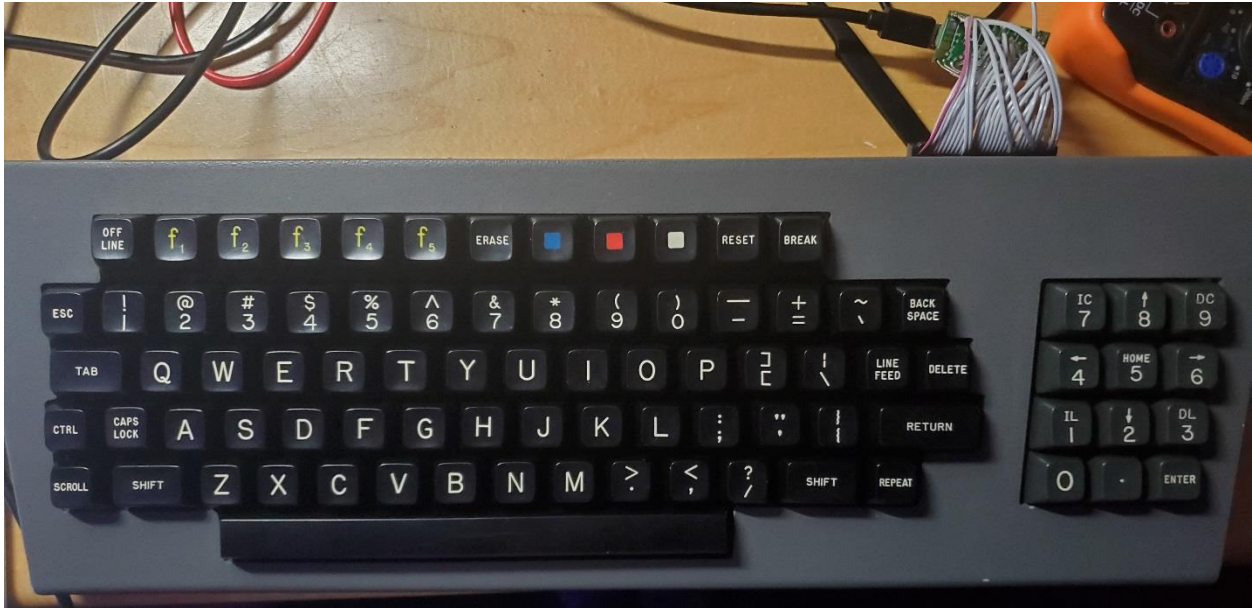This document will describe how the Heathkit H89 Keyboard, shown below was converted to USB by Adam (with my help).

Note the odd key layout for the bracket keys, the lack of a Num Lock key, and several keys that do not exist on a modern keyboard. These odd keys are not implemented because they don't have any USB HID codes.

A standard 34 pin ribbon cable will fit the keyboard connector and the other end has been soldered directly to the Teensy 3.2 pads as shown below:
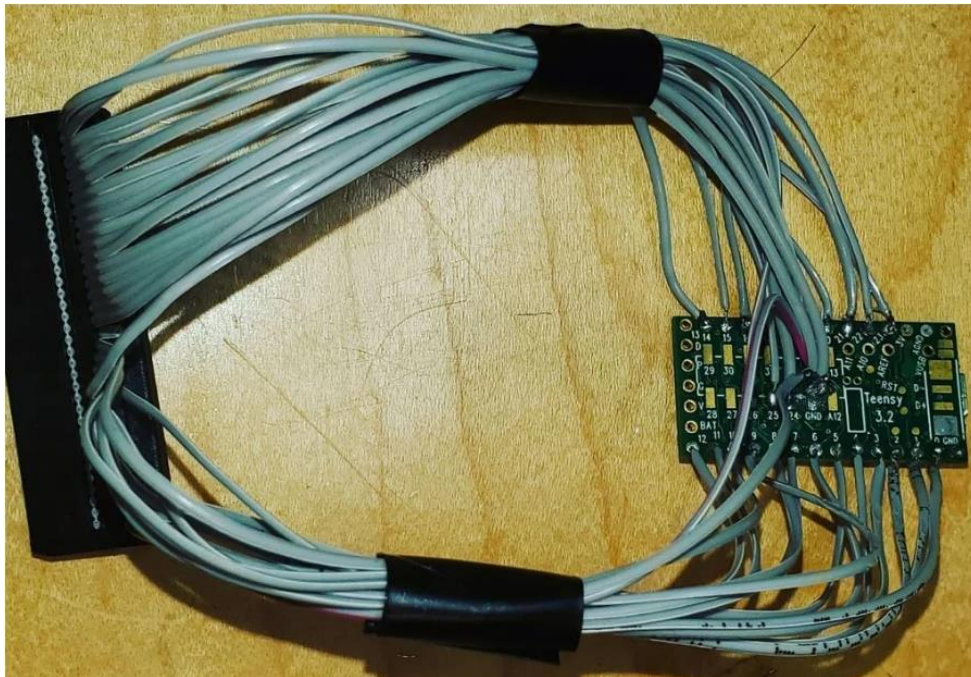
The table below shows how the ribbon cable was wired to the Teensy 3.2.

| Ribbon Cable – 34 signals	Teensy 3.2	Signal Name
1 (red stripe)	GND	Ground
2	I/O # 0	Matrix Column
3	I/O # 1	Matrix Column
4	I/O # 2	Matrix Column
5	I/O # 3	Matrix Column
6	I/O # 4	Matrix Column
7	I/O # 5	Matrix Column
8	I/O # 6	Matrix Column
9	I/O # 7	Matrix Column
10	I/O # 8	Matrix Column
11	GND	Ground
12	GND	Ground
13	I/O #9	Caps lock
14	I/O #10	Matrix Row
15	I/O #11	Ctrl
16	I/O #12	Matrix Row
17	I/O #27 (note 1&2)	Reset
18	I/O #14	Matrix Row
19	I/O #15	Break (used as Num Lock)
20	I/O #16	Matrix Row
21	I/O #17	Shift Right
22	I/O #18	Matrix Row
23	GND	Ground
24	I/O #19	Matrix Row
25	I/O #20	Shift Left
26	I/O #21	Matrix Row
27	I/O #22 (note 2)	Off Line
28	I/O #23	Matrix Row
29	GND	Ground
30	I/O #24	Matrix Row
31	I/O #25 (note 2)	Rpt
32	I/O #26	Matrix Row
33	GND	Ground
34	GND	Ground
	I/O #32	Optional Num Lock LED
	I/O #33	Optional Scroll Lock LED

Note 1 – This signal can be wired to Teensy I/O #13 if the LED on the Teensy is removed. With this change, a Teensy LC can be used instead of a Teensy 3.2.

Note 2 – These keys are not currently reported in the software and don't need to be wired. Leaving these unwired will reduce the I/O count so that a Teensy LC can be used.

The original Heathkit key matrix schematic is shown below. Note the pin 28 correction.
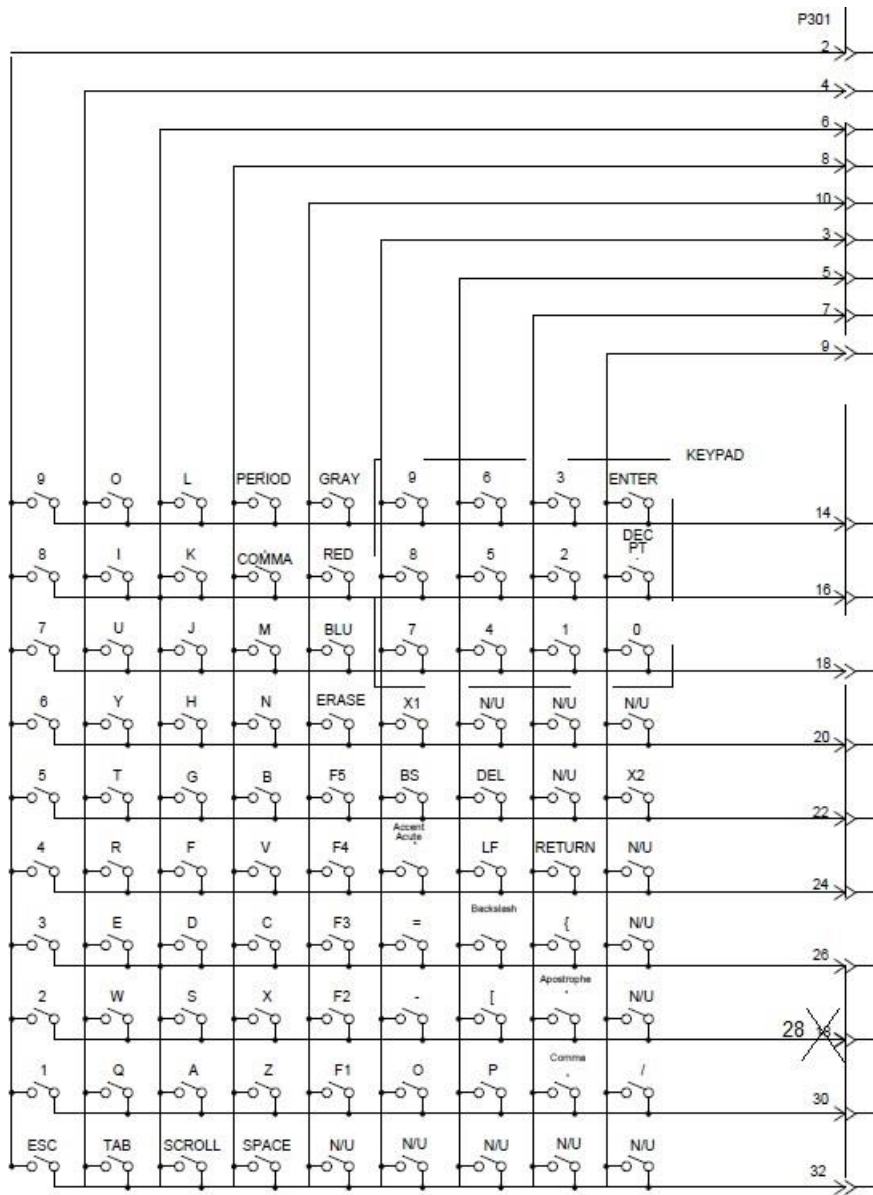
The modifier and special keys are switched to ground instead of being wired in the matrix:
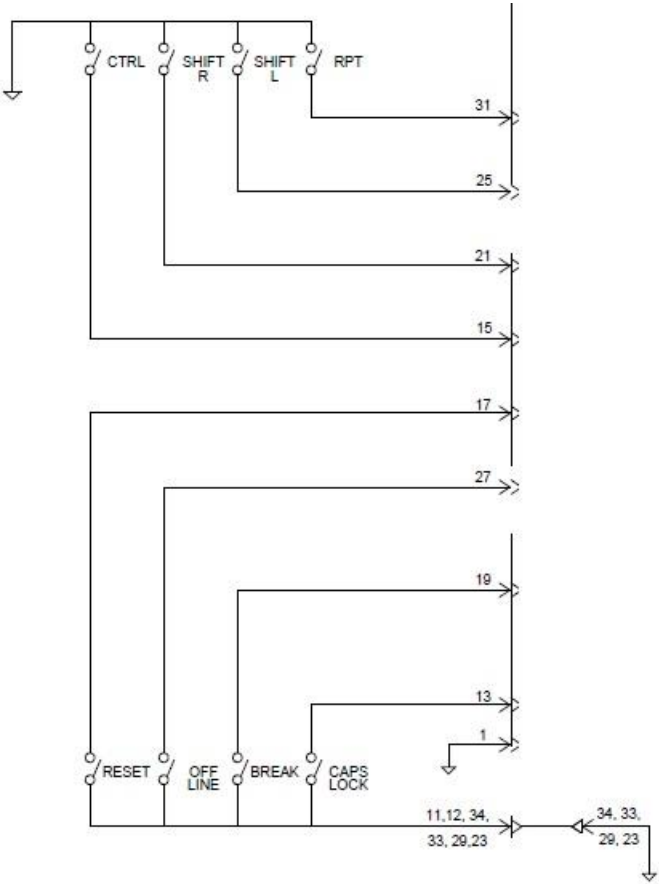
The code to implement a USB keyboard is "Heathkit_H89_Keyboard_RevF.ino"

The LED on the Teensy 3.2 is currently coded to show when CAPS LOCK is turned on. Wire a separate LED to I/O #13 with a current limit resistor if you want better visibility.

Wire an LED to I/O #32 with a current limit resistor if you want a NUM LOCK indicator.

Wire an LED to I/O #33 with a current limit resistor if you want a SCROLL LOCK indicator.

There are several nonstandard keyboard keys that are not easily supported with USB HID codes. The following keys have been coded differently than originally designed:

The break key is used as a Num Lock Key. This was done because there is no Num lock key and the number pad is needed for the arrow keys.

The Line feed key will cause a down arrow.

The Erase key acts as another Delete key.

The square and curly bracket keys are grouped in a non-standard way.

> Left square bracket key works as follows:
>
> > Unshifted, it will produce a left square bracket.
> >
> > Shifted, it will produce a left curly bracket.
>
> Left curly bracket key works as follows:
>
> > Unshifted, it will produce a right square bracket.
> >
> > Shifted, it will produce a right curly bracket.

Other keys not implemented because they have no USB HID code:

Off-Line, Blue, Red, Grey, Repeat, Reset.