James P. McAdams WA5OKA
2604 Oaks
Pasadena TX 77502

Updating the Heathkit IB-1101

For people like myself, who want a frequency counter for a tool instead of a construction project, a good way to go is to buy a kit. In particular, I have found the Heathkit IB-1101 to be a very good counter for the price. The time base is quite stable (mine drifts from 1.2 Hz high to 0.6 Hz high during warm-up) and it will count to somewhat in excess of 100 MHz.

However, it has a problem. The only counting periods available are 1 millisecond and 1 second. This makes the use of the counter annoying in the "kHz" position because it only updates its display with a new count every 2 seconds. Also there is no way to make an accurate count on frequencies below 100 Hz. A 10 second count is needed for this.

With these facts in mind, I added circuitry and switching to make each decade from 10 seconds to 1 millisecond available from the time base. I also provided for external gating and reset. This freed the counter for a wide variety of counting and timing uses.

At this point, I might mention that I have never used the external inputs. If you are not interested in the external gating and reset functions, and you do not need accuracy at the low audio frequencies, you can get away with no added integrated circuits, only switching.

Circuit Description

To accomplish the desired functions, switching must be provided for the decimal point, the range indicator, the gate, and the reset. As in the original circuit, no switching is required for the input to the memory latch. Of these functions, the generation of

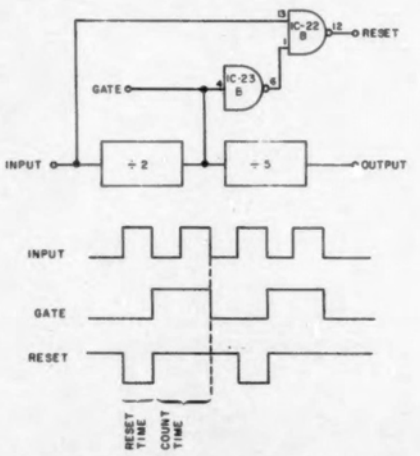


Fig. 1. Gate and reset generator, before modification.

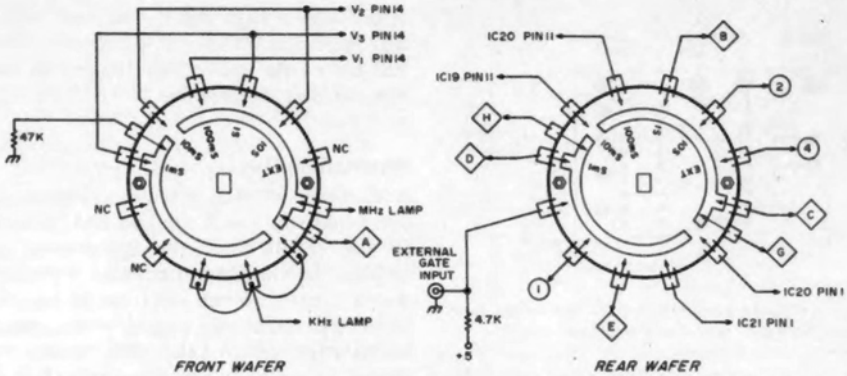
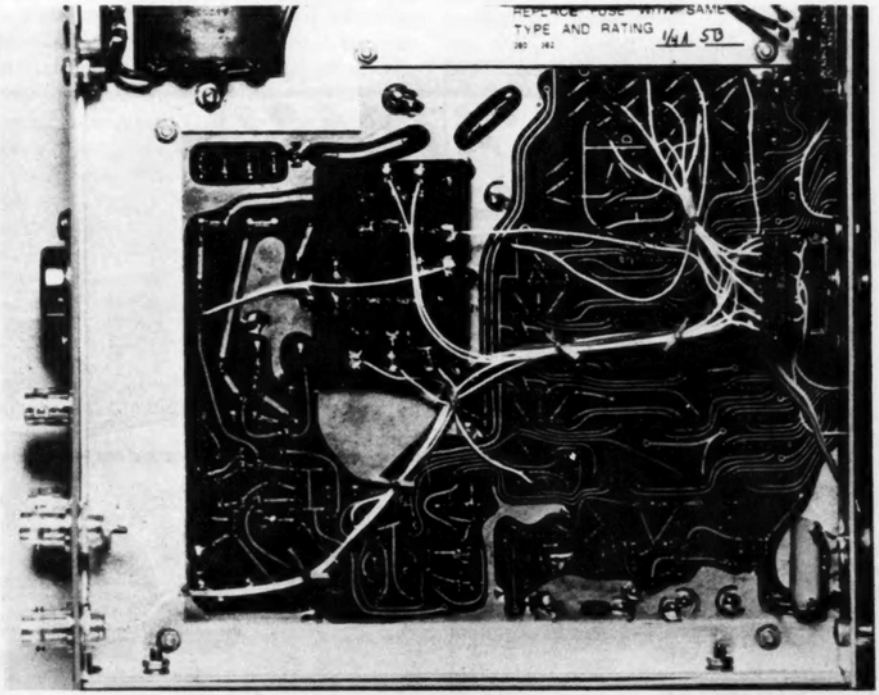


Fig. 2. 4-pole, 6-position rotary switch connections. Numbers in circles refer to Fig. 3. Letters in diamonds are Heathkit designations printed on PC board. Switch wafers are shown from the rear in the MHz (1 ms) position.

the gate and reset signals might be of interest to home brewers who do not own an IB-1101, so I will explain it here.

Following the time base oscillator is a string of 7490 decade counters. Each 7490 consists of a divide by 2 and a divide by 5 circuit. For this application, the binary stage is used as the input. As shown in Fig. 1, the gate signal is simply the output of the binary stage. This line connects to the J and K



Underside view of the counter, showing the added printed circuit board and rotary switch.

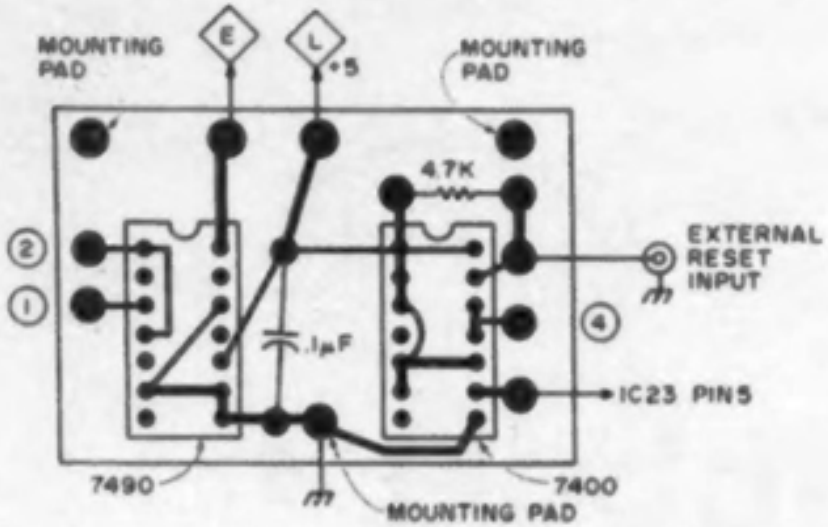


Fig. 3. Printed circuit board for the added functions, foil side view.

inputs of the first flip flop in the counter (a JK flip flop, of course); thus, the gate is open when the gate signal is high. Using this scheme, T=1/F, where T is the time that the gate is open, and F is the frequency of the square wave input to the binary stage. To get a 1 millisecond count, therefore, apply a 1 kHz wave to the input.

Reset is in effect when the reset line is low. The integrated circuits used in the counter will not count when the reset is activated. By the way, to reset a 7490, this reset signal must be inverted because a 7490 resets with a high input. The logic timing diagram in Fig. 1 shows how the reset occurs just before the gate pulse. The NAND gate requires that the gate line be low for a reset to occur.

Modification Details

A 4-pole, 6-position switch is necessary and it must be small, due to a lack of space in the IB-1101. These requirements are satisfied by the Centralab PSA-211. It is a 2-wafer rotary switch. The switch connections are shown in Fig. 2. This switch completely replaces S102, and, in order to mount it, you must make a pair of small plates to cover the square hole for S102. The plates are drilled for the PSA-211 and bolted to the chassis using the mounting holes for S102.

Two changes must be made in the printed circuit board. R21 must be removed. Also, the printed circuit bridge between pins 2 and 5 of IC-23 must be broken so connection can be made from the external reset circuitry to pin 5. Do not break this bridge if the external functions are not desired.

Due to the small size of the pads on the

Heathkit board, small wire and care in soldering should be used. I used #24 stranded wire with teflon insulation (Alpha Wire #2844/19). The teflon is very convenient because it will not scorch or shrink from the heat.

Fig. 3 shows the printed circuit board for the added decade and external inputs. It is installed by perching it on 3 pieces of stiff (#18) bare wire which are soldered to the mounting pads on the added board, and to the ground plane on the Heathkit board, as shown in the photo. One of these provides the ground connection for the extra board.

Take a look at Fig. 4. I did not notice this when I originally performed the modification, but if you connect pin 5 of IC-23 directly to the external reset input, one of the added gates (inverters) can be eliminated. The advantage of doing this is that IC-23 has an unused gate. So, by making the proper changes to the Heathkit circuit board, the extra 7400 can be eliminated. I leave this as a suggestion to you.

The only thing left is the functioning of the external inputs. When the external gate input is low, the gate is closed. When the external reset input is low, the counter resets, independently of the gate. With the connections as in Fig. 4, the count cannot be transferred to the memory and display until the gate is low. This means that you cannot see the tally until you close the gate. The addition of a switch, as shown in Fig. 5, will allow the count to update 5 times per second independently of the gate and reset conditions.

To do this, remove IC-23 and break the printed circuit bridge between pins 3 and 9. After reinserting IC-23, solder the 4.7 k 1/4

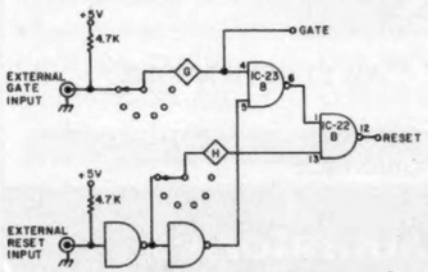


Fig. 4. Modified gate and reset generator with the function switch in the external position.

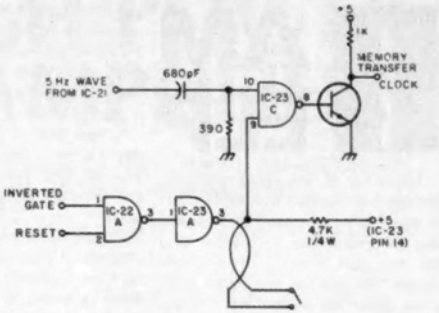


Fig. 5. Circuit to allow continuous transfer of the count to memory, independent of the gate or reset state.

W resistor between pins 9 and 14. The switch is then mounted on the back panel and connected between pins 3 and 9 with a twisted pair. When you close this switch, the counter will function normally. This modification is not in the photograph, but it is in my counter and it is quite satisfactory.

These modifications should add greatly to the use and enjoyment of your IB-1101 counter.

...WA5OKA