Chapter 5

The Master Clock Circuit

The “clock" circuit of a computer is actually not a clock in the traditional sense (since there is a separate section called a “clock / calendar". Rather, it is an oscillator which is more like a metronome or drill sergeant. It supplies pulses which keep all the parts of the computer marching in step.

5-1. Discussion

Fig. 5-1 shows the diagram of the master clock for the entire computer. U78 is a 16 MHz oscillator module containing a crystal oscillator and all the logic circuitry to provide a square wave output at the right levels for TTL logic circuitry. Its output goes to U77a, a 74ALS74 type-D flip-flop wired as a divide by 2. Each time the CK (clock) input goes from a low to a high, the flip-flop flips from one state to the other. Its output therefore goes through a complete cycle once for every two input cycles, so its output is at 8 MHz, exactly half of the 16 MHz input. This signal, called CLK8, is used in a number of places throughout the computer.

In addition, if J24 has a jumper from the center terminal to terminal 1 (which would be the normal situation), U77b also divides the 16 MHz by two and provides an 8 MHz clock signal, called MPUCLK, to the 68000 and elsewhere.

To run the computer at 10 MHz, you would install another oscillator module, running at 20 MHz, at U79 and place the J24 jumper in position 2. CLK8 would still be at 8 MHz, but MPUCLK would now run at 10 MHz. Two modules are necessary because CLK8 is used elsewhere in the computer and must stay at 8 MHz even if the 68000 itself runs faster.

Incidentally, the small triangle inside the clock inputs on U77 indicates that these inputs respond to a change of voltage, also called an edge. Since there is no bubble on the outside of this pin, the clock input responds when the input goes high (i.e., a positive edge.)

5-2. Construction

Now mount the following components:

U78	16 MHz oscillator and its special socket. Note that three corners are rounded; the pointed corner identifies pin 1
U77	74ALS74 (ALS, not LS) and its socket
J24	3-pin header
C58, C59, C60	0.1 µF disc capacitors
	a shorting jumper from the center pin to pin 1 of J24

Although U78 is installed in a socket, in most applications it would be soldered directly to the board. Note that a special socket is needed since its pins are round, whereas most IC pins are rectangular.

5-3. Testing

Next, power up the computer. If you have an oscilloscope or a logic probe which can detect pulses, test the CLK8 and MPUCLK lines for the required pulses (inexpensive oscilloscopes may have trouble displaying the clock pulses, or may show them as a very distorted sine wave.)

Testing is a bit tougher if you only have the LED probe connected to J14-1; still, it can be done. First, note how bright the LED is when the probe wire is not connected. Then connect it to CLK8 or MPUCLK; the LED should be somewhat dimmer, indicating that the signal is high part of the

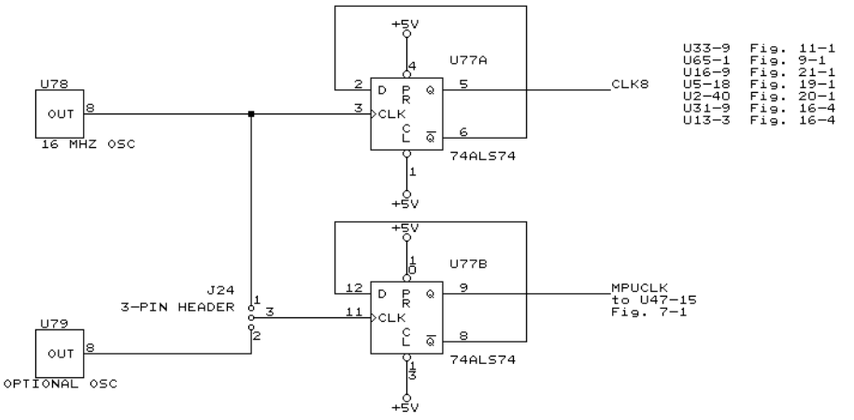

Fig. 5-1. Main clock circuit.

time and low part of the time. Since the LED is flashing on and off so fast you cannot see it, it appears somewhat dimmer than when on continuously.

Next, connect the probe wire to MPUCLK and note its brightness. Then slip off the shorting jumper from J24-1 and note whether the LED gets brighter or darker. Each time you do this, you stop U77b from flipping. Sometimes it will stop in the set state, in which case the LED will be getting a full high voltage and become brighter; other times it will stop in the reset state, in which case the LED will go off. If all this is happening, then all is well.