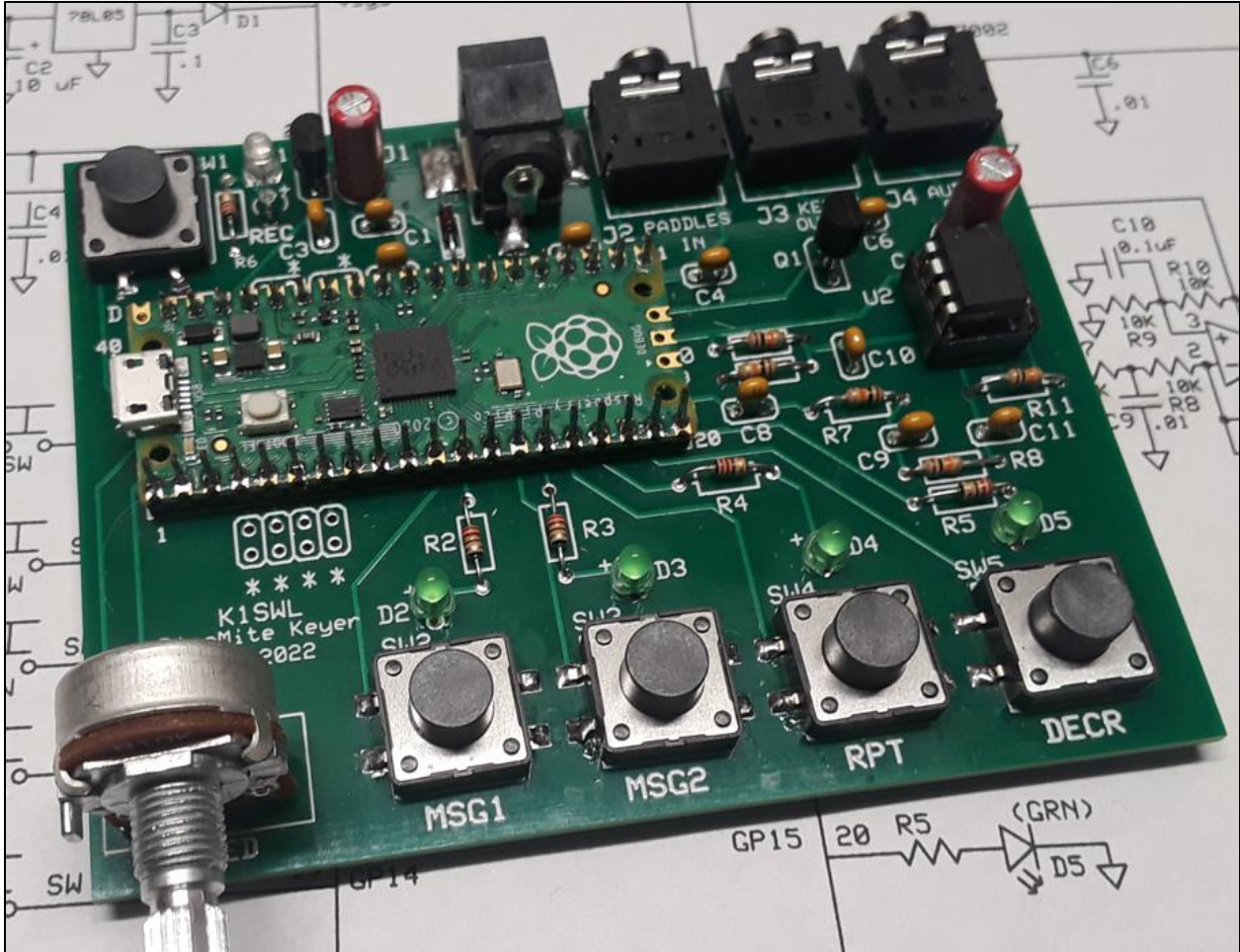# PicoMite Memory Keyer

Assembly & Operation

Welcome aboard, and thanks for your interest in the PMK Keyer!

There are three parts to this guide:

1) **ASSEMBLY –** Assembly order is fairly non-critical, but we'll note anything of interest along the way. It's a good idea to review your collection of parts before launching into assembly. If you find that parts are missing, contact George (N2APB@MidnightDesignSolutions.com) for prompt assistance.
2) **SETUP –** You will need to use a "terminal" app on your PC/Mac to install the software onto your Pico processor and set some basic operating characteristics for the Pico, and then download the latest PMK software (aka, firmware) to it in order to have the keyer work.
3) **OPERATION –** This last section describes the use of the pushbuttons and keyer features.

So let's begin!

ASSEMBLY

Static-sensitive parts

The ICs and the Pico may be considered static-sensitive. If possible, ground yourself while installing them.   A grounded wrist strap is ideal. If none on hand, touch something grounded frequently while working.   Avoid moving around on carpeting and also avoid resting these components on paper.

'Tight spaces'

There are a few. The components immediately above the Pico are 'down in the hole' if you leave them toward the end of assembly.   That's true of R12 and R13 (below J2) and the 2-pin header between J1 and J2 as well.

_____

Polarity-sensitive Components

The two 1N4148 diodes (D1 and D7)

Ensure that the banded ends of the diodes matches that shown on the silkscreen for those devices.

The two electrolytic Caps (C2 and C12)

The longer of two wire leads is positive (+). Ensure that it's installed with that lead closer to the + sign

on the silkscreen.

The five LED indicators (D2- D6)

The longer of two wire leads is positive (+). Ensure that it's installed with that lead closer to the + sign

on the silkscreen.

The two integrated circuits (U1 and U2) and Q1.

Ensure that the 'flats' on U1 and Q1 face in the direction shown on the silkscreen.

Ensure that the notch on U2 faces 'up' (toward C12).   _Note: if you install the socket upside down, leave it. It too has a notch, but that doesn't affect operation in either orientation._

The Pico itself

The **Pico installation** is the only tricky step in the assembly process.

    1) Install the two 20-pin headers on the Pico board, but **do not solder yet**.

    2) Likewise install the two 20-pin headers on the main circuit board. **Do not solder yet.**

    3) Mate the headers and sockets together on the board. You'll need to keep the assembly secure with a fingertip.

4) Tack at least one pin on the Pico with solder. Invert the board and solder at least one socket pin to the underside of the board. This is a 3-handed operation. I hang a length of solder over the edge of my bench and maneuver the board to the solder. Once this is achieved, solder all remaining connections on the Pico and the socket strips.

Here's why: if the sockets or header pins are tipped, you won't be able to install the Pico in the sockets. Ask me know I know this.

5) The Pico **must** be installed with the USB micro connector facing the Left edge of the board.

SMTs: There are 5 of them – the tactile switches. They're huge by SMT standards.

Add solder to one of the four SMT pads. Hold the switch in place while heating that corner. Once cooled, proceed to solder the remaining 3 pads on each switch. *Easy-peasy.*
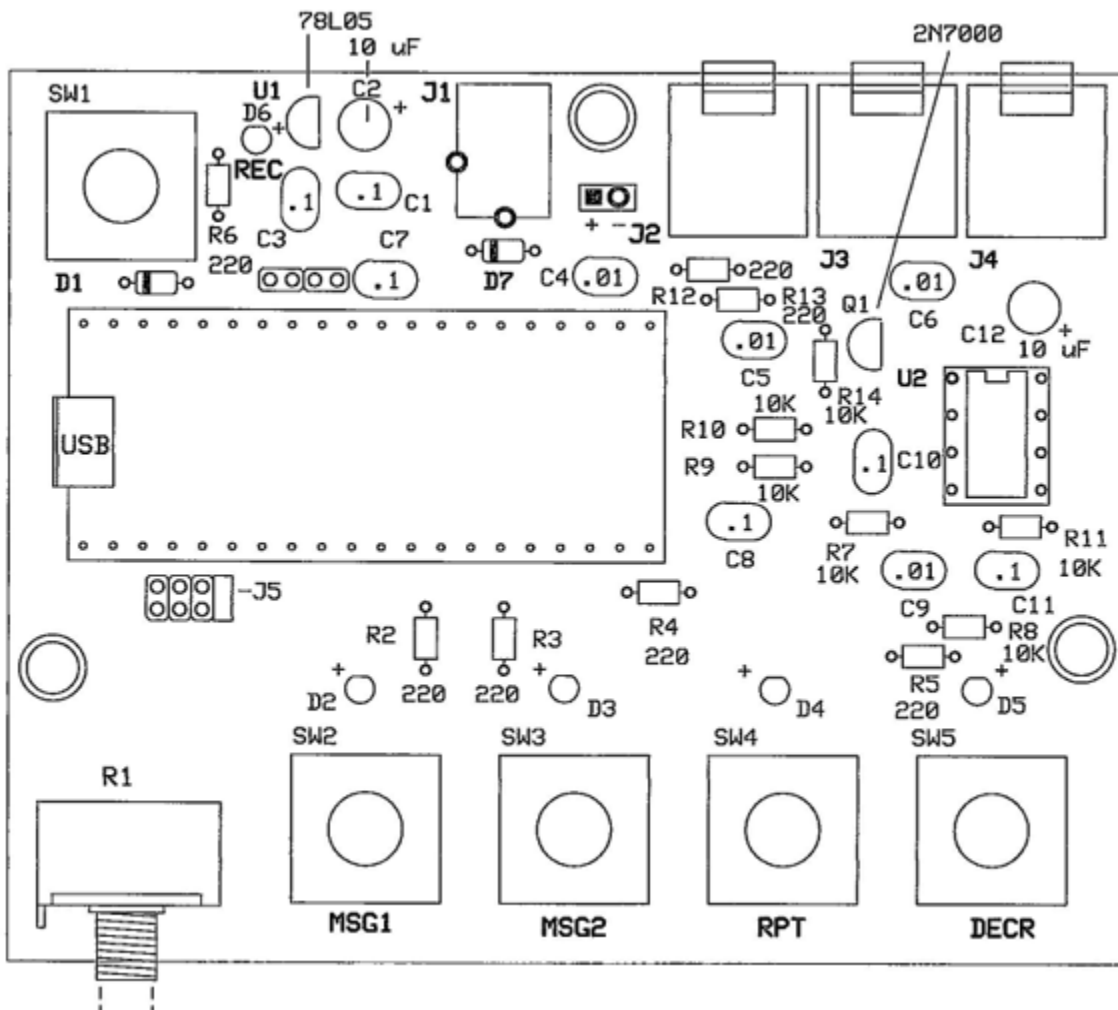
Software Installation

The software installation process for the PicoMite is straightforward and the website https://geoffg.net/picomite.html describes the operating environment and features.

Step 1: Download the MMBASIC software, the Manual and the .uf2 Boot Loader

Toward the bottom of Geoff's page is a dialog button for downloading the MMBASIC software. It's in zipped form, and the .uf2 file therein contains the MMBASIC code. The companion document - the User Manual - is included in that zipped directory and describes the installation process in detail on pages 5 and 6. That's not all - the manual runs 172 pages in all and is an excellent and comprehensive guide to MMBASIC. Unzip the file to a folder located in a convenient place on your hard drive.

Step 2: Install the Boot Loader

a) Connect the Pico to your computer using a USB cable … while at the same time holding down the small white tactile switch on the Pico. This action will trigger the computer to open a new device folder in the Windows File Manager.
b) Locate the .uf2 file (from step 1 above) and drag it into this newly created folder.
c) The Pico will immediately reboot and appear as a new serial device as can be seen in Windows Device Manager. It's LED will be blinking to indicate that MMBasic is loaded and running!

Step 3: Load a Terminal Emulator to Windows to Communicate with the Pico

We recommend locating and loading the 'TeraTerm' terminal emulator app to your computer. It is free and quite usable. <https://osdn.net/projects/ttssh2/downloads/74780/teraterm-4.106.exe/> Once installed and started, click the 'Serial' radio button, and see the standard COM1 and the newly-created COM port (e.g., COM3, COM7, etc). Select the latter and hit carriage return. You should see a command prompt ('>') appear on the terminal. You're now running BASIC!

The installation took about 15 minutes, and most of that time was spent on reading up on the installation steps. The process itself went flawlessly on a Windows 10 machine, and versions are also available for MAC and Linux. The software Driver necessary for Windows 7/8 isn't supported by Microsoft, but a link to a generic Driver is provided on page 7 of the User Manual. This too was successfully installed on my 'workhorse' Windows 7 computer.

Step 4: Load the PMK Software

This last step is to download and install the PMK software. The latest software is currently v2.11, located on the PMK website as a text file. Right-click on the link and **Save As …** to that same convenient place on your computer's hard drive.

We use the TeraTerm's "XMODEM" command to transfer the program file to the Pico, and the PicoMite's Xmodem Receive command to gobble up the PMK software.

a) At the TeraTerm command prompt, type: xmodem receive
b) In the TeraTerm menus along the top, select: FILE..Transfer..XMODEM..Send, then navigate to and select the PMK software you just downloaded.
c) When the command prompt '>' reappears, the PMK software is now loaded successfully.

PMK OPERATION
(for versions 2.1+)

Five Pushbuttons

PicoMite Memory Keyer (PMK) has five tactile switches to control operation. Four initiate the message functions and a fifth starts the recording process in 'standalone mode'. Each of the five inputs has a corresponding LED indicator.

"MSG1" = Send Callsign

This one is pretty self-explanatory! The callsign must be first entered using the RECord mode, as described in the Operating section below.

"MSG2" = Send Contest Exchange

Most of 'the good stuff' is in this function. It's user-programmable by several methods and is able to playback a callsign as well as a sequential serial number that's useful in many contests. Refer to the Operating section below for usage details.

"RPT" = Repeat Contest Exchange

This function repeats the exchange just sent. This is needed for the situation where the CQ'ing station sends '?' or 'AGN' (again).

"DECR" = Decrement Exchange Serial Number

This one rolls back the contact number in the case of a 'busted' contact, which is when the other party never gets the complete exchange and sends 'SRI' (sorry) or goes back to CQ'ing. This button is also used when inserting a serial number into the MSG2 memory. (See the Operating section for details.)

"RECORD" = Record Message to MSG1 or MSG2

This function enables one to record keyer paddle input to the message buffers. Pressing the 'RECord' button arms the programming mode. At the end of the message, press one of the two message pushbuttons to store it in the desired location and the Record LED will turn off. Press that message buffer button to play out the newly stored message in Morse.

Two Software States

The PMK software has two states: SETUP and OPERATING.

SETUP – The USB connection to a computer is required for initially (<u>and only once</u>) doing several things:

    a) Entering the several Pico controller options:
        i) OPTION AUDIO GP20,GP21
        ii) OPTION AUTORUN ON
    b) Specifying the user's operating preferences:
        i) Paddle dit/dah reversal
        ii) Iambic Mode A or Iambic Mode B
    c) Optional viewing of instructions for the Operating state (which follows).

OPERATING – After optionally viewing the OPERATING notes, the Keyer enters the normal OPERATING state, which is solely controlled by the paddle. No further interaction occurs with the computer, and as long as 12V DC power is applied to J1, the USB cable may be removed.

The OPERATING state is by far the most common way to use the PMK on the bench, in the field, when portable, etc. *As long as the jumper is on J5,* the Keyer will power up into the OPERATING state and may be used without a computer.

The user has several "controls" available by means of the paddle in the OPERATING mode:

a) Reset SN?
   When first entering Standalone mode, you will hear a question sent in Morse to the headphones: "**RESET SN?**," which gives the opportunity to reset the exchange serial number if desired. Tapping either paddle will do this; or by just waiting three seconds, operation will continue with the same SN sequence as before.

b) To enter messages #1 and #2 without a QSO Count:

   Press the Record pushbutton and see the red LED come on. Enter your intended message on the keyer paddles. When complete, press either the MSG1 or MSG2 button to store a message to either of those memories. The green message LED will come on for 0.5 seconds and the red Record LED will go off.

c) To enter a message to MSG2 with a QSO Count:

   For a QSO Count at the START of a message:

   1. Tap the REC pushbutton;
   2. Tap the DECR button;
   3. Enter the message via the keyer paddles; and
   4. Tap the MSG2 button to store the message. (This feature is helpful for the ARRL CW Sweepstakes.)

   For a QSO Count at the END of the message: (note the different order of step 2 & 3) …

   1. Tap the REC button;
   2. Enter message via the keyer paddles;
   3. Tap the DECR button; and
   4. Tap the MSG2 button to store the message.

Notes

1) User settings (paddle reversal and iambic mode selections) are stored in non-volatile memory and are restored upon application of power.

2) Message buffers 1 and 2 are stored in non-volatile memory and are restored upon application of power.

3) The PMK retains the last serial number if the PMK is not reset. This allows the keyer to recover gracefully in the event of a power interruption.

Summary

As a 'little gun' operator with a modest station, I wouldn't dream of trying to hold a frequency in a contest. The PMK satisfies my needs for 'search-and-pounce' operation in the occasional contest operation. I'm using it on a weekly basis and I find pushing a single button more productive than working the keyer paddles. I'm able to begin logging while the PMK is sending the exchange.

If your Morse skills are rusty or if you are new to the game, a memory keyer is a real boon. You are able to put your 'best foot forward' on the air- without the 'jitters' that can arise from being relatively unfamiliar with Morse operation. It is worth noting that Novice/Technician licensees have CW privileges on 80, 40, 15 and 10 meters.

With high-band conditions improving as we head into Cycle 25, this would be a good time to make use of those operating privileges!
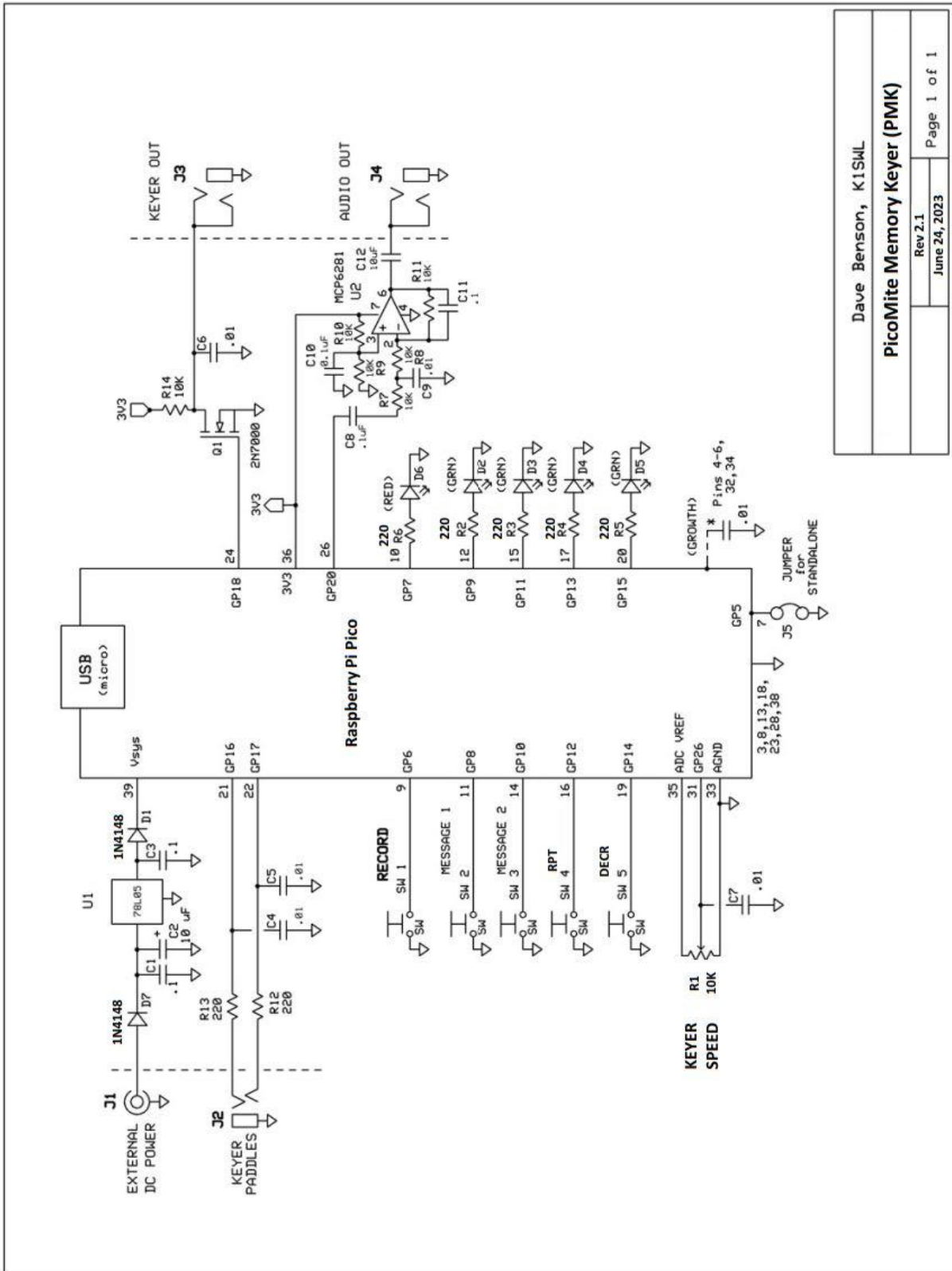
Good luck & 73!

Dave Benson, K1SWL, email: daveK1SWL@gmail.com

(with George Heron, N2APB, email: n2apb@MidnightDesignSolutions.com)

HARDWARE CONNECTIONS

PMK mounted on wood with Lexan cover plate

SCHEMATIC

Dave Benson, K1SWL

PicoMite Memory Keyer (PMK)

Rev 2.1
June 24, 2023

Page 1 of 1

PARTS LIST

Ref. Designator	QTY.	DESCRIPTION	Mouser Part No.
C1, C3, C8,C10,C11	5	0.1 uF, 0.1" lead spacing (L.S.)	594-K104K10X7RF5UL2
C2,C12	2	10 uF 16V, 0.1" L.S.	710-860010372001
C4-C7, C9	5	.01 uF, 0,1" L.S.	594-K103K10X7RF5UL2
D1,D7	2	Diode	512-1N4148
D2-D5	4	Green LED, T-1 pkg	710-151031VS04000
D6	1	Red LED, T-1 pkg	710-151033RS03000
J1	1	2.0/5.7mm jack, PC-mount	PJ-059A
J2-J4	3	3.5mm jack, PC-mount	490-SJ1-3523N
- -	1	DIP-8 Socket	649-DILB8P223TLF
- -	2	header-strip, 20-pin	649-68002-420HLF
Q1	1	2N7000, through-hole	512-2N7000BU
R1	1	10K pot, linear taper	858-P160KN-OQC17B10K
R2-R6, **R12, R13**	**7**	220 ohm 1/6W	CFR-12JT-52-220R
R7-R11, **R14**	**6**	10K ohm 1/6W	603-CFR-12JT-52-10K
SW1-SW5	5	Tactile Switch, 12x12mm	710-430172085816
- -	4	Rubber bumpers	517-SJ-5076-BLACK
U1	1	78L05 Regulator, TO-92	863-MC78L05ABPREG
U2	1	MCP6281, DIP-8	579-MCP6281-E/P
- -	1	PicoMite Computer	358-SC0915
- -	1	2-pin header	571-4-103327-4
- -	1	2-pin jumper	523-G89011020023DEU

Miscellaneous:

1) **USB-A to USB-Micro adapter cable:** 'Smartphone charging cord'. Walmart has these.

2) **"Socket Strips" for Mounting the Pico & Shields:** It's advisable to use single-row "strip sockets" on the pcb for plugging in the Pico microcontroller. Makes it easy to replace the Pico in the future should it be necessary. These strip sockets are also used on the shields to mount onto the Pico. You can get these 1x20 position SIP sockets at ...

   https://www.adafruit.com/product/5585

3) **"Pinheaders" for Mounting the Pico:** For the same reason as above, you can find strips of double-long pinheaders that should be soldered to your Pico controller so it can be plugged into the PMK pcb when the sockets are used. Why "double-long"? So you can plug shields on top of the Pico later on if desired. See photos on the web page showing this.

   https://www.adafruit.com/product/400

4) **Blank PC board:** for the PicoMite Memory Keyer is available from ...
   https://midnightdesignsolutions.com/pmk/