

Owner's Manual for the BE19490013B KIT

January 30, 2025

By Mike Bafaro

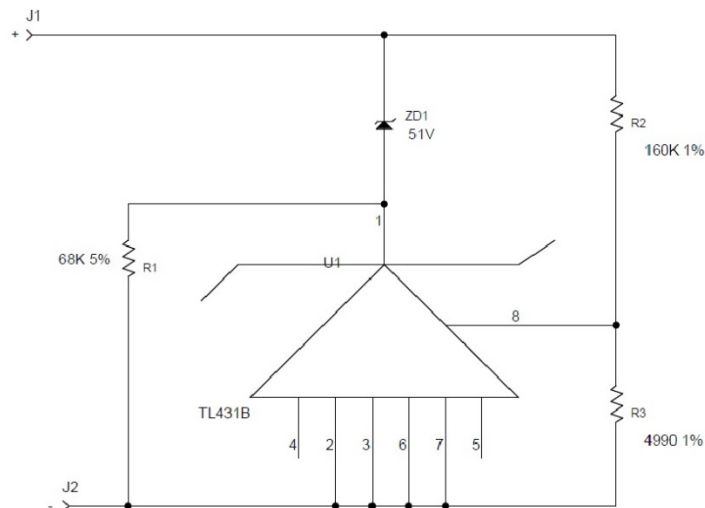
Purpose:

The purpose of this manual is to inform the customer on the use, theory of operation, and the installation of the BE19400013B. This is a solid-state replacement for the Neon tube HP part number 1940-0013 voltage reference that is used in the HP141T display.

Theory of operation:

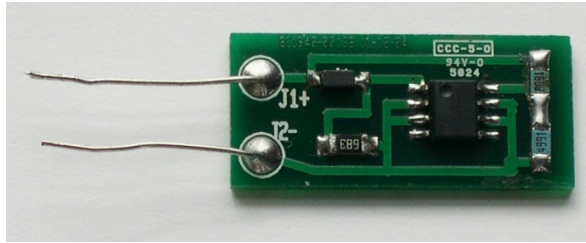
The BE19400013B uses a TL431B programmable Zener and a standard 51V Zener to provide a stable 82.3V reference. The original reference for the 141T was a Neon tube which is longer available. TL431 has a very stable reference that can be used to provide a stable reference up to 37V. Since an 82V reference is required a 51V Zener was added in series with the TL431. The added Zener brings the voltage that the TL431 with stands to less than 37V. The resistors R2 and R3 are set to step down the 82.3V to 2.49V that is needed at reference input voltage for the TL431. The resistor R1 is present to sink the leakage from the Zener to ensure that the maximum voltage the TL431 sees is less than 37V. My calculations indicate that all the components in this kit are within the manufacturer's specifications.

Figure 1 Schematic Diagram:



Schematic of BE19400013B

Figure 2: BE19400013B

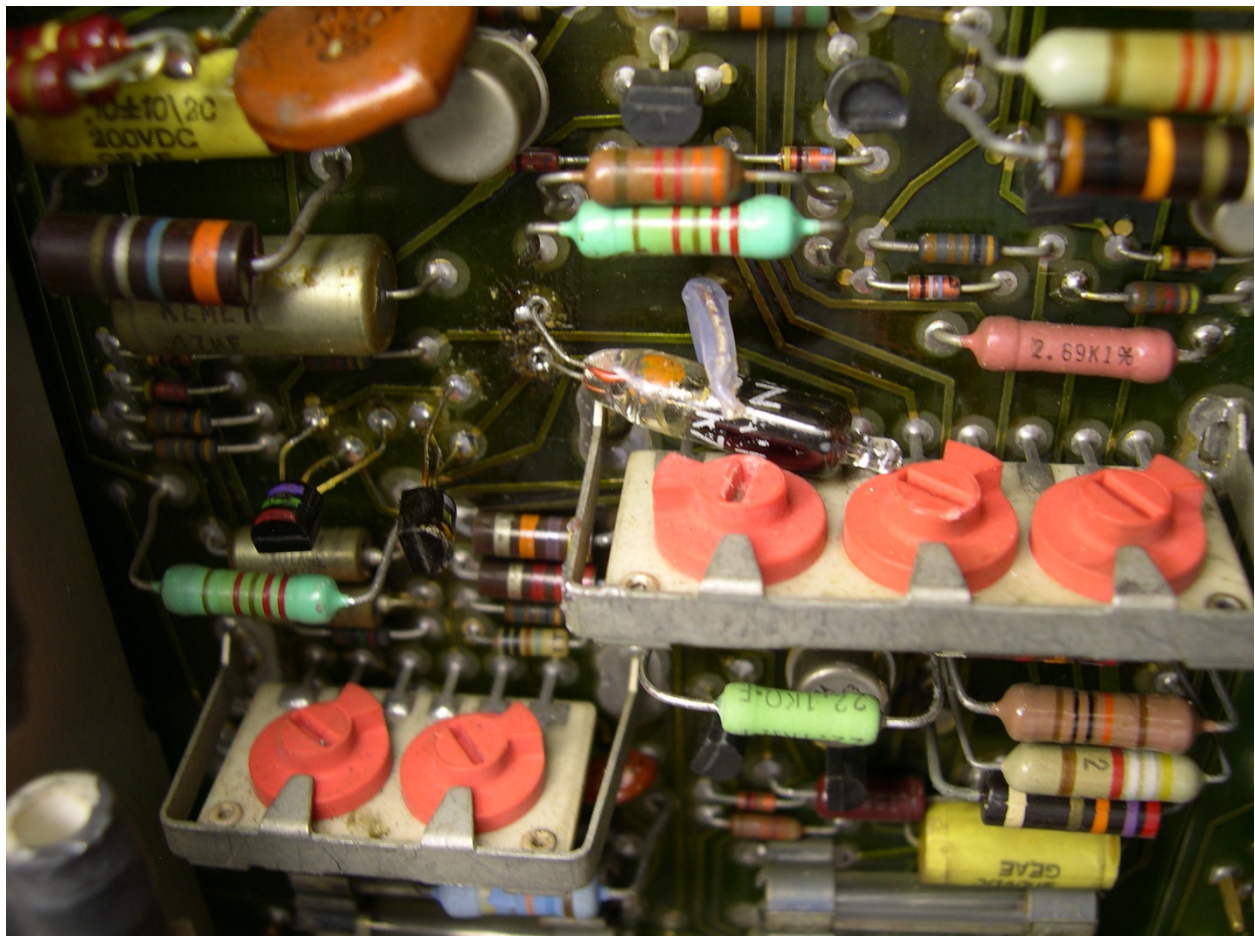


Installation:

The circuit is laid out using surface mount parts to make the overall kit dimensions as small as possible. I suggest that the person installing the BE19400013B kit start by removing the wire that is holding the neon tube to the original circuit board at one end only. This wire can be used to hold my kit down with the Teflon tubing provided with the kit.

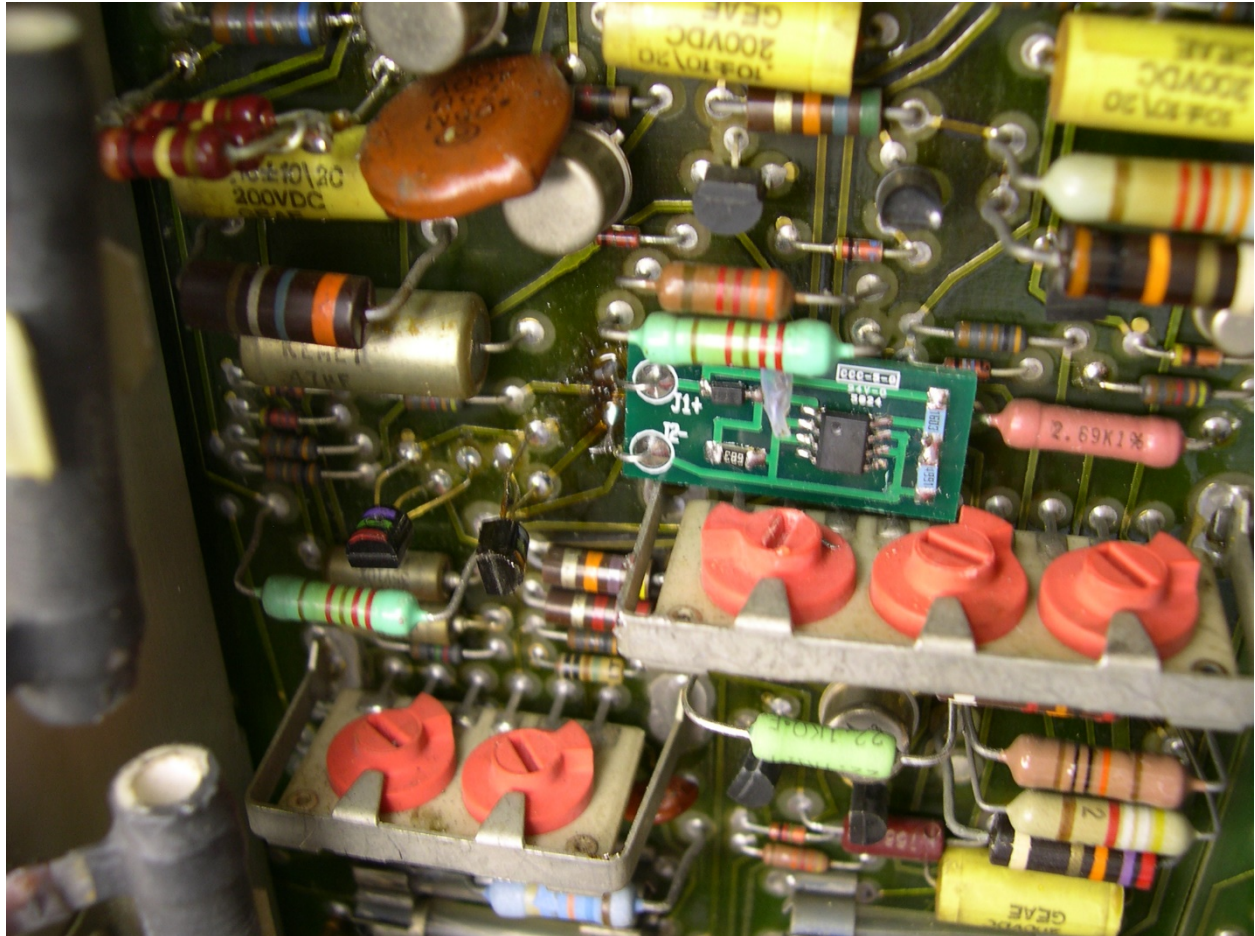
The neon tube can then be desoldered from the HP board and the through holes cleared of solder with a vacuum device. The ground hole is the one closest to the bracket that holds the 3 adjustment pots.

Figure 3: Placement of the original neon tube in the 141T



The solid-state kit has the polarity marked on it. The kit is laid out so that the leads provided with the kit can be bent down and inserted directly into the original HP board and soldered in the board.

Figure 4: The BE19400013B installed in the HP141T

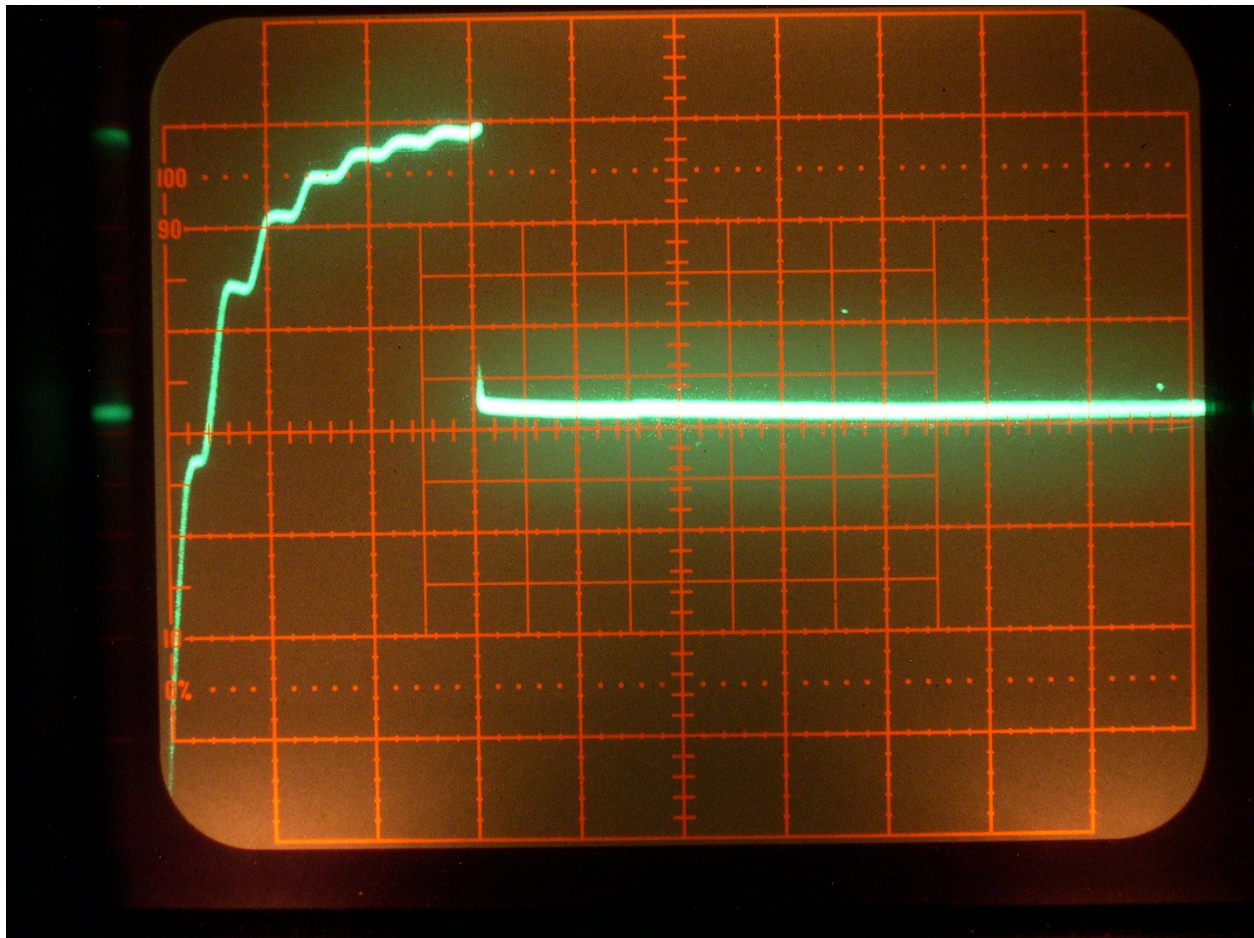


After the kit is installed the 141T +100V supply will have to be adjusted back to 100V as close as possible. The neon tube and my solid-state reference may have slightly different voltage. The center pot on the 3-control bracket is R25 which is the adjustment for the +100V supply.

Observations:

The original neon tube has a small amount of radio-active element on one of the electrodes to make it fire as close as possible to the running voltage of 82V. By now the half-life of the radioactive material has gone by and the neon tube in my 141T was overshooting to $> +100\text{V}$ during the start up. The scope photos have voltage per division of 20V . The time per division is 20msec .

Figure 5: Startup of the old neon tube



Since the regulators in 141T are tracking regulators all the outputs of the 141T supplies will overshoot. This causes the -12.6V to overshoot to -15V which is enough to trigger the overvoltage protection in the HP8552 IF section which will pop the two fuses on the back of that module.

Figure 6 shows the startup of BE19400013B.

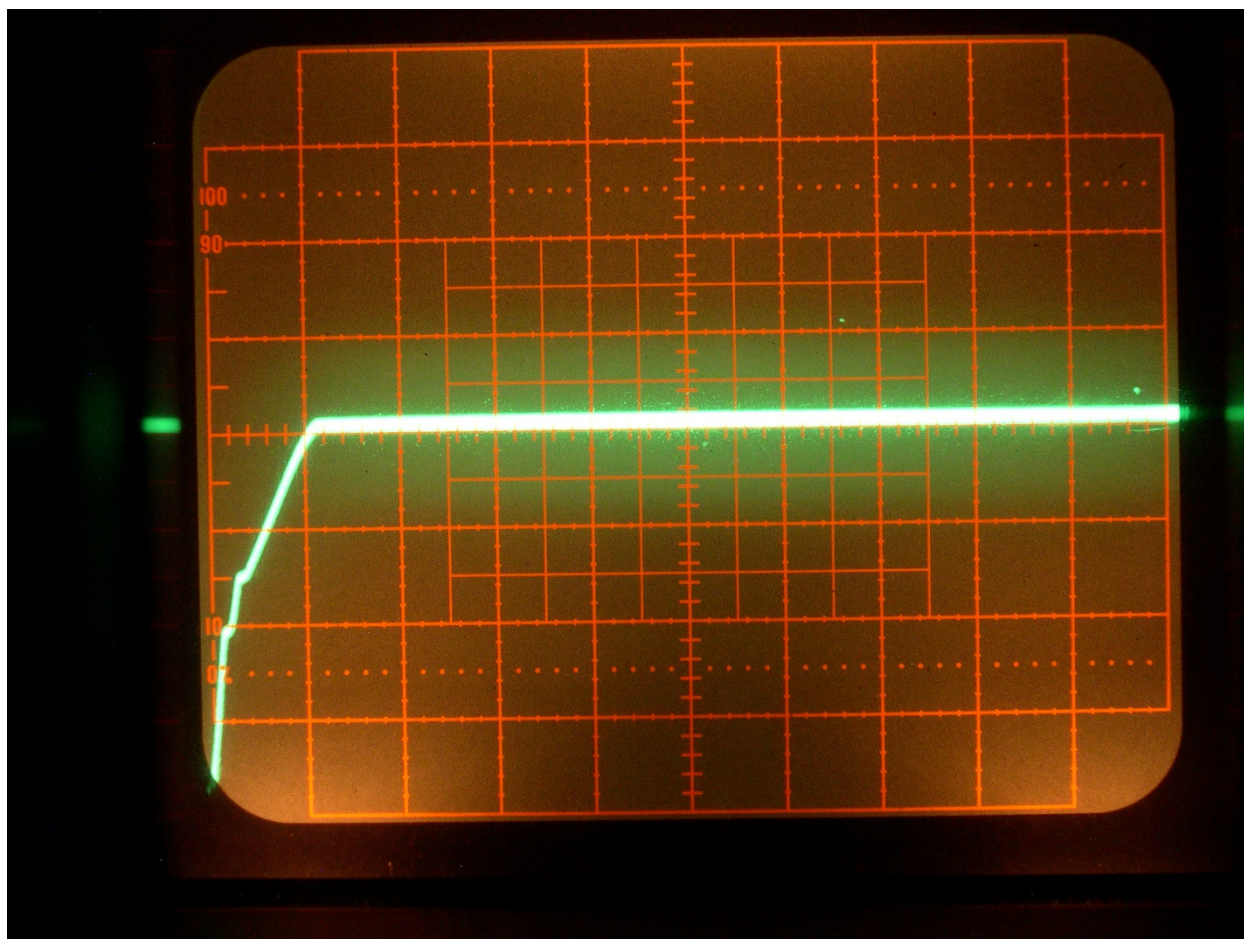


Table1:
Parts
list

Ref Des	Quantit y	Description	Mouser P/N
R1	1	Chip resistor 68K 5%	660- RK73B2BTTE683J
R2	1	Chip resistor 160K 1%	660- RK73H2BTTD1603F
R3	1	Chip resistor 4.99K 1%	660- RK73H2BTTE4991F
ZD1	1	Zener Diode 51V 500mW	863-MMSZ5262BT1G
U1	1	TL431 programable Zener	595-LM431BIMX/ NOPB

Conclusion:

If you have any questions about this module, how to install and use it, please contact me at:

Mike Bafaro

1804 Cottingham Dr.

Schaumburg, IL. 601941

By email at m.bafaro@comcast.net

By phone at (847) 843-3428.