

NOXAS PicoKeyer-Plus

Ultra Low Power Morse Memory Keyer

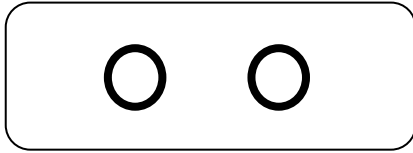
The PicoKeyer is a single chip, automatic iambic Morse code memory keyer. Its small size, low power requirements and robust set of features make it perfect for portable or QRP operation or for integrating into transmitters or transceivers.

Features of the PicoKeyer-Plus:

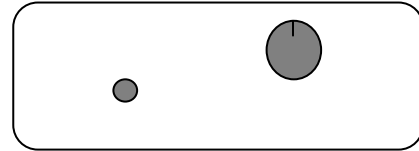
- Dual MOSFET keying circuit will key transmitters up to 60 V, positive or negative
- Simple one-button "menu" interface
- Four 60-character message memories can be chained together for longer messages
- Works with any dual lever iambic paddle, single lever keyer paddle or straight key
- Dot and dash memories, automatic timing and element spacing
- Setup and message entry using your paddle
- Auto straight key detect, all message memories available with straight key
- "Bug" mode allows automatic dots with manually formed dashes
- Speed adjustable from 5 to 60 WPM via menu OR speed control potentiometer
- Dual-Set Speed allows quick QRS/QRQ and return to favorite speed
- Adjustable weight
- Variable pitch audio sidetone
- Curtis "A" or "B" or Ultimatic modes
- Variable letter/word spacing (Farnsworth)
- Tune mode with on/off carrier or automatic string if dits for easy tuneup
- Beacon mode with adjustable 0 – 99 second repeat delay and optional power-on auto start
- MCW mode for sending audio Morse over voice radios
- Memory "pause" command allows manual insertion of RST etc. into message
- Auto-incrementing QSO / serial number can be embedded in memory messages, with or without leading zeros
- Paddle switching - select left or right handed operation
- Variable transmitter QSK delay compensation
- Memory and parameter settings retained with power off
- Low voltage - from as low as 2.5 to 5.5V
- Low current - typical sleep current .005 μ A, under 1 mA when keying.
- On-board potentiometer for speed control

Operating the PicoKeyer:

Your PicoKeyer-Plus is fully assembled, mounted in the cabinet and has the battery installed. All you need to do is to connect your paddles and transmitter or transceiver, and take a little time to read this manual to learn how to use your PicoKeyer's features.



This is the **connections** end of your PicoKeyer. The left hand jack is for your paddles (input); the right hand jack is for your transmitter or transceiver (output).



This is the **controls** end of your PicoKeyer. The speed control knob is on the right, the memory/setup pushbutton is on the right.

Power control

Note that your PicoKeyer does not have a power switch! The microprocessor “brain” of the keyer will go into a low-current sleep mode after about ½ second with inputs from either paddle. In sleep mode, the keyer chip draws so little current that the internal battery will last for years. As soon as you touch a paddle, the chip “wakes up” and continues its normal operation. At this point the keyer will operate as a normal iambic keyer, sending dots and dashes with automatic spacing and timing according to paddle inputs and stored settings.

The Pushbutton

One pushbutton switch is used for memory messages and setup. Pressing and immediately releasing the button once (a “tap” of the button) will send the message stored in Memory 1 (M1), if there is one stored. Pressing and holding in the pushbutton more than about half a second will allow you to send one of the other three memory messages. If you wish to send the contents of message memory 2 (M2), release the button when you hear two dits, sent via the sidetone only. Similarly, to send message 3 or 4 (M3 or M4), hold in the button until you hear three or four dits, then release. To enter setup mode, continue to hold the button down after you hear the four dits for M4.

This is the method used to access all features other than M1. In general, the way to access message memories M2 through M4 or any setup menu item is the same. Simply hold the setup button down until you hear the keyer send the character corresponding to the item you want, then immediately release the button.

In setup mode the keyer will use the sidetone only and not key the transmitter. As you hold in the button the keyer will cycle through the available menu choices, described later in this document. You can simply release the button when you hear the item you want to check or change. Once you finish with that menu item, you can hold the button down to advance to the next item. If you're done, just tap the button to exit the menu – the PicoKeyer will send “SK” and return to normal operation.

Dual-Set Speed

The code speed can be adjusted from 5 to 60 words per minute (WPM) by simply turning the speed control knob. You may notice that the speed will decrease to 5 WPM as you rotate the knob counter-clockwise, then suddenly jump to 13 WPM. This is a special feature known as “Dual-Set Speed”.

Two Morse code speed settings are available for your use. The *current speed* is the speed at which the keyer is operating, regardless of whether that speed is derived from the speed pot or the menu. The *stored speed* is saved in the chip's internal non-volatile memory, and is used when the speed pot is turned to its minimum position. At any time you may use the speed adjustment to set any speed from 5 to 63 WPM. Setting the speed with the pot does not affect the stored speed, which will

always be available by simply turning the pot to its minimum setting. This feature can be very useful; for example, you can keep your speed set at a constant, favorite speed, but have the option of rapid QRS/QRQ to answer faster or slower stations. Or, you can simply ignore the stored speed and always use the pot for speed control – it's up to you.

Replacing the Battery

The battery in your PicoKeyer-Plus should last for a long time – anywhere from several months to several years. Battery life depends on a few factors:

- Frequency of use. Obviously, the more you use the keyer, the shorter the battery life will be.
- Sidetone. The sidetone speaker draws more power than the rest of the keyer. Using the sidetone speaker will reduce battery life – but you should still only have to replace it once in a great while.
- Straight key use. Leaving a straight key plugged in while not using the keyer will drain the battery within a few weeks. If you use a straight key, unplug it when you're not operating.
- Setup mode. The keyer does not sleep while in the setup menu, so make sure you don't accidentally leave it in setup mode for long periods.
- Beacon mode. The keyer does not sleep between messages while in beacon mode. If you use your PicoKeyer to control a beacon full time, refer to the HamGadgets web site (www.HamGadgets.com) for information about using external power.

Battery replacement is straightforward – just remove the two screws from the cabinet bottom, open the cabinet and pop the coin cell battery out of its holder. Hold the setup button in for a couple of seconds to make sure power is completely drained, then release the button and install the new battery.

If you should need to replace the battery in your keyer, you will need a CR2032 or equivalent lithium cell. These are very common and are used in many devices from garage door openers to car remotes to thermometers and medical monitors. You can order high quality CR2032 cells from www.HamGadgets.com.

Master Reset

In case you happen to get the settings to a point where the keyer is unusable, you can easily return your PicoKeyer to its default settings. Open the case and remove the CR2032 coin cell from its holder. Push the setup button with the battery removed – this is to ensure that power is completely removed from the chip. Now, hold in both paddles while you insert the battery into its holder. The keyer will send “73”; *immediately* release the paddles. At this point the keyer will send a question mark (?); tap either paddle to perform a complete reset. Note that you may need to try this a few times, depending on how quickly you let go of the paddles while the keyer “wakes up”.

Straight Key Mode

The PicoKeyer can automatically detect and use a properly wired straight key if one is plugged in when power is applied. During its power-on program, the PicoKeyer checks to see if either paddle input is grounded. If one input is shorted, the other input is assumed to be a straight key. This way you can plug in a straight key wired to a mono plug and use it without any changes or adjustments. Be aware that while the menu will still function, many parameters will not be adjustable (and would not apply to a straight key anyway). You will not be able to record messages while using a straight key. If your PicoKeyer is in the plastic cabinet, you may find it more convenient to switch between paddles and a straight key using the **K** menu setting.

Sidetone

The PicoKeyer's sidetone is a square wave audio signal. Sidetone can be turned on or off and the audio frequency can be changed from the setup menu. There is a very noticeable peak in the response of the on-board speaker at roughly 2 kHz; if your PicoKeyer is installed in the plastic cabinet you'll probably want to find this peak so you can hear it with the case assembled.

Keying the transmitter

The PicoKeyer will key any solid state, tube or hybrid transmitter or transceivers that uses a keying voltage of **60V or less**, positive or negative. If you are using the keyer with a negative keyed transmitter, you will need to make sure the KEY and RIG jacks are isolated from each other – this is the case when the keyer is mounted in its plastic cabinet.

If you intend to use the PicoKeyer with a rig requiring grid-block or cathode keying voltages over 60 V, you will need to use a separate high voltage keying adapter. The Universal Keying Adapter 3 available from NØXAS at www.hamgadgets.com is optically isolated and will handle solid-state, grid-block or cathode keyed transmitters at up to 400 V.

Keying Modes (What's Mode A, Mode B and Ultimatic??)

There have been a couple of different operating modes for iambic keying that have evolved over the years. Modes A & B are simply a matter of when the keyer checks for input from the paddles. In iambic mode A, the keyer only checks for paddle inputs after the end of each dot or dash. In iambic mode B, on the other hand, the keyer will check for paddle input during each dot or dash.

In practice, this can mean that you get “extra” or “dropped” dots or dashes at the end of a character, depending on how you send. If you find that the keyer often drops the last dot or dash in a character, or you often get an extra dot or dash at the end of a character, try switching between modes A & B and see which one best suits you. I find that Mode B worked best for me when using a single-lever paddle, while Mode A works best with a dual-lever paddle.

Ultimatic mode is a different way of handling iambic keying. In modes A & B, if the keyer sees both paddles closed it will alternate sending dots and dashes. Ultimatic, on the other hand, will send dots or dashes *according to the last paddle to be pressed*. For example, to send the letter P in mode A or B, you would close the dot paddle, then close the dash paddle and release the dot paddle for the two dashes, then release the dash paddle and close the dot paddle for the last dot. In Ultimatic mode, you would close the dot paddle and hold it closed, close the dash paddle for the two dashes, then release it for the last dot. Some letters are easier to send and require less effort using Ultimatic mode. It's a little bit of an adjustment from regular iambic keying; it took me a couple of hours of practice to get used to it.

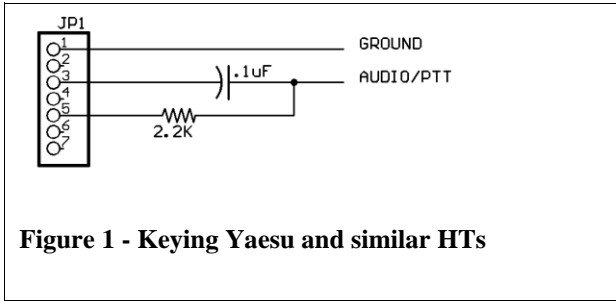
Selecting a keying mode (A, B or Ultimatic) is largely a matter of personal preference. There is no one “right” way that works for everyone; find which works best for you.

Using Your Keyer With a Handheld or FM Rig (“MCW” Mode)

One of the unique features of your PicoKeyer-Plus is MCW mode (menu option “T” for sidetone, select “M” for MCW). In this mode, the keying output can be used to trigger the PTT input of a VHF or UHF handie-talkie or FM mobile rig, allowing you to use your FM rig for Morse code. This is not CW (Continuous Wave) operation, nor is it true MCW (Modulated CW) mode – it's really just an FM transmission, with audio Morse code tones sent instead of voice. This makes it easy, for example, to have a CW practice net using a local repeater – with the blessing of the repeater operator, of course – or a simplex frequency. Those participating don't need HF privileges or HF equipment to learn and practice Morse code on the air.

It is not possible to give detailed instructions for attaching your keyer to every rig on the market. You will need to take a look at your rig's manual to determine how the audio and PTT signals from the keyer need to be connected. Doing it wrong could possibly damage your rig and/or your keyer! However, presented here are a few examples that you may find useful for setting up your station for FM code practice. Refer to the operator's manual for your rig for specific requirements for PTT and audio.

Using MCW mode requires making soldered connections to a set of solder pads (JP1), which is located underneath the battery holder on the Picokeyer's printed circuit board. You can “tack solder” wires in place using a low wattage pencil type iron, 25-35 Watts maximum. Be sure to remove the battery before soldering.



In Figure 1, we see the most common method that will work with many handheld transceivers from Alinco, Yaesu, Icom and others that use a similar combined audio/PTT scheme. This value of the capacitor is not critical, and can be several times smaller or larger. A 2.2K or 2.7K Ohm resistor is used in series with the PTT line to key the rig. In most cases, GROUND is connected to the sleeve (barrel) of a 2.5mm stereo plug, and PTT/Audio is connected to the tip – but again, be sure to consult your rig’s manual.

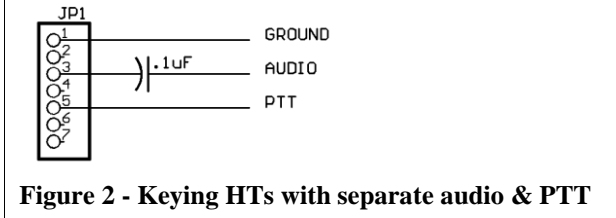
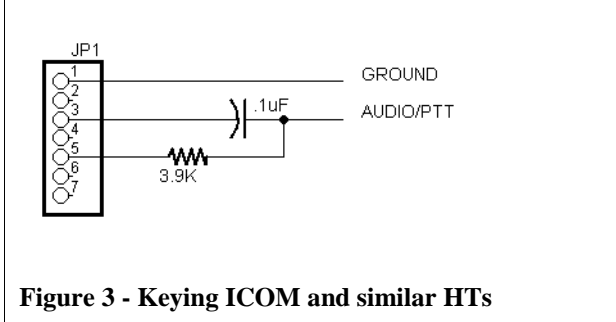


Figure 2 shows the method for using with with separate audio and PTT lines. Consult your rig’s manual for the correct plug and wiring to use.



The diagram in Figure 3 illustrates the method used by some Icom handhelds. If your HT does not respond with the circuit in Figure 1, try this one instead.

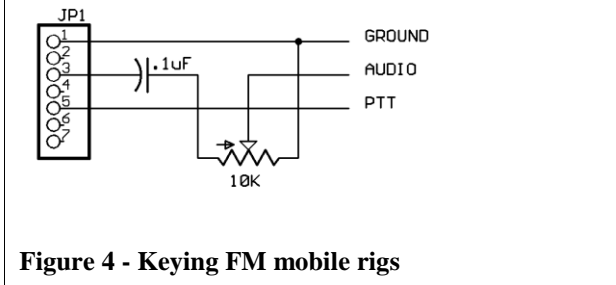


Figure 4 shows the method used with mobile or fixed station rigs. You will likely find it easiest to connect the keyer via the packet data connector. The schematic shows an optional audio level control potentiometer that may or may not be needed.

PicoKeyer Setup Menu Commands

U	<p>Tune mode: Tune mode is used to send either a steady carrier or a series of dits for adjusting or testing your station equipment. While in tune mode, each paddle acts as an on/off toggle switch. Tap the dash paddle to turn a steady carrier on or off. Tap the dot paddle to start or stop a continuous stream of dits. This gives you a 50% duty cycle signal that is preferred by some operators as a way to tune up with less stress on final PA, tuner and antenna components.</p>
S	<p>Speed: The keyer will always announce the <i>current speed</i> in WPM. If the <i>current</i> speed is not the same as the <i>stored</i> speed, the keyer will announce the current speed followed by a slash and the stored speed. For example: Assume the stored speed is 13 WPM, any you have the optional speed pot installed and set for 20 WPM. The keyer will announce “20/13”. If you have the pot set to its minimum, you will be using the stored speed and the keyer will only announce the stored speed, since it is the same as the current speed. It sounds more complicated than it is; play with it a little and you’ll get the hang of it.</p> <p>You can adjust the <i>stored speed</i> from the menu. Tapping the dot paddle will decrease the speed by one WPM, or the dash paddle will increase it. Holding either paddle will continuously increase or decrease the speed, with a dot or dash sent at the new speed for each step. When the paddle is released, the keyer will again announce the current speed setting and the stored speed, if it is different from the current speed. Speed may be set from 5 to 60 WPM.</p>
M	<p>Messages: Four message memories are available, numbered 1 through 4. When you enter Message mode, message 1 will be the default selection. You have a choice of actions available to you when in memory mode, selected by sending a single character from your paddle:</p> <ul style="list-style-type: none"> • Send the number 1, 2, 3 or 4 to select a message memory. The keyer will respond by sending <i>I</i>, 2, 3 or 4 to confirm. • Send P (Play) to listen to the contents of the currently selected memory. The keyer will play the message, followed by the Morse prosign <i>AR</i> and the message number. • Send R (Record) to record a new message. If a message already exists it will be erased and replaced. The keyer will respond with <i>K</i> to let you know it is in record mode. Enter your message, with exaggerated word space but normal spacing between characters. If you make a mistake when recording the message, just send 8 dits and the keyer will backspace one word. You will hear a single dit to confirm this (two dits means you are at the beginning of the message). Tap the setup button once when you are finished recording. The keyer will send <i>R</i> and the message number to indicate the end of the message. You can then Play the message back. • Send C (Continue) to add to or edit the message. The keyer will play the current message, then enter Record mode. You can backspace over existing words if needed. <p>You can use the R, P and C commands to listen and change your message until you're satisfied. Each memory can hold up to 60 characters. If you send something other than 1 - 4, P, R, or C the keyer will respond with “?” and let you try it again.</p> <p>Several special embedded commands may be used in messages. All commands start with a slash followed by one or two characters. When playing back a message in setup mode you will hear the command itself, not its effect – message chaining, QSO numbers, pause and beacon mode are inactive while in setup mode. For example, you will hear <i>/R</i> instead of the word to be repeated. To store a slash character in a message, save it as //.</p> <ul style="list-style-type: none"> • <i>/R</i> will repeat the last word, including the word space after it. This can save a lot of memory space, since each <i>/R</i> takes up only two character positions in memory. For example, to send a 3x3 CQ, you can simply store “CQ <i>/R/R</i>DE (callsign) <i>/R/RK</i>”. This can save a lot of memory space. • <i>/1</i>, <i>/2</i>, <i>/3</i> and <i>/4</i> can be used to chain the message memories. The indicated message will be played

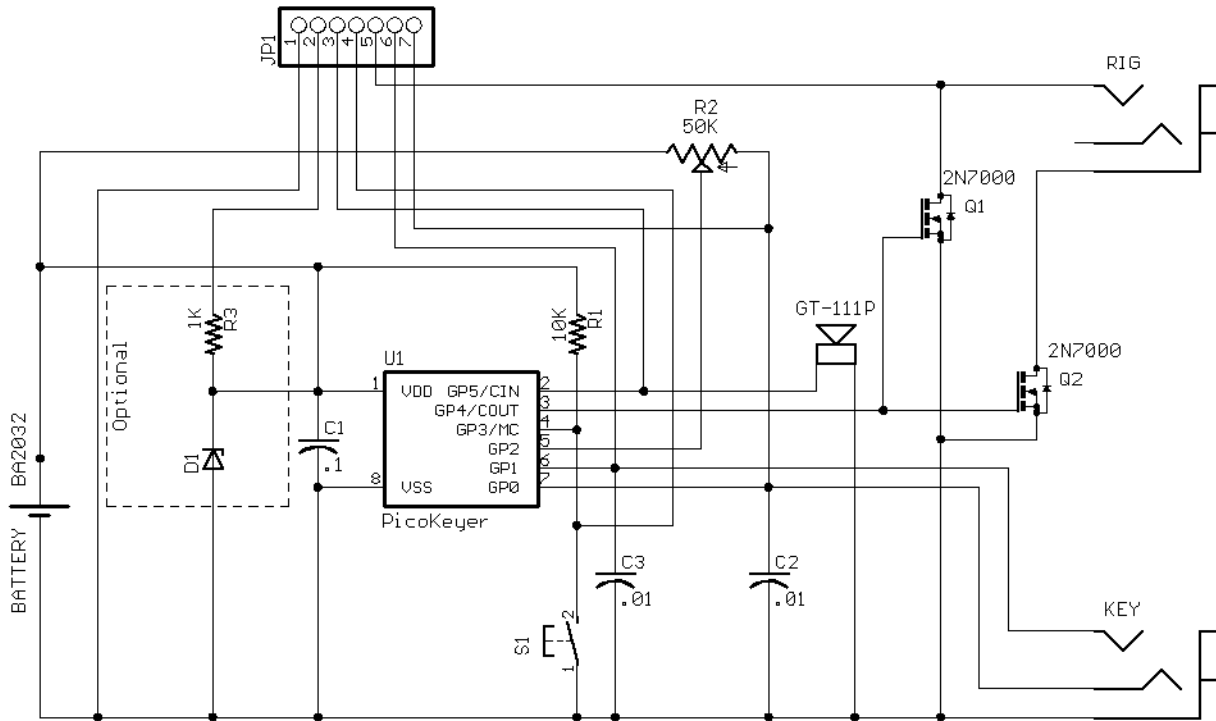
	<p>immediately when one of these commands is encountered. You can chain messages in any order.</p> <ul style="list-style-type: none"> • /P will insert a pause in the message. This will cause the message to pause while you manually send information such as manually entered QSO number, RST, etc. Tapping the setup button while paused will resume the message. <i>Hint:</i> If you use /P, store it immediately following the preceding characters without a word space. In other words, store “UR RST/P ...” instead of “UR RST /P ...”. This prevents you starting to send before the word space completes, which will terminate memory playback completely. • To have your message automatically repeat at timed intervals, insert the command /B (BEACON) at the end of your message. This will cause the keyer to delay for the number of seconds set with the B parameter (see below) and re-send the message. You can terminate beacon operation by tapping either paddle or the button. This can be especially useful for calling CQ, or to use your PicoKeyer to control a propagation beacon or “fox” transmitter. • To have Message #1 automatically start whenever power is applied to the PicoKeyer, store the /A command as the first two characters in message #1. This is useful for autostarting a keyer used as part of a beacon. Remember that you will still need to use /B at the end of the message if you want it to repeat. • To send the QSO number and increment it by one, send /QI (QSO Increment). • To send the QSO number and NOT increment it, send /QN (QSO No increment). • To the last (previous) QSO number, send /QR (QSO Repeat). This is useful during contests if you need to send a “fill”. • To temporarily increase the keyer speed by one WPM, send /SU (Speed Up). Note that this and the /SD command will take effect immediately and will remain in effect only until the message is finished. You can store multiple /SU or /SD to change speed by more than one WPM – for example, /SU/SU will increase your speed by 2 WPM. • To decrease keyer speed by one WPM, send /SD (Speed Down). • To alter the letter spacing, send /Fn where <i>n</i> is one digit, 0 through 9. This will act the same as setting the letter spacing in the menu. For example, say you want to add a little extra space between letters in your call sign in a CW message. You could store, “CQ /R/R DE /F2N0XAS /R/R K /F0/B”. Remember to set the letter spacing back to your normal setting. • To insert an extra word space in your message, use the special prosign character “IM” (.-----). • To insert a steady carrier, send more than 9 dashes. The length of the carrier will be equal to the number of dashes, with no spaces in between.
Q	QSO Number: The keyer will send the current QSO number. You can use the paddles to set the QSO number anywhere from 1 to 255. Note that when the QSO number is auto-incrementing, it can go from 1 to 65535.
R	Reset QSO number: Keyer sends “?” and waits. Tapping either paddle will reset the QSO number to 1.
L	<p>Auto letter spacing: The keyer will announce the current setting and wait for input. Automatic letter spacing takes effect for messages sent from memory as well as code sent manually with the paddle.</p> <ul style="list-style-type: none"> • 0 turns automatic letter spacing off. In this mode you control the spacing between letters. This is the default setting, and is the same as most keyers. • 1 turns on auto letter spacing at the set speed. A letter space is automatically inserted if the keyer detects no input from either paddle at the end of the space after a dot or dash. • Settings from 2 to 9 will set automatic letter spacing with longer delays. For example, selecting 2 will insert one extra “dit” length spacing between characters. Selecting 3 will insert an extra 2 “dit” lengths, and so on. • Note that auto letter spacing is inactive while in setup mode.
X	Cut numbers: The keyer will send Ø and 9 using the current setting and wait. You can cycle between no cut numbers (Ø 9) cut zeros (T 9), cut nines (Ø N), or both (T N). Note that this <i>only</i> affects the way QSO numbers are sent. Other numbers in stored messages, or numbers sent by hand, are not affected. The default setting is no cut numbers.

Z	Leading Zeros: The keyer will send “Y” or “N” and wait. As with other menu settings, either paddle may be used to switch between the two settings. Y will send numbers in stored messages with up to two leading zeros (1 is sent as 001, 99 is sent as 099, 123 is sent as 123, 1000 is sent as 1000). N sends numbers without leading zeros. Like the X setting, this affects only QSO numbers and not other numbers stored in messages or sent manually. The default setting is N.
B	Beacon delay: The keyer sends the current beacon delay in seconds. Use the paddles to increase or decrease the delay between beacon transmissions from 0 to 99 seconds.
W	Weight: The keyer announces the current weight and waits for input. The dot paddle may be used to decrease the weight or the dash paddle to increase it. Weight can be set anywhere from 1 (50% "light") to 5 (normal) to 9 (50% "heavy"). The default setting is 5.
T	Sidetone: The keyer announces the current sidetone setting and waits for input. You can use the dot and dash paddles to switch between “N” (sidetone OFF), “Y” (sidetone ON) and “M” (MCW mode). In MCW mode, the keying output is active any time code is being sent and for two word spaces after the key is released. This can be used to control the PTT line of an FM transmitter. Regardless of the sidetone setting, the sidetone is always used while in setup mode.
K	Key Mode: The keyer will send the current keying mode: "A" or "B" for iambic A or B timing modes, “U” for Ultimatic, “G” for bug or “S” for straight key. You can use the key or paddle to switch between modes. In “Bug” mode, dots are made automatically with the correct spacing and length with one paddle input, while dashes are made manually with the other. If straight key mode is selected while using a paddle, either paddle input will key the transmitter.
P	Paddle Selection: This will allow you to reverse the paddles for mis-wired paddles or left handed operators. Simply hit whichever paddle you want to use for DITs. No need to rewire your paddle!
A	Audio Tone: The keyer will send a dash at the selected sidetone audio frequency each time a paddle is hit. Use the paddles to increase or decrease the audio frequency as desired. The default setting is approximately 700 Hz.
D	Transmit delay compensation: Some transmitters tend to shorten Morse code elements when used in QSK mode. This setting can be used to lengthen Morse elements and shorten spaces to compensate. The setting can be from 0 to 50 milliseconds. This is similar to weighting, except that it is independent of speed. Weighting shortens or lengthens elements by a percentage; delay lengthens elements by a specified number of milliseconds. Be aware that this can cause problems when using large delays and fast speeds. The default setting is zero.
V	Firmware version: Keyer sends the version number of its program.
F	Factory Reset: Keyer sends “?” and waits. If you tap either paddle the keyer will be completely reset to its original settings All message memories are deleted and the QSO number is reset to 1. You can also perform a factory reset at power-on. If both paddle inputs are grounded when power is first applied, the keyer will enter the “F” menu function and send “?” in Morse code. Tap either paddle to perform the reset, or press the button to exit without resetting.

Warranty & Support:

Your PicoKeyer is guaranteed against defects for one year from date of purchase. This warranty does not cover damage due to improper modification, improper soldering or wiring, overvoltage, static damage or other misuse or abuse. If you have problems, please contact me via email to arrange for an exchange or replacement part. If you accidentally damage your keyer, don't panic – just contact me, replacement parts and repairs are not expensive.

Should you need support, have questions, have feature requests or bug/problem reports, please feel free to contact me via email at support@HamGadgets.com. I will make every effort to respond as quickly as possible.



PicoKeyer-Plus Schematic

PicoKeyer Menu Quick Reference			
2 dits (I)	Send M2	Z	Leading Z eros on/off
3 dits (S)	Send M3	B	B eacon delay
4 dits (H)	Send M4	W	W eight
U	tUne mode	T	Siditone
S	Speed	K	K eyer Mode (A , B , U matic, b u G , S traight)
M	M emory	P	P addle reverse
Q	Q SO# Set	A	A udio tone
R	R eset QSO#	D	X mit precomp. D elay
L	L etter spacing 0-9	V	F irmware V ersion
X	Cut numbers 0 / 9	F	F actory R eset

Header JP1 Connections	
JP1-1	Ground
JP1-2	DC power, 3-14V DC Only
JP1-3	Siditone Audio
JP1-4	Pushbutton Switch
JP1-5	Keying (60V / 200 mA Max)
JP1-6	DOT paddle input
JP1-7	DASH paddle input