Mini-Yack Iambic Keyer
Assembly Instructions

Mini-Yack is a "bare bones" Iambic keyer for embedding into QRP and home brew equipment. The keyer has the following features:

- Keying from 1-50WPM
- YACK memory Keyer IC developed by DK3LJ and AI4SV with mods by KC9ON
- 2 memories with 75+ characters each
- Beacon mode
- Iambic practice & training modes including a progressive training mode.
- Operation to as low as 2V*
- Straight key operation bypass (limited keyer functionality)
- Positive (40V) interface radio keying
- Sidetone abilities

### Parts List

<table>
<thead>
<tr>
<th>Section</th>
<th>Qty</th>
<th>Ref</th>
<th>Description</th>
<th>Markings</th>
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</thead>
<tbody>
<tr>
<td>MAIN</td>
<td>3</td>
<td>C1, C3, C7</td>
<td>Capacitor Electrolytic .1ls 6x11mm 100uF</td>
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<tr>
<td>MAIN</td>
<td>4</td>
<td>C2, C4, C5, C6</td>
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<td>103</td>
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<td>MAIN</td>
<td>1</td>
<td>D1</td>
<td>Diode .4ls 1N4007</td>
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<tr>
<td>MAIN</td>
<td>1</td>
<td>U2</td>
<td>IC Microcontroller AtTiny85</td>
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<tr>
<td>MAIN</td>
<td>1</td>
<td>D2</td>
<td>LED 3mm Red</td>
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<tr>
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<td>4</td>
<td>R2, R3, R4, R8</td>
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<td>Brown-Black-Red-Gold</td>
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<td>MAIN</td>
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<td>R6</td>
<td>Resistor CF 250mW 5% 4.7K</td>
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<td>MAIN</td>
<td>2</td>
<td>R1, R5</td>
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<td>SW1</td>
<td>Switch SPST Tactile 6x6mm A-5156</td>
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<tr>
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<td>2</td>
<td>P1, P3</td>
<td>Terminal Block 2-pin_3.5mm</td>
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<tr>
<td>MAIN</td>
<td>2</td>
<td>P2, P4</td>
<td>Terminal Block 3-pin_3.5mm</td>
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<tr>
<td>MAIN</td>
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<td>Transistor MOSFET 2N7000 2N7000</td>
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<td>Trimmer 6mm Horiz 10K</td>
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<td>MAIN</td>
<td>1</td>
<td>U1</td>
<td>Voltage Regulator 78L33</td>
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<td>U1-REF</td>
<td>Socket DIP 8 pin</td>
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<tr>
<td>MAIN</td>
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<td>Rst</td>
<td>Header 2 pin</td>
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<td>PCB</td>
<td>PCB Mini-Yack</td>
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<td>Buttons</td>
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<td>PCB Mini-Yack Button</td>
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<td>Switch SPST Tactile 6x6mm A-5156</td>
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<td></td>
<td>Wire 22ga strnd GREEN ft</td>
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<tr>
<td>Buttons</td>
<td>0.25</td>
<td></td>
<td>Wire 22ga strnd WHITE ft</td>
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</tr>
</tbody>
</table>
Mini-Yack Iambic Keyer
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This kit was designed using through hole components and enlarged PCB solder pads for ease of assembly. Only a few basic tools are recommended:

- Pencil type soldering iron and solder.
- Needle nose pliers, small surgical clamps, small vice
- Magnifier Glass (if needed)
- Slotted or Philips screwdriver
- Digital Multi-Meter (DMM)
- Oscilloscope (optional)
- Power Source/supply 4.5-15V

Construction notes:

- Familiarize yourself with components using the included parts list.
  
  TIP: Not sure what part is what? We recommend picking up a copy of the ARRL Handbook. The GQRP web site also has several good articles on component identification.

- Some parts in this kit may have been substituted with parts of a better quality. Alternates will be shown in the parts list with "SUB".

- All parts are mounted on the top side of the PCB except the CMD button which can be placed on either side depending on your final mounting configuration. For the YACK-buttons board parts can be mounted on either side depending on your mounting configuration.

- Solder and trim the excess leads after installing each component.

  TIP: Not sure how to solder? There are many excellent videos on the internet. Check out sites such as Sparkfun.com, adafruit.com, and electronics123.com
Mini-Yack Iambic Keyer
Assembly Instructions

Assembly

1. ( ) Install the following components:
   ( ) D1 1N4007 Diode  Match the band on the diode to the silkscreen.
   ( ) U1 78L33 Regulator
   ( ) C1 100uF Electrolytic Cap  Observe Polarity when installing
   ( ) C3 100uF Electrolytic Cap  Observe Polarity when installing
   ( ) P1 2 pin terminal block  Position the terminal block so the wire entrances are away from the board.

![Component Diagram]

2. ( ) Power Supply Testing. Connect a 4-15V power source to P1 observing power polarity. Screws on P1 are shipped in the fully closed position. Using a DMM measure U2 pin 8 to ground. One of the mounting holes can be used as ground as well as any GND pin. There should be approximately 3.3V at this point. Disconnect power from P1.

3. ( ) Install the following components:
   ( ) R3 Resistor 1K  Brown-Black-Red-Gold
   ( ) R4 Resistor 1K  Brown-Black-Red-Gold
   ( ) R1 Resistor 47K  Yellow-Violet-Orange-Gold
   ( ) C4 Capacitor .01uF  103
   ( ) C5 Capacitor .01uF  103
   ( ) RST Header 2 pin

![Component Diagram]
Mini-Yack Iambic Keyer
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4. ( ) Install the following components:
   ( ) C2  Capacitor .01uF  103
   ( ) U2  8 pin DIP socket  Align notch on socket with notch on board.
   ( ) P2  3 pin terminal block  Position the terminal block so the wire entrances are away from the board.

5. ( ) Install the following components:
   ( ) R7  Resistor 2.7K  Red-Violet-Red-Gold
   ( ) R6  Resistor 4.7K  Yellow-Violet-Red-Gold
   ( ) C6  Capacitor .01uF  103
   ( ) P4  3 pin Terminal Block  Position the terminal block so the wire entrances are away from the board.
Mini-Yack Iambic Keyer
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6. ( ) Install the following components:
   ( ) C7  100uF Electrolytic Cap   Observe Polarity when installing
   ( ) R5  Resistor 47K*    Yellow-Violet-Orange-Gold
   ( ) RV1 Trimmer 10K    103

   *Note: Resistor R5 was set to inject sidetone into an existing QRP transceiver. Other
   resistances may be required depending on your radio's sidetone requirements. Jumpering R5
   (shorting) will allow a Piezo buzzer or small speaker to be used.

7. ( ) Install the following components:
   ( ) Q1  Transistor 2N7000    Align case with silkscreen
   ( ) R8  Resistor 1K    Brown-Black-Red-Gold
   ( ) R2  Resistor 1K    Brown-Black-Red-Gold
   ( ) D2  LED    Align flat side with square pad. Square pad is
                  also the short lead.
   ( ) P3  2 pin Terminal Block    Position the terminal block so the wire
                  entrances are away from the board.
8. ( ) Determine which side of the board you want the CMD button on and solder to board.

9. ( ) Place the ATTiny85 IC into the socket at U2. Align the dot on the IC (pin 1) to the square pad on the PCB. This pin is also located near the notched edge of the IC socket and PCB silkscreen.
Mini-Yack Iambic Keyer
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YACK-Buttons (optional) – Assemble the following on the YACK-Buttons PCB if you wish to add external buttons for Playback of memories, QRS, COMMAND, and power RESET:

10. Determine which side of the PCB you wish to mount the buttons and terminal block depending on your mounting configuration. For example you may wish to mount the switches on the top side and the terminal block on the bottom in order to mount the board on an enclosure.

11. Install the following components:

( ) R101  Resistor 510 Ohms  Green-Brown-Brown-Gold
( ) R102  Resistor 560 Ohms  Green-Blue-Brown-Gold
( ) R103  Resistor 1.8K Ohms  Brown-Grey-Red-Gold
( ) SW101-SW105  Push Switch
( ) P1    3 pin Terminal Block  Position the terminal block so the wire entrances are away from the board.

12. Final assembly:

( ) Connect your Iambic keyer to the DIT, DAH, and GND (common) connections of P2. If later you find the DIT and DAH requires swapping you can either swap the 2 wires DIT and DAH or use the "X" command in software.

( ) Connect your transmitter key to the P3. XMT- is also ground on the keyer board. Note that this board only works with positive keying transmitters.

( ) Connect your 4-15V power source to P1 observing polarity. Slightly lower voltages sources can be used by jumpering the blocking diode D1. Additionally the regulator U1 can also be bypassed if the voltage is maintained between 2.7 and 5.5V. However there will no longer be reverse polarity or over voltage protection on the micro controller when bypassed.

( ) (Optional) connect the sidetone output to a pair of headphones or your receivers audio chain using the GND and TONE connections of P4. Use RV1 to control the side tone volume. Review the foot note in step #5 for further information.
Mini-Yack Iambic Keyer
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( ) (Optional) Connect the YACK-Bottons board to the Mini-YACK as follows:
( ) Strip 1/4" of insulation from each end of the Black, Green, and White wires. Tin each end. Substitute your own cable for longer lengths.
( ) Connect wires as follows:

<table>
<thead>
<tr>
<th>WIRE</th>
<th>FROM Mini-YACK</th>
<th>TO YACK-BUTTONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK</td>
<td>P4 GND</td>
<td>P1 Ground (Pin 3)</td>
</tr>
<tr>
<td>WHITE</td>
<td>P4 CMD</td>
<td>P1 CMD</td>
</tr>
<tr>
<td>GREEN</td>
<td>RST Header pin 2 (Nearest to R1) - SOLDER</td>
<td>P1 RST</td>
</tr>
</tbody>
</table>

Congratulations! Your keyer is now ready to use! See the Yack operation manual for using your Mini-Yack.

Specifications:
Supply Voltage: 4.5-15V (typical)
Current consumption:
@13.8V 4.2mA idle 6mA keyed
@5V 3.8mA idle 5.5mA keyed
@4.2V 3mA idle 4.3mA keyed
@2.0V* 1.9mA idle 2.5mA keyed

Transmitter Keying: Positive keying from to 30V 150mA max

* - Minimum usable voltage with D1 and U1 bypassed – do not exceed 5.5V! Lower current ratings may be obtained by removing LED D2.
Adding extra buttons to the CMD port

Diagram of additional buttons connected to CMD port.
YACK User Manual
Version 1.8j for Mini-Yack

YACK (Yet Another CW Keyer) is a universal CW keyer developed for the Atmel ATTiny processors by Jan Lategahn DK3LJ with modifications by Jack Welch AI4SV. Further modifications for Mini-Yack were developed by John Clements KC9ON.

Startup

**Default Settings:** The keyer initial settings on first power on is IAMBIC B at 15WPM. This can be changed to your own setting as shown below.

**Power On:** The keyer will respond with HI when powering up.

**Straight Key Operation:** Connect a straight key into the jack. Either a Mono jack may be used or a stereo jack with the ring (middle connection or DAH) connected to shield (ground). The keyer will automatically see the “mono” jack on power up and put the keyer into straight key mode. The optional external buttons PLAY1, PLAY2, QRS, and RESET will still function in straight key mode. However the COMMAND button will not accept commands.

Mini-Yack Buttons

**COMMAND** – Enters command mode. See below for command mode settings.

**Optional External Buttons (not included – see buttons schematic):**
- **Play 1** – Play back the contents of memory 1.
- **Play 2** – play back the contents of memory 2.
- **QRS** – each button press will slow the speed by 5WPM. Your original WPM can be retrieved by powering the unit off and on or by pressing the reset button.
- **Reset** - Equivalent to powering the unit off and on. This will quickly restore any presses of the QRS button back to your default WPM setting.

Speed Change

Speed can be changed by pressing and holding the COMMAND button while operating the DIT and DAH paddles. DIT reduces speed while DAH increases speed. The keyer plays an alternating sequence of dit and dah while changing speed without keying the transmitter.

Command mode

Pressing the command button without changing speed will switch the keyer into command mode. This will be confirmed with the '?' character. Another press of the same button takes the keyer back into regular keyer mode and will be confirmed by sending OK.

During command mode the transceiver is never keyed and side tone is always activated. Further functions can be accessed by keying one-letter commands as listed below. After 6 seconds of inactivity the keyer will return to regular mode and send OK.

If a command is not interpreted properly an error message of 8 dits is sent. Successful commands will typically respond with 'R'.
It is highly recommended to perform the 0 - LOCK command after you have made your setting preferences to avoid accidentally changing them. Locking will prevent commands 1, 2, A, B, D, F, I, K, L, R, S, & X, from being changed until the 0 – UNLOCK command is given.

## COMMANDS - BASIC

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>PLAY 1</td>
</tr>
<tr>
<td>5</td>
<td>PLAY 2</td>
</tr>
<tr>
<td>1</td>
<td>RECORD 1</td>
</tr>
<tr>
<td>2</td>
<td>RECORD 2</td>
</tr>
<tr>
<td>G</td>
<td>QRS -5WPM</td>
</tr>
<tr>
<td>Q</td>
<td>QRQ +5WPM</td>
</tr>
<tr>
<td>W</td>
<td>QUERY SPEED</td>
</tr>
<tr>
<td>P</td>
<td>PITCH</td>
</tr>
</tbody>
</table>
YACK User Manual
Version 1.8j for Mini-Yack

U TUNE
The transceiver is keyed for a duration of 20 seconds for tuning purposes. Tuning mode is aborted once either DIT or DAH paddles are touched or the control key is pressed.

COMMANDS - KEYER

A IAMBIC A MODE
Sets IAMBIC A as permanent keying mode.

B IAMBIC B MODE
Sets IAMBIC B as permanent keying mode.

D DAH PRIORITY
In squeezed state a sequence of DAHs is sent. Some of the first generation keyers exhibited this behavior so the chip can simulate that.

L ULTIMATIC MODE
Sets the keyer into ULTIMATIC mode. In Ultimatic mode always the last paddle to be touched is repeated indefinitely when paddles are squeezed.

X PADDLE SWAP
DIT and DAH paddles are swapped.

F FARNSWORTH PAUSE
Allows setting of an extended inter-character pause in all sending modes which makes fast keying easier to understand. Note that this of course only influences RECEPTION, not TRANSMISSION. If you desire Farnsworth mode in transmission, please manually pause during characters.

COMMANDS – TRANSMITTING AND TONE

I TX INVERT
This function toggles whether the "active" level on the keyer output is positive or negative. This setting is dependent on any additional attached keying circuits or radios. Normally this command is left alone.

K TX DISABLE
Toggles the setting of the TX keyer output. In default state the keyer switches the output line when it is in keyer mode. Toggling this setting enables or disables that function. NOTE: Keying is always off in Command mode.

S SIDETONE
The side tone oscillator setting is toggled (ON -> OFF or OFF -> ON). NOTE: This setting is only of relevance for regular
keying mode. Side tone is always on in command mode.

COMMANDS – FEATURES

C  CALLSIGN TRAINER    The keyer plays a generated 2x2 call signs (side tone only) at the current WPM setting. The call signs are then entered back using the iambic key. If it is repeated correctly, "R" is played and the next call sign is given. If a mistake was sensed, the error pro-sign (8 dots) is sounded and the current call sign is repeated again for the user to try once more. If nothing is keyed for 10 seconds, the keyer returns to command mode.

Z  ADVANCED TRAINER    Similar to the training mode above except on each successful entry the speed is increased by 1WPM. An unsuccessful entry reduces the speed by 1WPM. Pressing the command button will terminate the training, return the keyer to the original WPM speed, and give statistics of speed at end of session, number of calls sent, and number of calls correct. Do not press command mode while the keyer is sending. The last call sign sent is not counted.

N  BEACON MODE    The keyer responds with "N" after which a number between 0 and 9999 can be keyed. After a 5 second timeout the keyer responds by repeating the number and 'R'. Once the keyer returns to keyer mode, the content of message buffer 2 is repeated in intervals of the message length plus N seconds. The setting is preserved in EEPROM so the chip can be used as a fox hunt keyer. Returning to command mode and entering an interval of 0 (or none at all) stops beacon mode. Keyer will respond with 'R'.

COMMANDS - GENERAL

R  RESET    All settings are returned to their default values except for the stored messages in the message buffers. Restored settings include speed, Paddle Swap, TX level inversion, side tone and TX keyer settings. Speed will be reset to 15WPM in IAMBIC B mode.

V  VERSION    The keyer responds with the current keyer software version.
0  LOCK/UNLOCK  The 0 command locks or unlocks the main configuration items but not speed and playback functions.

HARDWARE RESET
You may find you have lost control of your keyer by setting the speed too fast or accidentally issuing a command (See LOCK) which makes it act strange. The keyer may be reset to factory defaults with the following sequence:
1) Power on the unit.
2) Hold the command button down
3) Push and release the reset button
4) Release the command button
Memories will still be in tact.

YACK IC PINOUT
Pin 1 : RESET
Pin 2 : DIT
Pin 3 : DAH
Pin 4 : GND
Pin 5 : TX key line
Pin 6 : Side Tone key line
Pin 7 : ADC Input from command keys – See Mini-Yack schematic for example.
Pin 8 : +5V

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YACK INFORMATION
The original YACK software and instructions can be found at:
http://sourceforge.net/projects/yack/
## YACK QUICK REFERENCE GUIDE

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<th>KEYER</th>
<th>GENERAL</th>
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<td>R</td>
</tr>
<tr>
<td>S</td>
<td>PLAY 2</td>
<td>V</td>
</tr>
<tr>
<td>1</td>
<td>RECORD 1</td>
<td>0</td>
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<tr>
<td>2</td>
<td>RECORD 2</td>
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<tr>
<td>G</td>
<td>QRS -5WPM</td>
<td>X</td>
</tr>
<tr>
<td>Q</td>
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</tr>
<tr>
<td>W</td>
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<tr>
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<td>PITCH</td>
<td>K</td>
</tr>
<tr>
<td>U</td>
<td>TUNE</td>
<td>S</td>
</tr>
<tr>
<td></td>
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