Chapter 4

The Reset Circuit

The 68000 microprocessor must be initialized when the system is first turned on, or whenever it must be restarted from a major error. This process is called *resetting.*

4-1. Discussion

Resetting is done by temporarily grounding two 68000 pins - the $\overline{\text{RESET}}$ line and the HALT line. Remember - the “not bar" denotes that these signals are active low. Hence grounding them, which forces them to a low, asserts these two lines or turns them on. Asserting $\overline{\text{RESET}}$ and HALT together for a minimum of 100 milliseconds resets the 68000 and gets it ready to run a program.

The 68000 should be automatically reset every time the power is turned on, but it is also useful to have a button which can be pushed to force a reset if the computer does something it is not supposed to do. Both of these functions are done with the circuit of Fig. 4-1.

The main IC in the circuit is U91, a 555 timer which is connected to a timing circuit consisting of R23 and C63. When the computer is running, C63 is charged through R23 to about +5 volts, and then the output on pin 3 of the timer is a low; this is inverted by the two U22 inverters to a high. Actually, this description is not entirely correct. U22 is a 7406, which is an open collector (or o.c.) hex inverting buffer. Open collector devices (marked on diagrams by a vertical line inside the logic symbol) are missing the part of the output circuit which can output a high; hence they can only output a low or nothing. In this case, they output nothing - an open circuit. But because of R20 and R21, two 2200-ohm resistors connected to +5 volts, the $\overline{\text{RESET}}$ and HALT lines are pulled high by the resistors instead; that’s why these resistors are called pullups. In general, if you ever see an open-collector device which does not have some sort of a pullup resistor connected to

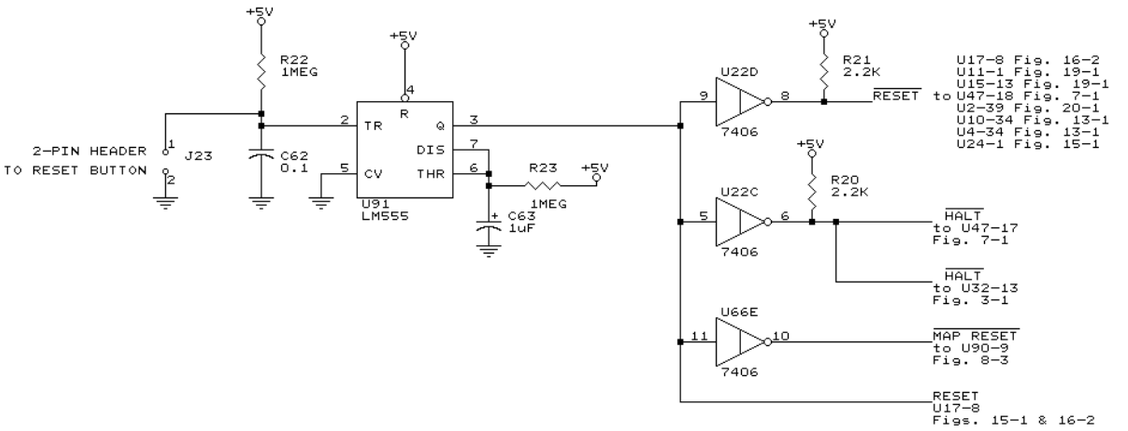

Fig. 4-1. The RESET circuit.

its output (the LED circuit in Fig. 3-1 was a pullup in a way) it usually means somebody made a design error.

Whenever a pushbutton connected to J23 is pressed, this applies a low to pin 2, the trigger input of the timer, which causes the timer to ground pin 7, which discharges C63. (This also happens when power is first applied, since C63 would normally start off discharged). The 555 timer sees this low voltage on its pin 6, and therefore outputs a high on pin 3. This is inverted to a low by U22, and asserts a low on RESET and HALT of the 68000, resetting it. (The reset signal also goes elsewhere through U66e, but more on that later.)

As soon as the pushbutton is released (or the power supply voltage has risen), C63 starts to charge through R23. When it reaches about 3.3 volts, the 555 timer senses this rise and shuts off its output on pin 3; this removes the low from RESET and HALT, and lets the 68000 begin operating.

How long does it take for the voltage on C63 to reach 3.3 volts? About one time constant, which is defined as the product of R23 and C63. Since R23 is 1 megohm (1,000,000 ohms) and C63 is 1 µF (0.000001 farads), the product is 1,000,000 x 0.000001 = 1 second. Thus the RESET and HALT signals will go low for about 1 second at startup or whenever we push the reset pushbutton.

4-2. Construction

Install the parts listed below, but note that tantalum capacitor C63 is a polarized capacitor; its positive terminal must go toward pin 6 of U91. Also, the two-pin header strip for J23 has a short end and a long end; the short end goes through the board and is soldered on the bottom, while the long end sticks up.

R22 and R23	1 megohm 1/4-watt resistors

R20 and R21	2200 ohm 1/4-watt resistors
C57, C61, C62 and C64	0.1 µF disc capacitors
C63	1 µF 16-volt tantalum capacitor
J23	a two-pin single header strip
U91	555 timer and its socket
U22	7406 open-collector buffer and its socket
U66	74LS04 hex inverter and its socket
	Two unmarked 0.1 µF capacitors to the left of U66.

4-3. Testing

Turn on the power. The HALT LED should go on for about a second, and then suddenly switch off.

Now use the LED probe wire connected to J14 to check the signals at the outputs of U22d, U22c, and U66e. Connect the probe to one of these, and use a screwdriver or wire to short the two pins of J23; the test LED should go off and then, a second or so later, back on, indicating that the signal went low and then back high.