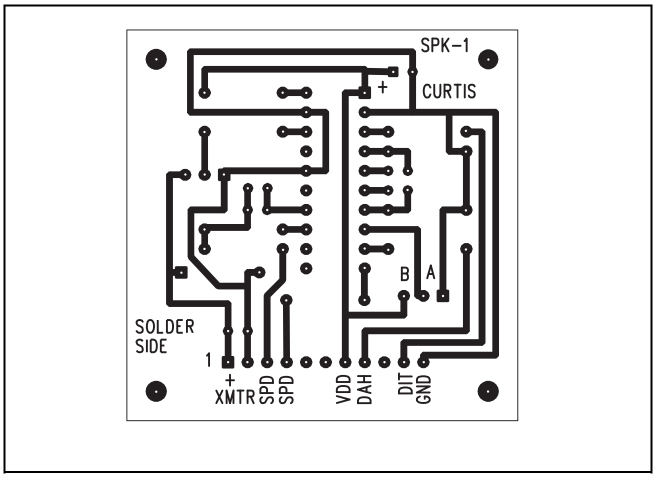

Fig. 21. Actual size foil pattern.

Suggested Parts List for Simplest Possible Keyer[7]

Part	Mouser P/N	Value	Comments
C1,C2,C3	581-UEZ103K1	0.01µF	
C3	ME208-50V10	10µF, 10V	
C5A	581UDZ104K	0.1µF	(1)
C5B	581UDZ473K	0.047µF	
D1	333-1N4006	1A, 600PRV	
J1	16PJ080	paddle jack	
P1	17PP080	paddle plug	
P2	544-CA-S36SP100	11x0.1" header	(2)
Q1	570-2N4401	NPN transistor	
R1,R2	29SJ250-470	470 Ohms, 1/4W	
R3,R4	29SJ250-1M	1 megohm/ 1/4W	
R5	29SJ250-100K	100K Ohm, 1/4W	
R6	29SJ250-1K	1K Ohm, 1/4W	
R7	29SJ250-47K	47K Ohm, 1/4W	
R8	29SJ250-91K	91K Ohm, 1/4W	
R9, S1	31CB505	500K pot	with on/off switch(3)
S1	(see R9)		
S2	clip from P2	3x0.1" header	(4)
U1	509-8044ABM	keyer IC	
W1	jumper	#24 wire	(5)

Miscellaneous:

Jack	16PJ035	RCA type xmtr jack	
Knob	45KN024	0.98" knob with pointer	
Cabinet	537-CR-332	3-3/4Dx3Wx2-1/8H	(6)
PCB	(see figure 21 and 22)		

Feet, 4-40 mtg. hard.are, nylon spacers, wire, solder, 9V battery.

Notes:
(1) We use C5A and C5B in parallel to obtain near the 0.15µF value. This value is not always easily found.
(2) There are cheaper and more appropriate header strips available but Mouser does not stock them.
Clip to make 11-pin header for P2 and 3-pin header for S2. Using a header makes a neater job but you may wire directly to the PCB.
(3) This potentiometer is an audio taper unit. Reverse taper units are difficult to find. Connect for reverse rotation as shown in figure 18(b). (Connect between two “SPD” pins on PCB.)
(4) Clip three pins from the same strip as P2 is cut from.
(5) Just use a clipping from one of the resistors to make this jumper.
(6) Just a suggestion. Plan your own to make sure it fits.
(7) Build the PCB into a metal cabinet. Use an RCA type jack for the output to the transmitter. Use shielded cable as short as practicable for the paddle and transmitter connection.

Where to Buy

All the 8044 Series IC’s are now priced at $19.95 plus $1.75 shipping. At the present time we offer no kits except for the 8044ABM-3 which includes an 8044ABM, a 20-pin socket, a PCB for a full-featured keyer ($34.95) (not the Simplest Possible Keyer shown here) and a construction manual. Please refer to the ARRL Handbooks of recent years for other circuit ideas.

The 8044, 8044B and 8044ABM are carried by Mouser Electronics (tele: 800 346 6873 in U.S. and Canada) who have numerous warehouses around the United States (use the prefix 509- to order). They are an excellent source for almost all the electronic parts needed to build this keyer.

The 8044BM is no longer available, the 8044M is available for replacement use in limited quantities from Curtis Electro Devices, Inc. at Box 4090, Mountain View, CA 94040.

Prices and specifications shown in this application note are subject to change without prior notice.

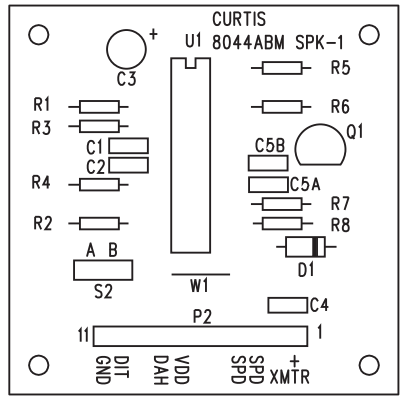

Fig. 22. Actual size silkscreen.

John G. Curtis is the founder of Curtis Electro Devices, Inc. and the designer of the 8044 Series as well as other electronic equipment offered by the family held company.

Mr. Curtis was born in Bradford, Pennsylvania in 1930 and obtained his amateur radio license in 1947 (W3NSJ). He was graduated from Pennsylvania State University in 1952 with a B.S. in Electrical Engineering and was first employed by the Sperry Gyroscope Company in Long Island, NY. He served in the U.S. Navy from 1954 until 1959 and was stationed at the Ship Repair Facility in Yokosuka, Japan.

After discharge from the Navy as Lt., he was employed by Corning Glass and later by Signetics Corporation, an integrated circuit manufacturer.

In 1968 he founded Curtis Electro Devices as a hobby, first manufacturing the EK38 electronic keyer. A variety of electronic keyers and Morse keyboards were developed for the amateur market in addition to the 8043 and 8044 series of keyer chips. A line of PROM and EPROM programmers was also marketed.

At the present (1992), the company is engaged in the manufacture of test equipment and publications for the cellular telephone installation industry. The 8044ABMs continue to be manufactured for both OEMs and individual hams.

Mr. Curtis currently holds amateur radio callsign K6KU with Extra Class privileges.