

Keyrama

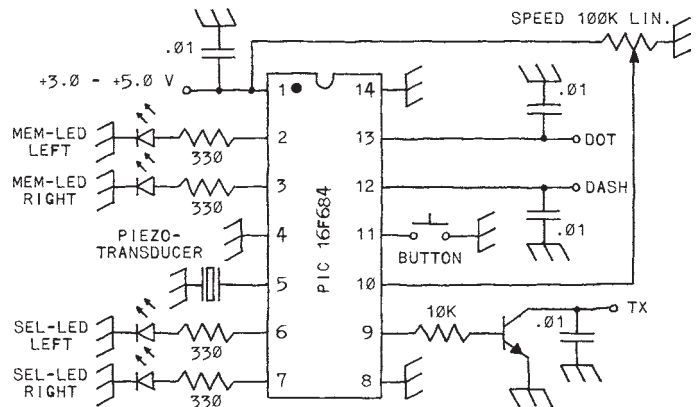
A unique PIC-based multi-mode Morse code keyer

Radio amateurs invented and pioneered electronic Morse code keyers, but today their knowledge of the different twin-lever keying modes is sparse. Because I could not find one single document with a competent and proper treatment of that topic, I wrote *"All about Squeeze-Keying"* [1] and highly recommend to read it before building and operating this keyer in order to be able to fully appreciate its special features.

The suffix "-rama" stems from the Ancient Greek word "οραμα" which means "wide view". In order to complement my explanation with a useful practical device, I developed *"Keyrama"* which enables the operator to get a wide view of the different keying modes, to compare its proper logic and accurate timing with other keyers, to follow the visualized action of dot/dash-memory and to find out to which extent his specific keying technique really makes use of it.

features

- * emulation of the following keying modes:
 - ultimatic
 - iambic type "A" (Curtis-keyer)
 - iambic type "B" (Accu-keyer)
 - OZ (MSK5-keyer)
 - single-lever
 - bug
 - cootie, sideswiper
- * dot/dash-memory (selectable)
- * visualized keyer action
- * autospace (selectable)
- * keying speed 6 - 60 wpm
- * variable weight 25 - 75 %
- * variable dash-length 50 - 250 %
- * two message-memories for max. 80 / 160 characters with editing function
- * message loop function with adjustable delay
- * sidetone with adjustable frequency and volume
- * dot/dash-levers reversable
- * highly accurate timing
- * one-button control
- * simple circuit with few components
- * supply voltage range +3.0 to +5.5 V
- * low current drain (< 0.2 mA in sleep-mode)



construction

The keyer schematic is shown in the above figure. Programmed PICs 16F684 are available from the author, the HEX file can be downloaded [2] for personal non-commercial use. The transistor is any general-purpose NPN type. For voltage supply I recommend 3 AA batteries giving 4.5 V, the low current drain of approx. 0.2 mA in sleep-mode makes a switch unnecessary.

Please note that a piezo-transducer (NOT a piezo-buzzer !) is used because of its high impedance and low current drain, its schematic symbol is the same as for a quartz crystal. Use any transducer size that is available and fits your needs, but do NOT replace it by a conventional loudspeaker ! The keyer is controlled by a single momentary push-button switch. A linear taper potentiometer must be used for speed adjustment. "DOT" and "DASH" go to the associated keying-lever contacts, "TX" goes to the keying jack of the transmitter.

In order to get a good visualization of keyer action the four LEDs should be arranged on the front plate like the corners of a rectangle, with the two SELEctor-LEDs of one color (e.g. green) in the upper two corners and the two MEMory-LEDs of another color (e.g. red) in the lower two corners. Bright 5mm types are recommended. LEDs have one longer and one shorter lead, the shorter lead (cathode) goes to ground. During initial setup the LED-assignment (parameter-code "L") must be set so that the left SEL-LED is on when the left lever is pressed. If you are not interested in the visualization you can omit the four LEDs and 330 Ohm resistors and leave the pins # 2,3,6,7 unconnected - do NOT ground these pins !

Because the keyer circuit is so simple, no circuit board layout is presented here. Instead of an etched board you may use a small piece of perf-

By Karl Fischer, DJ5IL

Friedenstr. 42, 75173 Pforzheim, Germany
www.cq-cq.eu - DJ5IL@cq-cq.eu



board, or you take single-sided PCB (printed circuit board) material and mill out the outlines of the copper traces with a dremel tool as I did with my prototype shown without cover on the above pictures. This is my preferred construction method for simple circuits and I also build sturdy cabinets from solder-joined plates of this material. In this case I simply used the copper-clad backside of the front plate as the circuit board.

Please note the arrangement of the four LEDs. The piezo-transducer is glued to the circuit board below the red push-button, in the middle between the four LEDs. The sound is emitted through a small hole in the transducer's plastic cover, a slightly larger hole was drilled through the front plate.

operation

After power is applied, the keyer responds with "DJ5IL" and is ready for operation. The parameter and message-memories are non-volatile. If any permanent malfunctioning should occur, hold a lever pressed while power is applied - this procedure resets all parameters to their default values.

To **inquire or set the keying mode** press and hold the button, a "?" followed by the code of the currently selected mode is played:

- U = ultimatic
- IA = iambic type "A" (Curtis-keyer)
- IB = iambic type "B" (Accu-keyer)
- OZ = OZ (MSK5-keyer)
- S = single-lever
- B = bug
- C = cootie, sideswiper

Keeping the button pressed, the next / previous keying mode is selected by a short tap of the dot / dash lever and after releasing the lever its code is played. Release the button to resume normal operation.

When single-lever modes (S / B / C) are emulated with a twin-lever paddle and the levers are squeezed, only the lever which was pressed first is recognized as pressed because with a single-lever paddle both contacts cannot be closed at the same time. Because twin-lever paddles seduce the operator into squeezing and provoke curtailed spaces in these modes, single-lever paddles work much better.

To **inquire or set a parameter** (only possible in the keying modes U / IA / IB / OZ / S) press the button and release it WHILE a "?" is played. The dot/dash lever-assignment can only be set but not inquired. It is toggled by entering more than 7 consecutive dots or dashes, an "N" for normal or an "R" for reversed is played. To set any other parameter or to load a message into memory, enter its code according to the parameter table immediately followed by the value or message to be assigned to the parameter or memory. The pause between code and value or message must be shorter than an interword space (7 dot lengths). The keyer rejects invalid actions or inputs with a fast error-sign (8 dots). Valid parameter values are set and normal operation is resumed without any signal. In order to inquire a parameter or message just wait after entering its code until its value or text is played. Some examples: "F65" sets the monitor frequency to 650 Hz, "L1" sets the LED-assignment to reversed, "S15" sets the keying speed to 15 wpm at the current knob position, "A" inquires the autospace setting, "2" inquires message-memory #2. The inquiry of a message-memory is aborted by a short tap of a lever.

The effect of **autospace** depends on the keying mode. In the modes U / IA / IB / OZ / S it supports proper spacing of characters within a word and prevents character crowding by forcing at least one intercharacter space (3 dot lengths) whenever a pause longer than one dot length is detected. In the modes B / C it prevents curtailed spaces within a character by forcing at least one interelement space (1 dot length) whenever the lever contact is changed. The speed-pot varies in mode C the length of the

interelement space only, in mode B the dot length as well. Irrespective of its parameter setting the **monitor** is always on while inquiring or setting the keying mode or a parameter. The **dash-modifier** varies the dash length, which is normally 3 dot lengths. The keying **weight** is the duty cycle of a series of consecutive dots which is normally 50% because dots and spaces have the same length. Higher values produce longer dots and shorter spaces ("heavier" keying), whereas lower values produce shorter dots and longer spaces ("lighter" keying). If the dash-modifier is set to the normal 100% the dash length is varied by the same period as the dot length, otherwise the weight has no influence on the modified dash length. When inquiring or setting the keying speed please note that it is independent of weight but only valid if the dash-modifier is set to 100%. Irrespective of the **dot/dash-memory** parameter setting in keying mode OZ only the dot-memory is set and only if within a character that starts with a dash the dot-lever is pressed during a dash-element for the first time.

To **load a message** into memory proceed according to the following rules: characters with more than 7 elements (dot + space or dash + space) are invalid and rejected. A pause longer than an intercharacter space (3 dot lengths) is recognized and stored as an interword space and confirmed by a short "pip". There is no limit to the elapsed time between words, so there is no need to hurry and only one interword space is written into memory. Entering more than 7 consecutive dots is recognized as an error-sign, the character previously stored is replayed and erased from memory. In that way the whole memory can be edited backwards, character by character. If the memory shall be played in an endless loop, enter a colon (---...) at the end of the text followed by the 3-digit delay-time in tenths of a second with leading zeros (min. 000, max. 999 = 99.9 seconds). While entering a pause of any length is allowed after the colon and between the delay-time digits. For example, entering "1CQ CQ CQ DE DJ5IL K: 03 5" loads the message "CQ CQ CQ DE DJ5IL K" into memory #1 and causes the message to be played in a loop with 3.5 seconds delay. When the memory is full, an error-sign and an "F" are played. The capacity is 80 characters for memory #1 and 160 characters for memory #2. Pressing the button ends message loading, after release an "R" is played and normal operation is resumed.

Start playing of message #1 with one short tap (less than 0.4 s) of the button, of message #2 with two short taps in fast succession (pause between taps less than 0.4 s). If a fast error-sign is played at the end of the message, it contains an invalid delay time. Playing is aborted either immediately by pressing a lever, or after the currently played character by pressing and holding the button. Normal operation is resumed after the lever or button is released.

what the LEDs indicate

The keyer is able to generate two different character elements: a dot-element (dot + space) or a dash-element (dash + space). A **SEL-LED** lights up when the associated lever is SElected for polling (no element can be in progress at that time) and pressed. Provided the dot- and dash-memory is on (check the parameters setting), a **MEM-LED** lights up when that MEMory is set because the associated lever changed its state from "unpressed" to "pressed" (modes U / IA / OZ) or because it just was in the state "pressed" (mode IB) anytime during generation of the other element. The LEDs go out as soon as generation of the associated element is completed.

The following interpretation of the LEDs allows to judge the iambic timing of your keying and exhibits to which extend you really need support from dot- or dash-memory. Please note that the two LEDs in the same column are considered at a time, that is either the left SEL-LED and MEM-LED or the right SEL-LED and MEM-LED:

SEL-LED on, MEM-LED off: the currently generated element was triggered immediately by pressure of the associated lever without any action of the dot- or dash-memory.

SEL-LED on, MEM-LED on: the associated lever was pressed too early, but it was held long enough so that its currently generated element would have been triggered even without the set memory. When this condition occurs, the operator does not really make use of the associated dot- or dash-memory.

SEL-LED off, MEM-LED on: the associated lever was pressed and released too early and its element has been or will be triggered by the set memory. The more often this condition occurs, the more often the operator really needs the associated dot- or dash-memory.

parameter table

Code Description [default value]

A	autospace [0] 0 = off for all keying modes 1 = on for keying modes IA / IB / U / S only 2 = on for keying modes B / C only 3 = on for all keying modes
D	dash-modifier [100] 50 - 250 (%)
F	frequency [50]

500 - 990 (Hz, only the first two digits are entered / played)

L LED-assignment [0]

0 = normal
1 = reversed

M dot/dash-memory [0]

0 = off
1 = dot-memory on
2 = dash-memory on
3 = dot- and dash-memory on

S speed at current knob position

6 - 60 (wpm)

T tone [1]

0 = off
1 = on

V volume [5]

3 - 10

W weight [50]

25 - 75 (%)

1 message-memory #1

2 message-memory #2

lever-assignment [N]

to toggle enter more than 7 dots or dashes:

N = normal
R = reversed

references

1. http://cq-cq.eu/DJ5IL_rt007.pdf
2. <http://cq-cq.eu/keyrama.hex>

DJ5IL_rt008e.pdf
Original version: 4.10.2016
Revisions: 20.10.2016