Your SOS Deserves a Clock
or
A 30 Minute, Do-It-Yourself Project for the Apple ///

by Arthur E. ('Skip') Anderson ///

Most likely, your Apple /// is missing its clock chip. Having never had it, you've missed a great deal: Automatic time stamping of files, the ability to use Backup /// to automatically backup/restore files by date, the ability to ask and receive the proper time and date, and (almost) never having to set the time on computer power-up. I know what you're thinking: "Why me? Why can't I have a clock chip too? How come I'm always the last guy on the block to own a clockchip? Why can't I keep up with the Joneses?" Well, now you too can own one! And best of all the Apple /// clock chip does *not* use any additional slots, nor will it cost you an arm and a leg.

When the Apple /// was first introduced, one of its improved features was a built-in clock. There were some problems achieving quality consistency, however, and the decision was made to kill time. Early /// purchasers got a refund check for $50, and the clock was made to disappear. Apple folks began asking, "What clock?". If you have early versions of the manuals, you know about the reserved variables in Business BASIC and Pascal. But the clock chips have come up in reliability, and that empty slot can now be filled.

Your Cost:

The author has used his clock for more than a year now and has modified several Apple ///s. In the last month Peter Weiglin, Editor and Publisher of **Apple Orchard**, has mod-

ified a half-dozen Apple ///s. If he can do it, almost anybody can do it! We think that it's possible for every Apple ///er to have his own, but there is a cost (Ah ha!):

1. You must accept responsibility for tinkering on your Apple ///. Apple Computer Inc., **Apple Orchard**, and the author can not be responsible for your work. It will undoubtedly void your warranty (if you have one).

2. Installation will require approximately 30 minutes of your time. Futhermore, you will need some technical ability, including the ability to solder wires, a working knowledge of ICs (which way they go in), and the ability to disassemble and reassemble the bottom of your Apple ///. You may wish to ask your dealer to perform the installation.

3. You will need to purchase the following hardware at an approximate cost of $10.00 (Yes folks! That's ten big ones!):

   a. One MM58167 clockchip. National Semiconductor manufactures this integrated circuit and its technical data sheet. Typical mailorder prices range from seven to ten dollars. Many parts vendors stock these chips so shop around if you like. Mailorder suppliers will often provide data sheets upon request.

   b. A battery holder that will hold two (or three) cells of the penlight or "AA" battery size, and the battery clip that a 9-

volt battery or the holder plugs into. A two or three battery holder will work fine. They cost about $1.00. Typical vendors are mail-order vendors and Radio Shack, etc. You need 3 cells to provide 4.5 volts for the clock when the computer is turned off. 4.5 volts is the *maximum*. If you can find only a 4-battery holder, use it, and wire a jumper in place of one of the batteries.

c. Enough penlight batteries to fill up your battery holder, i.e. two or three "AA" cells. Approximate cost is $1.00. These batteries ensure that the clockchip can continue to keep time. Two batteries will provide three volts, which will keep the chip operating. But the time between replacements is much longer if three batteries are used.

d. Two lengths of wire, 20 to 24 inches long. Prefer No. 24 size wire, and different colors (e.g., red and black) for the wires. Because you will mount the battery pack next to your Apple /// speaker and run the wires down to the main circuit board, you will need about 24 inches of lead length.

e. In order to attach the battery pack onto the Apple /// chassis (next to the speaker), you will need something sticky. Scotch (3M) brand double-sided adhesive mounting squares work great. Some people prefer to use adhesive Velcro strips for this. The mounting squares are available at stationery stores, etc., for about $1.00.

Installation:

Thanks to Apple Computer, Inc., about 99% of the hardware installation job and 100% of the software installation is done!! (Great folks there at Apple, even if they won't admit it!)

To install your clock:

1. Gather together the above mentioned parts.

2. Gather your tools together. You will need a Phillips screwdriver, a flathead screw driver, a small soldering iron (i.e. 20-40 watt), and a small amount of 60%-tin rosin core solder. *Don't use a soldering gun*, and *don't use acid-core solder*. Also, don't use "non-corroding" paste flux.

3. Chances are that your battery clip came with two short wires attached. Now attach the wire leads to these short wires; red to red and black to black (or green to green, etc.) Wrap these joints with electrical tape to insulate them. With most battery clips, the positive wire is red. It's the one going to the *female* connector on the battery clip. Remember, the male connector on the battery is positive, which means that the female connector on the clip is positive. Check to make sure which is which.

4. Disconnect power cables from your Apple ///. Take the top cover off your Apple /// and remove all of the accessory cards from the slots. The red LED on the main board, next to the accessory cards, must NOT be lit. (If the LED is lit, then you forgot to disconnect the power.) Remember where each card needs to be re-installed.

5. Carefully remove the large bottom plate from the bottom of your Apple ///. This plate has the Apple /// main circuit board mounted on it. Note where each of the external wires connect onto the main board, just in case you accidently pull a connector off!

6. Feed the battery-holder wires down through a hole next to the speaker. Using a screw driver, connect the negative lead, under the screw as illustrated in Figure 1. Solder the positive lead to the printed circuit board at the hole as shown in Figure 1.

7. Insert the MM58167 clockchip in the IC-socket at the front of the main board as shown in Figure 1. This socket is located at board coordinate: B-3. The socket is labeled 58167. Make sure the MM58167 is inserted in the socket with the notch facing forward, like the adjacent ICs. (This insures that pin #1 is aligned properly.) Be sure that all pins are seated properly.

8. Re-attach the connectors to the motherboard, and replace the bottom of the Apple ///. Be sure each of the external connectors are still attached to the main board.

9. Insert all of your accessory cards back into their proper slots.

10. Insert the batteries into the battery-holder, and attach the battery pack next to the speaker using a double-sided adhesive mounting square. Remember to put the batteries in properly.

11. Put the top cover back onto your Apple /// and reconnect the power cord.

12. Using your System Utilities diskette, set the time. If your clock chip is working properly, then you should see the seconds ticking away in the top left corner of your screen. If not, then you must recheck your work. If your clockchip completely loses its time setting when you power down the Apple ///, then something is wrong with the battery pack or its installation.

To make fine adjustments to the clock, there is a potentiometer (actually a variable capacitor) under the Apple ///'s keyboard, which you adjust with a screwdriver. If, as we found with one motherboard, the clock runs at about 10 times normal speed, get the motherboard fixed or replaced. This could be a problem until Apple acknowledges the existence of the clock; they won't fix what they claim doesn't exist!

A Clockchip in time, saves your mind:

The Apple /// clock chip will save you a great deal of trouble. SOS will time/date stamp your files each time you save them! You will always know when you last updated a file (or the last time you messed up a file!). If you keep regular backups of your work, you'll know which file to retrieve. That alone is worth a fortune!

Now that you have time on your hands (ha, ha, ha), you might want to play with your clock. But what software can use this clock, you say? The following is a list of some programs which are known to use the clockchip:

1. SOS. Automatically time & date stamps files. Any files saved through SOS (such as AppleWriter, Pascal, VisiCalc, etc.) automatically enjoy this benefit! I have yet to find a program that didn't enjoy this benefit! Also you can make the direct SOS calls: GET TIME and SET TIME.

2. Apple /// Pascal. You can use the Pascal filer to set and read the time and date. You can use the procedures: DATE(D), TIMEOFDAY(T), CLOCKINFO(. . .), and SET-
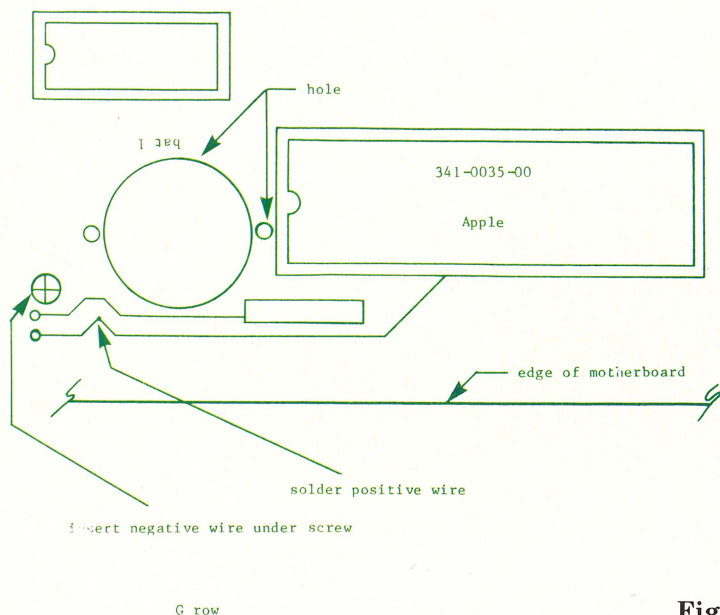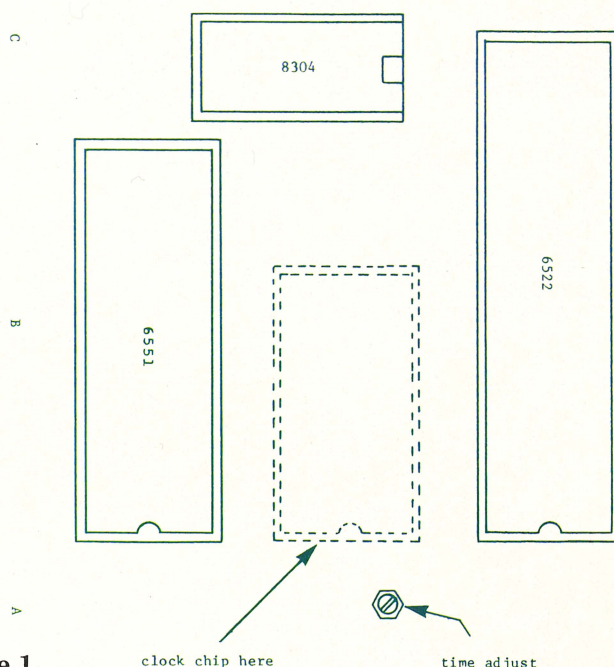
Figure 1

(Labels in figure: hole, bat I, 341-0035-00, Apple, edge of motherboard, solder positive wire, insert negative wire under screw, G row, 8304, 6551, 6522, clock chip here, time adjust)

TIME(. . .). Information is on Page 50 of Volume 2, *Apple Pascal Programmer's Manual* . . . at least the edition I have.

3. Apple /// Business BASIC. You may run the timeset program. The reserved variables DATE$ and TIME$ are available even though they are not mentioned in the later editions of the manuals!!

4. Apple /// COBOL. You can use the COBOL utility "date". The compiler time stamps the listing.

5. Softcard /// (CP/M card). You can use the time utility to set and read the internal Apple ///clock.

6. Backup ///. This fine utility will reference the clockchip as the date and time that the backup was taken. Furthermore, since SOS now time stamps your files, you may backup/restore files by date/time!

7. AppleWriter ///. You may set the date/time using the SOS commands menu cntrl-O.

8. Apple ///Utilities. This program allows you to set the date/time. The screen will also contain the current time.

9. The IAC's CP/M —} SOS Textmover. The current time is contained on the screen.

10. Volition System's Modula-2. Support of Applestuff unit and all Pascal calls relating to time.

Fun Projects for the Hardcore:

For those of you with an uncontrollable desire to play with the clock chip, I have three project suggestions. However, the three suggestions are not trivial!

It has been published that the Apple ///'s A/D converter has an analog switch, or multiplexer, on its input. This multiplexer allows selection of one of the eight inputs: the four different joystick inputs, a ground reference, a 2.4 volt refer-ence, an unused input, and the clockchip battery. It would therefore be possible to examine and report the clock's battery condition from a program. See references 1 and 3 for further reading.

Your clockchip is rumored to have an output that drives pin #4 on your color port connector. The Apple /// Owner's Guide, page 132, calls this PDI. Nothing more is said. (Clever, huh?) The MM58167 has a Power Down Interrupt mode (described by the data sheet as a 'standby interrupt'). This output allows the clockchip to set off an alarm (i.e. pin #4) at a predetermined time. One good use of this would be a wakeup-during-low-telephone-rates and send/download a message program. See reference 1 for more information.

The MM58167 clockchip has a small calibration adjustment (also adjustable from under the keyboard). This variable capacitor should be adjusted so that the clockchip and the 32KHz cystal keep accurate time. A smart program could measure the timing error and display it on the screen. Internal measurements could be made via the video field rate, the VIA timers, software timing loops, etc. See reference 1 for the circuit description.

I hope this article shares some valuable information with you , and helps you to tinker your way into an inexpensive Apple /// clock. It has been a pleasurable accessory for my Apple /// and I hope you enjoy it as much as I have.

References:

1. National Semiconductor's MM58167 Data sheet. Dated July 9,1979. About 6 pages long, including pinouts, timing diagrams, and circuit examples.

2. "It's /// O'clock and All's Well", by John Jeppson, page 69, *Softalk*, November 1982.

3. "Hot Rod ///, Start Your Engines!", by George Oetzel, page 90, *Softalk*, August 1983.