Semi-Automated Matrix Generator Procedure

This procedure assumes you have already used the matrix decoder program to create a pin connection list for all the keys. The manual procedure to determine the row and column pins can be time consuming so Marcel Hillesheim wrote a Python 3 program for the Teensy LC and 3.2 that eliminates most of the manual labor. I have updated his program over the years to add more Teensy controllers and have now modified it for KMK on the Raspberry Pi Pico or Solder Party 2350 XL .

Download the KMK_matrixgenerator.py Python 3 program to your PC. Load it into Thonny and in the lower right corner, select Local Python 3 so it will run on your PC.

Move the completed keyboard pin list text file into the same directory as the Python program so it's easy to find.

In Thonny, select the Run icon. The console window will show all the text files it sees in the directory. Here is an example of the Thonny console window with comments in *italics*:

index file name

1 Keyboard_pin_list_KMK_1545.txt

2 Keyboard_pin_list_KMK_E550.txt

Enter the index number of the *.txt file you want.

OR: enter your own filepath:

I've got 2 text files for 2 keyboards in the directory. For this example, I'll type 1 and Enter to use the 1545 keyboard pin list:

1

---

index device

1 2350

Please enter the index number of your device:

Currently there is only 1 device so type 1 and Enter to get the following:

1

initial output pin: 8 *the program looks at Control Left and Control Right to get it's bearings*

Results:

GPIO PINS:

8 input column GPIO's:

[1, 2, 3, 4, 5, 6, 27, 28] *creating this list of column inputs is the main goal of the program*

17 output row GPIO's:

[7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 26] *all other pins that are used*

KEY *this is the base layer key matrix with the correct names needed by KMK.*

```
{
{KC.NO,KC.NO,KC.PGDOWN,KC.LGUI,KC.NO,KC.NO,KC.NO,KC.PGUP},
{KC.NO,KC.RCTRL,KC.NO,KC.NO,KC.NO,KC.NO,KC.LCTRL,KC.NO},
{KC.RALT,KC.NO,KC.NO,KC.PSCREEN,KC.NO,KC.LALT,KC.NO,KC.NO},
{KC.NO,KC.Z,KC.A,KC.N1,KC.TAB,KC.ESC,KC.GRAVE,KC.Q},
{KC.NO,KC.C,KC.D,KC.N3,KC.F3,KC.F4,KC.F2,KC.E},
{KC.SPACE,KC.ENTER,KC.BSLASH,KC.F10,KC.BSPACE,KC.F5,KC.F9,KC.NO},
{KC.NO,KC.COMMA,KC.K,KC.N8,KC.RBRC,KC.F6,KC.EQUAL,KC.I},
{KC.NO,KC.DOT,KC.L,KC.N9,KC.F7,KC.NO,KC.F8,KC.O},
{KC.LEFT,KC.NO,KC.NO,KC.END,KC.NO,KC.UP,KC.HOME,KC.NO},
{KC.RIGHT,KC.NO,KC.NO,KC.F12,KC.NO,KC.NO,KC.INSERT,KC.NO},
{KC.DOWN,KC.NO,KC.NO,KC.F11,KC.NO,KC.NO,KC.DELETE,KC.NO},
{KC.SLASH,KC.NO,KC.SCOLON,KC.N0,KC.LBRC,KC.QUOTE,KC.MINUS,KC.P},
{KC.N,KC.M,KC.J,KC.N7,KC.Y,KC.H,KC.N6,KC.U},
```

{KC.B,KC.V,KC.F,KC.N4,KC.T,KC.G,KC.N5,KC.R},

{KC.NO,KC.X,KC.S,KC.N2,KC.CAPS,KC.NO,KC.F1,KC.W},

{KC.NO,KC.RSHIFT,KC.NO,KC.NO,KC.LSHIFT,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,FN,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

}

Func *this shows the Fn-Media key locations but it needs further editing*

{

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.MEDIA_EJECT},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.BRIGHTNESS_DOWN,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.MEDIA_PREV_TRACK,KC.NO,KC.BRIGHTNESS_UP,KC.AUDIO_VOL_UP,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.AUDIO_MUTE,KC.NO,KC.AUDIO_VOL_DOWN,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.MEDIA_NEXT_TRACK,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.MEDIA_PLAY_PAUSE,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

}

MODIFIER *this matrix is not used for KMK. It's left over from the Teensy code*

{

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

:

:

{KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO,KC.NO},

}

ONE *this matrix is not used for KMK. It's left over from the Teensy code*

{

{1,1,1,1,1,1,1,1},

:

:

{1,1,1,1,1,1,1,1},

}

Finished

Next, copy and edit the above information into your code.py KMK routine. I will use the 1545 example code.

The 8 input column GPIO's are [1, 2, 3, 4, 5, 6, 27, 28]. These are listed on line 28 of code.py as the keyboard column pins, adding board.GP in front of each number:

keyboard.col_pins = (board.GP1, board.GP2, board.GP3, board.GP4, board.GP5, board.GP6, board.GP27, board.GP28)

The 17 output row GPIO's are [7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 26]. These are listed on lines 29 and 30 as the keyboard row pins, adding board.GP in front of each number:

keyboard.row_pins = (board.GP7, board.GP8, board.GP9, board.GP10, board.GP11, board.GP12, board.GP13, board.GP14, board.GP15, board.GP16, board.GP17, board.GP18, board.GP19, board.GP20, board.GP21, board.GP22, board.GP26)

The “KEY” matrix from the matrix generator output could be used as-is for the layer 0 Base Layer found at lines 40 – 56 of code.py but it’s more readable if tabs are added as shown below.

```
[#layer 0: Base Layer
 KC.NO,         KC.NO,       KC.PGDOWN,  KC.LGUI,     KC.NO,       KC.NO,       KC.NO,       KC.PGUP,
 KC.NO,         KC.RCTRL,    KC.NO,      KC.NO,       KC.NO,       KC.NO,       KC.LCTRL,    KC.NO,
 KC.RALT,       KC.NO,       KC.NO,      KC.PSCREEN,  KC.NO,       KC.LALT,     KC.NO,       KC.EJCT,
 KC.NO,         KC.Z,        KC.A,       KC.N1,       KC.TAB,      KC.ESC,      KC.GRAVE,    KC.Q,
 KC.NO,         KC.C,        KC.D,       KC.N3,       KC.F3,       KC.F4,       KC.F2,       KC.E,
 KC.SPACE,      KC.ENTER,    KC.BSLASH,  KC.F10,      KC.BSPACE,   KC.F5,       KC.F9,       KC.NO,
 KC.NO,         KC.COMMA,    KC.K,       KC.N8,       KC.RBRC,     KC.F6,       KC.EQUAL,    KC.I,
 KC.NO,         KC.DOT,      KC.L,       KC.N9,       KC.F7,       KC.NO,       KC.F8,       KC.O,
 KC.LEFT,       KC.NO,       KC.NO,      KC.END,      KC.NO,       KC.UP,       KC.HOME,     KC.NO,
 KC.RIGHT,      KC.NO,       KC.NO,      KC.F12,      KC.NO,       KC.NO,       KC.INSERT,   KC.NO,
 KC.DOWN,       KC.NO,       KC.NO,      KC.F11,      KC.NO,       KC.NO,       KC.DELETE,   KC.NO,
 KC.SLASH,      KC.NO,       KC.SCOLON,  KC.N0,       KC.LBRC,     KC.QUOTE,    KC.MINUS,    KC.P,
 KC.N,          KC.M,        KC.J,       KC.N7,       KC.Y,        KC.H,        KC.N6,       KC.U,
 KC.B,          KC.V,        KC.F,       KC.N4,       KC.T,        KC.G,        KC.N5,       KC.R,
 KC.NO,         KC.X,        KC.S,       KC.N2,       KC.CAPS,     KC.NO,       KC.F1,       KC.W,
 KC.NO,         KC.RSHIFT,   KC.NO,      KC.NO,       KC.LSHIFT,   KC.NO,       KC.NO,       KC.NO,
 KC.NO,         KC.NO,       FN,         KC.NO,       KC.NO,       KC.NO,       KC.NO,       KC.NO,
```

The Layer 1 Fn Media layer on lines 59 – 75 is created by copying the base layer and then replacing the 9 media specific keys at the locations shown in the “Func” matrix.

```
[#layer 1: Fn Media Layer
 KC.NO,         KC.NO,      KC.PGDOWN,  KC.LGUI,    KC.NO,      KC.NO,      KC.NO,      KC.PGUP,
 KC.NO,         KC.RCTRL,   KC.NO,      KC.NO,      KC.NO,      KC.NO,      KC.LCTRL,   KC.NO,
 KC.RALT,       KC.NO,      KC.NO,      KC.PSCREEN, KC.NO,      KC.LALT,    KC.NO,      KC.EJCT,
 KC.NO,         KC.Z,       KC.A,       KC.N1,      KC.TAB,     KC.ESC,     KC.GRAVE,   KC.Q,
 KC.NO,         KC.C,       KC.D,       KC.N3,      KC.F3,      KC.BRID,    KC.F2,      KC.E,
 KC.SPACE,      KC.ENTER,   KC.BSLASH,  KC.MPRV,    KC.BSPACE,  KC.BRIU,    KC.VOLU,    KC.NO,
 KC.NO,         KC.COMMA,   KC.K,       KC.N8,      KC.RBRC,    KC.F6,      KC.EQUAL,   KC.I,
 KC.NO,         KC.DOT,     KC.L,       KC.N9,      KC.MUTE,    KC.NO,      KC.VOLD,    KC.O,
 KC.LEFT,       KC.NO,      KC.NO,      KC.END,     KC.NO,      KC.UP,      KC.HOME,    KC.NO,
 KC.RIGHT,      KC.NO,      KC.NO,      KC.MNXT,    KC.NO,      KC.NO,      KC.INSERT,  KC.NO,
 KC.DOWN,       KC.NO,      KC.NO,      KC.MPLY,    KC.NO,      KC.NO,      KC.DELETE,  KC.NO,
 KC.SLASH,      KC.NO,      KC.SCOLON,  KC.N0,      KC.LBRC,    KC.QUOTE,   KC.MINUS,   KC.P,
 KC.N,          KC.M,       KC.J,       KC.N7,      KC.Y,       KC.H,       KC.N6,      KC.U,
 KC.B,          KC.V,       KC.F,       KC.N4,      KC.T,       KC.G,       KC.N5,      KC.R,
 KC.NO,         KC.X,       KC.S,       KC.N2,      KC.CAPS,    KC.NO,      KC.F1,      KC.W,
 KC.NO,         KC.RSHIFT,  KC.NO,      KC.NO,      KC.LSHIFT,  KC.NO,      KC.NO,      KC.NO,
 KC.NO,         KC.NO,      FN,         KC.NO,      KC.NO,      KC.NO,      KC.NO,      KC.NO,
```

Final Notes:

Most of the KMK Keycodes are self-explanatory but I use the key alias which can be hard to understand. Here are the strange ones:

KC.N0 – KC.N9 are the number keys 0 – 9.

KC.LBRC is the left brace and KC.RBRC is the right brace.

KC.GRAVE is ` (to the left of the 1 key)

KC.PSLS is Pad slash

KC.PAST is Pad asterisk

KC.PMNS is Pad minus

KC.PPLS is Pad plus

KC.PENT is Pad enter

KC.PDOT is Pad dot (period)

KC.P0 – KC.P9 are Pad numbers 0 - 9

If you don’t have the key on your keyboard, (like a right GUI key), you don’t need to edit it out of the connection list. The Python program skips the unused keys.

Special cases: Lenovo keyboards treat their FN key (known as the “Hot Key”) differently. Most laptop keyboards are like the Dell 1545 example above which puts the FN key into the matrix so it shares its column input pin with other keys. Lenovo gives their FN key its own row and column pins. This causes the Matrix Generator program to not see the FN key. You can either manually add FN into a new row and column or fool the program by adding an unused key code (like KC.F24) into the connection list and give it the same row pin as FN but a different column pin. Once you run the matrix generator program, you can manually remove the KC.F24 key.

An example of this for a Lenovo E550 is described in this PDF.