

TimeMaster II H.O.

User's Manual

Programmer's

Supplement

APPLIED ENGINEERING

TimeMaster II H.O.

User's Manual

Programmer's Supplement

TimeMaster ProDOS Command Extensions

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Any comments or suggestions for improving this manual would be appreciated. Please forward your remarks to:

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Introduction Read Me First!

This manual is included as a supplement to the Applied Engineering TimeMaster II HO. User's Manual and is intended for use by Applesoft BASIC and assembly language programmers. It explains how to install and use the TimeMaster ProDOS Command Extensions. You will have no need for this information unless you are writing your own programs.

About **TPCE** (TimeMaster ProDOS Command Extensions)

The program file, TPCE, on the TimeMaster II H.O. ProDOS Time Utilities disk, when executed, will add 15 new BASIC commands. These commands provide a kit of convenient and powerful tools for using the many features of the TimeMaster II HO. clock card from within your ProDOS programs. You will be able to use these commands to set and display the TimeMaster II HO. time; use a Stopwatch timer which runs concurrently with your program; use your TimeMaster II H.O., card as an alarm clock; set the desired interrupt rate; schedule a call to an assembly language subroutine at specific intervals; send command strings to a BSR X-10 device; and more. The uses are limited only by your imagination!

TPCE was designed to work with ProDOS version 1.1.1 and BASIC.SYSTEM version 1.1, both of which are included on the TimeMaster II H.O. ProDOS Time Utilities disk. TPCE will not operate with other command interpreters; only BASIC.SYSTEM TPCE was also designed to utilize the many features available ONLY on the TimeMaster II H.O. clock card.

TPCE uses 4096 bytes of memory and installs between the ProDOS file buffers and BASIC.SYSTEM HIMEM is automatically lowered to \$8600. The actual location of TPCE is from \$8A00 to \$99FF.

For More Information

This supplement assumes the reader is somewhat familiar with Apple's Professional Disk Operating System (ProDOS), the Applesoft BASIC programming language, and the internal operation of the //e computer. Additional information can be found in the following manuals:

Applesoft BASIC Reference Manual
(Addison-Wesley Publishing 1-800-238-3801)

Apple IIe Reference Manual (Apple Computer, Inc.)

ProDOS User's Manual (Apple Computer, Inc.)

Beneath Apple ProDOS (Quality Software) by Don Worth and Pieter Lechner

BASIC Programming with ProDOS
(Addison-Wesley Publishing 1-800-238-3801)

TimeMaster II HO. User's Manual (Applied Engineering)

Getting Started

What Is Required

This is all you need to use the TimeMaster ProDOS Command Extensions:

- An Apple II+ or //e (standard or enhanced) with at least 64K of memory.
- A TimeMaster II HO. card installed in the proper expansion slot.
(see the TimeMaster II HO. User's Manual)
- One disk drive
- A monitor capable of displaying a 40 column screen
- ProDOS 1.1.1, BASIC.SYSTEM 1.1 and TPCE.

The switches on the TimeMaster II HO. should be in the following configuration.

Switch 1	Closed (on)	Set-protect disabled
Switch 2	Open (off)	TimeMaster Mode enabled
Switch 3	Open (off)	Non-Maskable Interrupts disabled
Switch 4	Closed (on)	Interrupt Request enabled

The revision of the TimeMaster II H.O. ROM should be .5 or greater. (The revision number label is on the 24 pin ROM chip on the TimeMaster II HO. card.) Earlier ROM will work, but make sure to use the TPCE commands to read the clock, NOT Applesoft BASIC IN# and PR# commands.

Note: Apple Computer's FILER program (version 1.1) has been included on the TimeMaster II HO. Time Utility disk. Please use it to make a backup copies of the TimeMaster II H.O. utility disks. Then store your originals in a safe place! CON VERT (version 1.2) is also included to allow conversion of DOS 3.3 files to ProDOS format. See the TimeMaster II H.O. User's Manual for details on which files are convertible.

Installing TPCE

The installation of the TimeMaster ProDOS Command Extensions is accomplished by loading PRODOS, BASIC.SYSTEM, then executing the binary file named TPCE. TPCE can be executed from either the immediate (keyboard) or deferred (program) mode. TPCE can also be installed by booting the TimeMaster II HO. ProDOS Time Utility disk and selecting the option "Install TPCE and exit to BASIC" from the main menu.

The TimeMaster II H.O. slot is automatically determined during execution of TPCE, which takes about two to three seconds. Successful installation from the immediate mode is indicated by an on-screen message. No message is presented upon successful installation from the deferred mode.

TPCE remains active until one of the following conditions is encountered:

- TPCE 'QUIT command
- System power-down or re-boot
- Execution of another ProDOS SYSTEM file.
- Execution of another BASIC enhancement program (Double-Take, GPLE, APA)

Command Syntax

In the descriptions and examples which follow, the commands are all shown in upper case, with spaces inserted merely for clarity. TPCE will, however, accept both upper and lower case characters and ignore all spaces between commands and arguments.

TimeMaster II H.O. ProDOS Command Extensions The New Commands

This section contains descriptions of each of the 15 new BASIC TPCE commands. The command are grouped into four categories; time and date commands, stopwatch commands, interrupt commands, and miscellaneous commands.

For your convenience, one of the new commands is **HELP**. The HELP command displays a screen full of information, listing and describing the other 14 TPCE commands. Figure 1 is an illustration of the HELP screen.

Figure 1 **TPCE "HELP" Screen**

```
..TIMEMASTER PRODOS COMMAND EXTENSIONS ..

TIME..... RETURN CURRENT DATE AND TIME
CLOCK.. SHOW DATE AND TIME CONTINUOUSLY
ALARM.. SETALARMATSPECIFIED TIME
SET .....SETORADJUSTDATE OR TIME

RESET.... STOP AND CLEAR ELAPSED TIMER
START....START ELAPSED TIMER
STOP..... STOP ELAPSED TIMER
TIMER.... RETURN ELAPSED TIMER VALUE
WATCH.. SHOW ELAPSED TIMER CONTINUOUSLY

RATE .....SET OR RETURN INTERRUPT RATE
LINK..... LINK USER PROGRAM TO INTERRUPT

SLOT..... RETURN SLOT NO. OF TIMEMASTER
BSR..... SEND BSR COMMANDS (*,A~V)
QUIT..... DEACTIVATE TPCE
```

Time and Date Commands

TPCE allows you to read the current time and date in any of six formats, provides an option to display the time and date continuously on the screen, set the TimeMaster II H.O. to a new time and date, and set an alarm to go off at a specified time.

TIME

The TIME command displays the current date and time. If no format is specified the default format will be used. When you specify a particular format, that format becomes the new default.

TIME	display date and time in the default format
TIME:	display as: FRI 11/15/85 15:45:25 (initial default)
TIME S	display as: 15-NOV-85 15:45
TIMEM	display as: 11/15 15:45:25.234
TIME &	display as: FRI NOV 15 15:45:25
TIME%	display as: FRI NOV 1503:45:25 PM
TIME#	display as: 85,11,05,15,15,45,25.234

This also allows you to read the time from an Applesoft program, in whatever format you choose. The sample routine, below, will read the date and time in the "." format into the string variable TM\$.

```
1200 PRINT CHR$(4); "TIME:"
1210 INPUTTM$
```

The first six TIME formats above will return strings. The "# format returns seven numeric values, the sequence of which is detailed in the SET command description. This format would be read in the following manner:

```
1200 PRINT CHR$(4) ;"IME#"
1210 INPUTY, MO, W, D, H, MI, S
```

CLOCK This displays the time and date in the MO/DD HH:MM:SS format on the screen at a specified position. If you do not specify a position, the display will appear on the top line, starting at column 26 on a 40-column screen or column 51 on an 80-column screen. (Only standard Apple //e 80-column display is supported.)

CLOCK	display at line 1, column 26 (initial default)
CLOCK 24,1	display at line 24, column 1
CLOCK OFF	turn off the date/time display.

If you are using a standard Apple //e 80-column display, the column number will be doubled and decremented by one. Therefore, CLOCK 1,26 will display the date and time starting at column 51.

You may specify any line or column number you wish, between 0 and 99. If you specify a line number greater than 24, TPCE will assume you really meant 24 (the bottom line). If the column argument specified is larger than 26 while in the 40 column mode, the CLOCK display will default to column 26. The display will be justified against the right side of the screen. The same is true for the 80 column display except that the default column will be 51.

The CLOCK display is written directly to the screen, so it will not appear on any other output device. If you select any line below the top line, copies of old times will be scrolled up the screen whenever the screen scrolls.

ALARM This command allows you to use your I/e and TimeMaster II H.O. as an alarm clock. The alarm can be set to "go off" at a specific time or at an interval measured from the present time. The examples, below, illustrate the various arguments used to set the ALARM.

ALARM +10	Set alarm to go off in ten minutes (interval)
ALARM +3:15	Set alarm to go off in 3 hours and 15 minutes (interval)
ALARM 5:30 PM	Set alarm to go off at 5:30 PM
ALARM 5:30 AM	Set alarm to go off at 5:30 AM
ALARM 17:30	24 hour clock notation; same as 5:30 PM
ALARM 5:30	24 hour clock notation; same as 5:30 AM
ALARM	Silence alarm or cancel a previously set alarm.

The alarm sounds for one minute, beeping the speaker at two-second intervals. You can silence the alarm by typing "ALARM". The beep is a lower pitch than the standard Apple "bell". Depending on the interrupt RATE, there are two possible ALARM tones.

You can only have one alarm setting active at a time. The interval ALARM is accurate to the nearest TimeMaster II HO. minute cycle.

SET This command allows you to reset the date or time on the TimeMaster II HO. card. There are actually six commands in one, allowing many different ways of changing the date and time. One of them is very useful for changing back and forth between Standard and Daylight Savings Time. Another makes it easy to synchronize, down to the second, with another clock.

SETH	Allows you to increment, decrement, or set the hour.
SETH +x	Add x to the current hour (modulo 24)
SETH -x	Subtract x from the current hour
SETHx	Set the hour to x

The parameter "x" may be any value from 0 to 99. The arithmetic is done modulo 24. For example, if you type "SETH+20" when the hour is 11, the result will be 7. ($11+20 = 31 = 7 \text{ mod } 24$).

In the Fall if you switch to Standard time, type SETH-1 to adjust your TimeMaster II H.O. When Daylight Savings Time starts, type SETH+1.

SETM Allows you to increment, decrement, or set the minute.

SETM +x	Add x to the current minute (modulo 60)
SETM -x	Subtract x from the current minute
SETM x	Set the minute to x

The parameter "x" may be any value from 0 to 99. The arithmetic is done modulo 60. For example, if you type "SETM+20" when the minute is 51, the result will be 11. ($51+20=71=11 \text{ mod } 60$)

SETW Allows you to increment, decrement, or set the day of week.

SETW +x Add x to the current day of week (modulo 7)
SETW -x Subtract x from the current day of week
SETWx Set the day of week to x

The parameter "x" may be any value from 0 to 99. The arithmetic is done modulo 7. For example, if you type "SETW+5" when the day of week is 4, the result will be 2. ($4+5=9=2\text{mod}7$)

The days of the week are represented by the integers 0 through 6, where 0=Sunday, 1=Monday, ...6=Saturday.

SETT Command: lets you directly specify the time of day.

SETT 5:30 Sets time to 5:30 AM
SETT 5:30 PM Sets time to 5:30 PM
SETT 17:30 24 hour clock notation; sets time to 5:30 PM

Note that the TimeMaster II H.O. is always in 24-hour mode internally, but will format the time any way you wish. Remember that the hour starting at midnight is called either 00:xx or 12:xx AM; the hour starting at noon is called either 12:xx or 12:xx PM.

SETD Command: permits you to set a new date into the TimeMaster II HO, card. You can specify the date in either of two formats:

SETD mm/dd/yy
SETD yy/mm/dd

Also, you may separate the fields with any non-numeric character, including ""-"" or comma. TPCE distinguishes which of the two formats you have used by the fact the the year must be at least 85. After 1999) this feature will stop working until 2085. If you are still using TPCE after 1999 A.D., congratulations!

SETS Command: stores 00 into the seconds register on the TimeMaster II HO. card.

There are no parameters, you merely type "SETS" and press the RETURN key. This allows you to easily synchronize to the seconds display with another time source. Simply use the "CLOCK" command so that the time with seconds is continuously displayed on the screen. Then type "SETS" (don't hit RETURN yet) and start watching your other time source. At the instant you see 59 seconds on the external time source, hit the RETURN key. Then you can use SETM, SETH, or SETT to adjust the hours and minutes if necessary.

Stopwatch Timer Commands

A stopwatch-like timer is included in TPCE. It can measure time intervals with either second or millisecond precision, according to the interrupt RATE you select. The total value of the accumulated time can go to 6 days, 23 hours, 59 minutes, and 59.999 seconds. (After that it starts over.)

If you have the interrupt rate set at one-per-second, the times are also useful for timing programs. If the interrupt rate is set at 1024-per-second, the interrupt overhead slows the Apple down significantly; in this case, timing of program execution is meaningless. The faster interrupt rate is quite handy for timing external events, though.

At the 1024-per-second interrupt rate, a six-digit counter is incremented by .000977 on every interrupt. The counter is initialized to .000528 when the second ticks. If you do disk I/O or other operations which disable the interrupts, some millisecond ticks may be missed. On the next second tick, the milliseconds will be re-synchronized.

RESET This command stops the stopwatch if it is running, and clears the accumulated time to 0.

START This command starts the stopwatch from where it last stopped. (If the stopwatch is already running, this does nothing.)

STOP This stops the stopwatch timer, unless it is already stopped.

WATCH This command is similar to the CLOCK command, except that the stopwatch time is displayed continuously rather than the date/time. The default position is line 1, column 1. You may place it anywhere on the screen, just like the CLOCK command. Both CLOCK and WATCH can be active at the same time.

WATCH	Display stopwatch value at line 1, column 1
WATCH 13,5	Display stopwatch value at line 13, column 5
WATCH OFF	Turn off stopwatch display

The display will show millisecond values if the interrupt rate is set to 1024-per-second. At a one-per-second rate, the millisecond display will always show ".000".

TIMER The stopwatch value at the instant this command is entered is displayed. If you issue this command from an Applesoft program, a following INPUT statement will read the stopwatch time into a string variable:

```
1200 PRINT CHR$(4);"TIMER"  
1210 INPUT SW$
```

Interrupt Commands

RATE This command sets the interrupt rate, and displays the setting. You may select one of three interrupt rates: never, slow, and fast. When you first install TPCE, the interrupt rate is set at 1 Hz (once per second). Consequently, all times will be shown in exact seconds, with ".000" for the millisecond portion. If you use the RATE command to change this rate to 1024-per-second, milliseconds will be counted and displayed.

RATE display the current RATE selection
RATE 0 stop the interrupts (until a new RATE)
RATE 1 interrupt at 1024-per-second rate
RATE 2 interrupt at one-per-second rate (initial default)

In all four cases, TPCE responds by printing the selected rate. If you issue the RATE command from an Applesoft program, follow it with an INPUT command to read the rate into a string variable.

The overhead at the 1024-per-second rate is extremely high, slowing execution of programs down to a snails pace (still faster than some other personal computers, though). This overhead is mostly inside the Apple monitor ROM and the ProDOS interrupt handler.

LINK This allows you to schedule your assembly language subroutine to be called (with a JSR command) at a specific interval. The examples, below illustrate this.

LINK \$300	JSR \$300 at every TimeMaster II HO. interrupt
LINK 0:0:1 0,\$300	JSR \$300 every 10 seconds
LINK 5:20,\$300	JSR \$300 every 5 hours, 20 minutes
LINK	stop calling your interrupt subroutine

When your interrupt subroutine is called, the registers have already been saved. You can do whatever you wish, then return with an RTS instruction. You cannot depend on the monitor ROM being switched on; in fact, it probably will not be. If you change any soft-switches, be sure to put them back like they were before you return.

If the carry flag is set when you return from your interrupt subroutine, the LINK will stay engaged. If carry is clear, the LINK will be disabled.

Miscellaneous Commands

BSR This command allows you to send command strings to your BSR X-1 0 device, assuming you have one connected to your TimeMaster II HO. The format is straightforward:

BSR xxxx where "xxxx" indicates any string of BSR codes.

The valid BSR codes are the letters A through V, and . (See pages 11-14 of the TimeMaster II HO. User's Manual.)

SLOT This command returns the slot number of the TimeMaster II HO. card. If you issue this command from an Applesoft program, follow it with an INPUT command to read the slot number:

```
1200 PRINT CHR$(4);"SLOT
1210 INPUTS
```

QUIT This command removes all trace of TPCE from memory. (Don't worry, it is still on the disk.) The installation process is reversed, returning BASIC.SYSTEM to its original state.

HELP This command displays the HELP screen, providing an on-screen summary of WOE commands.

Calling TPCE from Assembly Language Programs

You can use TPCE from assembly language programs, as long as you are operating under BASIC.SYSTEM. There are two pre-defined entry points.

JSR \$8A03 will read the current time and date, and store it into the nine bytes starting at \$8A06. The clock values assigned to the memory locations \$8A06 through \$8AOE are shown below.

```
$8A06: year
$8A07: month
$8A08: day of month
$8A09: day of week
$8AOA: hour
$8AOB: minute
$8AOC: second
$8AOD: milliseconds (most significant 2 digits)
$8AOE: milliseconds (least significant digit)
```

Each of the values is stored in BCD form. Therefore, if the year is 1985, \$8A06 will contain \$85. The millisecond count is in two bytes: the first two digits in \$8AOD, and the third digit in \$8AOE (as \$xO).

JSR \$8A00 will allow you to issue any of the TPCE commands, in either immediate or deferred mode. In immediate mode, the output from the TIME, TIMER, RATE, and SLOT commands goes directly to the current output device (usually the screen, but not necessarily). In deferred mode, the output from those four commands is placed in the buffer starting at \$0200. The output will be in ASCII, with high bit set, and terminated by a return character (\$8D).

In the routines shown below, the string address must be the address of your command buffer. It must contain an ASCII string terminated by a return character (\$8D or \$0D). The contents of the ASCII string should be a valid TPCE command. TPCE copies the string to the buffer at \$200, and then calls the regular TPCE parser to execute your command.

```
CLC                ;signal immediate mode
JSR  $8A00         ;call TPCE
.DA  string.address
BCS  ...error
SEC                ;signal deferred mode
JSR  $8A00         ;call TPCE
.DA  string.address
BCS  ...error
```

If the carry flag is set when \$8A00 returns, an error is indicated. The possible error codes, stored in the accumulator, are:

```
$01  did not recognize the command name
$02  command string was longer than 63 characters
$10  syntax error or range error in command
```