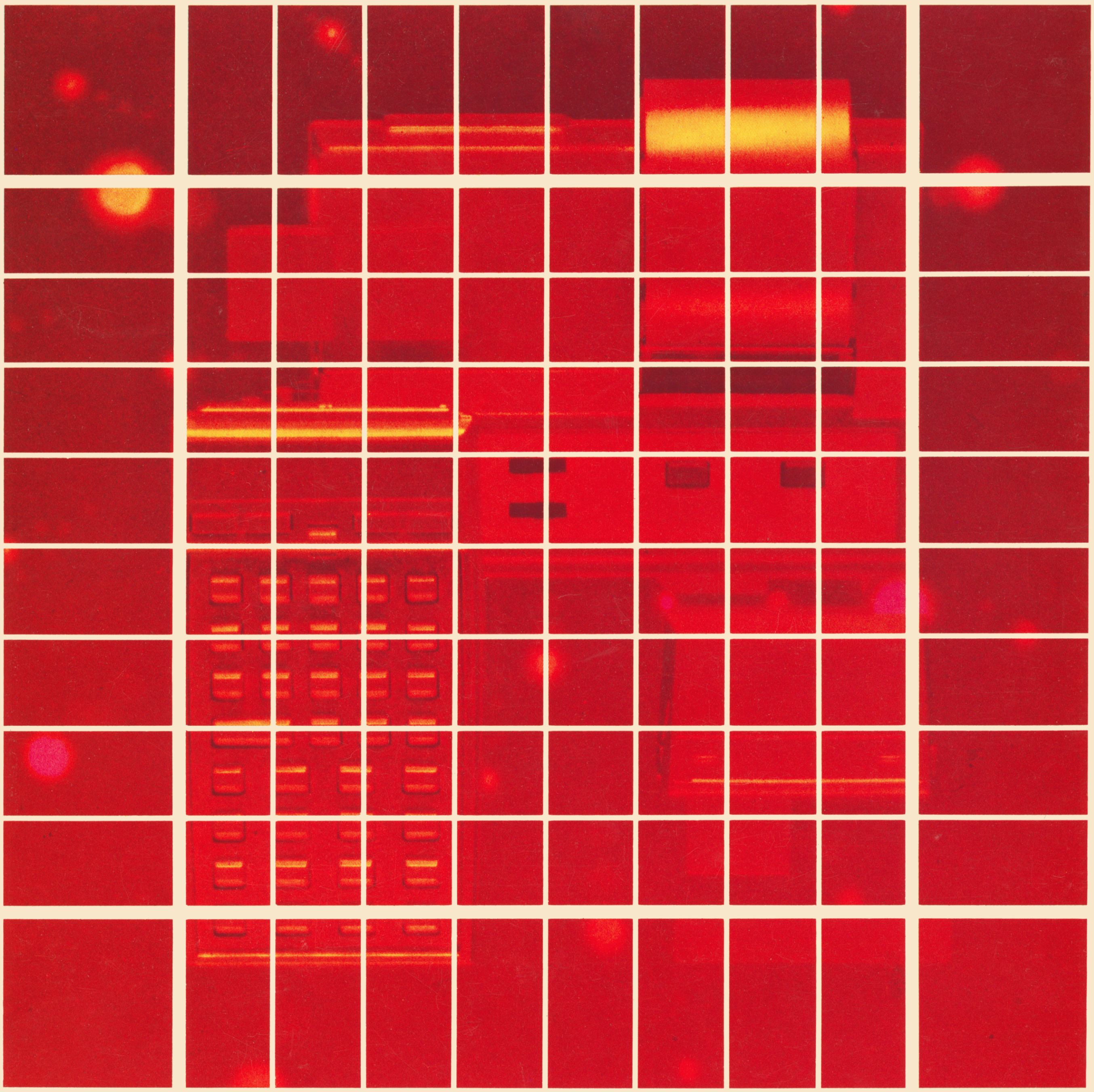
HEWLETT-PACKARD

HP 82182A

Time Module

OWNER'S MANUAL



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April 1984

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TIME MODULE

Introduction

The HP 82182A Time Module enables you to expand your HP-41 calculator system into the dimensions of time information and time-controlled operation. Using the time module, your calculator can become an alarm clock, an appointment minder, a calendar, a timer, an advanced stopwatch, and a time-based system controller.

This manual describes the operation of your HP 82182A Time Module. For information about the operation and special features of the calculator or other devices in your HP-41 system, please refer to the owner's manual for the particular device. If you are an experienced HP-41 system user, you may want to refer to the *HP 82182A Time Module Quick Reference Card* to learn basic time module operation, and refer to the manual when you need to know more detailed information.

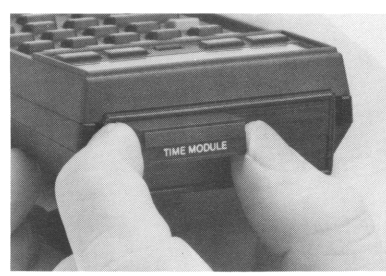
To help you maximize the use of the time module, Hewlett-Packard has published a series of time module applications programs in an HP-41C Users' Library Solutions Book entitled *Time Solutions I*. For further information concerning this publication, please contact your authorized Hewlett-Packard dealer.

Installing and Removing the Time Module

CAUTION

Be sure that the calculator is turned off before inserting or removing the time module. If this is not done, the calculator may be damaged or its operation may be disrupted.

The HP 82182A Time Module can be plugged into any HP-41 port. If any HP 82106A Memory Modules are also plugged in (HP-41C only), the time module must be in a port that is numbered higher than any port containing an HP 82106A Memory Module. (For port numbering, see the back of the calculator.) Push in the time module until it snaps into place. When you remove the time module, remember to place a port cap over the unused port.



Note: Each time you plug in the time module, turn on the calculator once to initialize the module. If the calculator is not turned on once after the module has been plugged in, the module may draw battery power at a higher than normal rate.

The time module does not contain an independent power source. Removing the time module from the calculator clears all time module settings (except alarms and the date format) to their default values. If you turn the calculator on then off before reinstalling the module, all alarms will be cleared.

Using This Manual

Variable Time Display Convention

Because the time module examples involve a continuously changing time, some of the simulated displays in this manual will differ from the times you will see in your calculator's display. That is, there will probably be a difference between a time "frozen" in the manual and the actual calculator time at the moment that you press the relevant key(s). Where the expected time difference is relatively small, an approximate time is printed in the manual. In other cases the symbols shown to the right are used to represent time.

Symbol	Indicates
HH:MM:SS.hh	Static Time Value
⁜⁜:⁜⁜:⁜⁜	Continuously Changing Time

Display Formats

Except where otherwise indicated, a [FIX] 6 display setting is used in the keystroke examples so that all digits of time or date values in the X-register will appear when the X-register is displayed.

Terminology

The term *input* refers to any numeric value or ALPHA string that you key into the calculator, recall from a storage register, or load from a peripheral device. The term *output* refers to any numeric value or ALPHA string that the calculator displays and/or places in a calculator register. The term *current time* refers to the time according to the time module.

Keys Printed in Blue

For simplicity, time module functions (and any other functions not on the standard calculator keyboard) are represented by single, blue keys—such as [TIME]. When you want to execute one of these functions, you can do so in two ways:

- By using [XEQ] [ALPHA] ***name*** [ALPHA].
- By assigning the function to a key using [ASN] and pressing that key in User mode. (Refer to User Mode Functions in the owner's handbook for your calculator.)

In this manual the description of each function is preceded by a summary of required and optional information used by that function. This provides a quick reference for function execution. For example:

[SETIME]	X	***time***	(***HH.MMSShh***)

This indicates that the time to which you want to set the time module clock should be placed in the X-register in an ***hours.minutes-seconds-hundredths*** (***HH.MMSShh***) format before you execute [SETIME]—from the keyboard or in a program. Leading zeros in the hours positions and trailing zeros to the right of the decimal can be ignored.

Getting Started

Using Your Calculator as a Clock and a Calendar

Plugging in the time module *and* turning on the calculator starts the time module's clock running from 12.00 a.m. on January 1, 1900 (the default time and date). Once started, the clock will continue to keep the time and date, whether the calculator is on or off.

To begin using your calculator as a clock, install the time module as described on page 7, then turn on the calculator. To display the clock, press ■ [ON]. If you press ■ [ON] less than one minute after installing the the time module, you will see the following time display; if you wait longer, a later time will appear.

Keystrokes	Display	
[ON]		Turns on the calculator.
[←] ■ [FIX] 6	0.000000	Clears display and sets [FIX] 6 display mode.
■ [ON]	12:00:** AM	Displays the clock (less than 1 minute after you pressed [ON]).

To include the current date in the clock display, execute [CLKTD] (*clock-time/date*) and display the clock. To reset to time-only clock display, execute [CLKT] (*clock-time only*).

[CLKTD]	0.000000	Specifies time *and* date for clock display.
■ [ON]	12:**AM 01/01	Displays the clock.

Since we have not yet specified a date, the calculator displays the default date—January 1, 1900. The seconds (***SS***) portion of the clock display is suppressed when the date is displayed.

[CLKT] ■ [ON]	12:**:** AM	Specifies time *only* clock display and displays the clock.

To switch from a display of the clock to a display of the X-register, press [←].

[←]	0.000000	Displays the X-register.
[ON]		Turns off calculator. (Clock continues to keep time and date internally.)
[ON]	0.000000	

Pressing [ON] while the clock is displayed also turns the calculator off.

Time and Date Input and Display Formats

When you key in a time setting, use the ***HH.MMSShh*** format. When keying in a date format you can either:

- Use the ***month.day year*** default format (***MM.DDYYYY***) or
- Use the ***day.month year*** format (***DD.MMYYYY***) by first executing [DMY] to switch the calculator to this format.

Now let's key in a time and date. Then we'll reset the clock to your local time and date so you can begin using your calculator as a clock and calendar. To set the clock to 9:06 a.m. on July 5, 1982:

Keystrokes	Display	
[CLKTD]	0.000000	Use a time/date clock display.
9.06 [SETIME]	9.060000	Sets clock to 9:06 a.m.
7.051982 [SETDATE]	7.051982	Sets date to July 5, 1982.
■ [ON]	9:**AM 07/05	Displays clock time and date.
[DMY] ■ [ON]	9:**AM 05.07	Converts to day-month-year format.
[MDY] ■ [ON]	9:**AM 07/05	Converts back to month-day-year format.

The clock is set to the specified time at the moment the key that executes [SETIME] is *released*.

A.M. and P.M. Time Inputs

Time inputs for hours later than 12:00 p.m. (noon) can be input either as negative numbers or in the 24-hour time format. To set the clock to 9:06 p.m., which is 21:06 in 24-hour format:

Keystrokes	Display	
9.06 [CHS]	-9.06_	Uses a negative time input to specify a p.m.
[SETIME]	-9.060000	time input
or ...		or ...
21.06 [SETIME]	21.060000	uses a 24-hour time input to specify a p.m. time input.
■ [ON]	9:06PM 07/05	
[CLKT]	21.060000	Specifies time-only clock display. (After executing this function, the X-register is displayed.)
■ [ON]	9:**:** PM	
[←] [←]	0.000000	

Now use [SETIME] and [SETDATE] to set the clock to your local time and date.

1. Assign [SETIME] to a key and place the calculator in User mode.
2. Key in an approaching time, using the ***HH.MMSShh*** format. Select a time that is sufficiently advanced to allow you enough time to execute [SETIME].
3. Press and release the key assigned to [SETIME] when the specified time arrives.
4. Key in the date. If you prefer the ***DD.MMYYYY*** format, execute [DMY] first to set the calculator to that format.
5. Execute [SETDATE].
6. Press ■ [ON] to display the clock. (Remember that the date will not appear in the clock display unless [CLKTD] has been executed to switch the calculator from the time-only clock display.)

The preceding clock function examples are intended to help you to quickly get started using your time module. For further details concerning these functions, plus information describing other clock functions, please refer to section 1, Date and Time Functions.

Using Your Calculator as a Stopwatch

For an exercise in time module stopwatch operation, turn to Section 3, Stopwatch Functions (page 27) and step through the introductory example.

The Time Module's Timekeeping Devices

Your HP 82182A Time Module contains two independent timekeeping devices:

- A time/date clock, referred to as the "clock."
- A stopwatch/timer, referred to as the "stopwatch."

When you plug in the time module *and* turn on the calculator, the clock begins running from 12:00 a.m. on January 1, 1900. The clock will keep time until you remove the time module from the calculator. The clock—and the stopwatch, if you start it—will run whether or not they are displayed. This means that you can perform normal keyboard and program operations while the clock and stopwatch are running *and* if you wish, you can plan your keyboard and programming operations to interact with both time devices.

> **Note:** Continuously displaying either the clock or the stopwatch will increase battery power consumption. The calculator will not display the clock if the **BAT** annunciator is displayed. For further information, refer to Power Consumption, page 61.

Date and Time Functions

The information under the first three major headings in this section, Date and Time Formatting, Setting the Date and Time, and Clock Display Functions, describes in more detail the functions that are briefly covered under Getting Started on page 9 in the Introduction. The rest of the information in this section describes clock adjustment and other time functions that you may find useful in your applications.

Date and Time Formatting

The date formats affect date inputs in the X-register and date outputs to the display and X-register. The time formats affect time outputs to the display, but do not affect time outputs to the X-register. When you install the time module, the default formats (month-day-year date format and twelve-hour time format) automatically become active. *The only time it is necessary to specify a date or time format is when you want to change the date or time format from the current setting to the alternate setting.*

Date Formatting

MDY

Execute MDY (*month-day-year*) to switch from the day-month-year format to the month-day-year format. When the MDY format is active, flag 31 is clear.

DMY

Execute DMY (*day-month-year*) to switch from the month-day-year format to the day-month-year format. When the DMY format is active, flag 31 is set.

The following table shows how the time module interprets numbers input as dates and how date outputs are formatted.

Time Module Date Format Options

Format Setting	X-Register Input/Output Format	Display and Printer Date Outputs	Flag 31
MDY (month-day-year)	***MM.DDYYYY***	***MM/DD*** or ***MM/DD/YY***	Clear
DMY (day-month-year)	***DD.MMYYYY***	***DD.MM*** or ***DD.MM.YY***	Set

You can omit leading or trailing zeros from inputs. For example, a number representing May 6, 1990 can be input as 5.06199. The appropriate leading and trailing zeros will appear in date outputs.

Time Display Formatting

Clock times are *displayed* in either a 12- or a 24-hour format. When the time module is installed it automatically defaults to a 12-hour display format. (Regardless of the clock time display, clock time outputs in the X-register are always in the form of a number representing a 24-hour clock time.)

CLK12

The CLK12 function switches the calculator from the 24-hour clock display format to the 12-hour clock display format. (This is the default format.)

CLK24

The CLK24 function switches the calculator from the 12-hour clock display format to the 24-hour clock display format.

Format Setting	Clock Display In Time Format	Clock Display In Time/Date Format
CLK12 (12-hour format)	***(H)H:MM:SS* AM** ***(H)H:MM:SS* PM**	***(H)H:MM* AM *date*** ***(H)H:MM* PM *date***
CLK24 (24-hour format)	***HH:MM:SS***	***HH:MM date***

Setting the Date and Time

Setting the Date

SETDATE X *date* (***MM.DDYYYY*** *or* ***DD.MMYYYY***)

The SETDATE function sets the date in the time module. To set a date, enter it into the X-register according to the current MDY or DMY format, then execute SETDATE. For example, to set the date to May 10, 1990, you would place one of the following numbers in the X-register, depending upon the current date format, then execute SETDATE:

MDY **Format**

$$\underbrace{5}_{\text{Month (May)}}\,.\,\underbrace{1\ 0}_{\text{Day (10th)}}\,\underbrace{1\ 9\ 9}_{\text{Year (1990)}}$$

DMY **Format**

$$\underbrace{1\ 0}_{\text{Day (10th)}}\,.\,\underbrace{0\ 5}_{\text{Month (May)}}\,\underbrace{1\ 9\ 9}_{\text{Year (1990)}}$$

If the format of the date you input does not correspond to the current MDY or DMY setting, no error message will result unless the date actually interpreted from your input is invalid. (Refer to Error Messages, page 67.) For example, a date input of 5.10199 will be accepted in MDY format as May 10, 1990; in DMY format as 5 October, 1990.

Note: In any SETDATE input, all trailing digits to the right of the year (***YYYY***) digits must be zeros, and the input must be positive. Otherwise, a **DATA ERROR** message will result.

The time module can be set to any date from January 1, 1900 (automatic default date) to December 31, 2199.

Setting the Time

SETIME	X	*time*	(***HH.MMSShh***)

When you execute SETIME, the clock automatically begins running from the time specified in the X-register. To set the clock, use the following time input format to place the desired setting in the X-register:

±***HH.MMSShh***

Hours	Minutes	Seconds	Hundredths
(0-23)	(00-59)	(00-59)	(0-99)

Note: The CLK12 and CLK24 formats affect clock time display outputs only. CLK12 and CLK24 have no effect on any numeric representations of time inputs or outputs in the X-register.

Then execute SETIME. Inputs can be any ***HH.MMSShh*** number from −23.595999 to 23.595999. Any digits beyond hundredths of a second (***hh***) will be ignored. When you release the key that executes SETIME, the clock is set to the specified time. The table to the right shows the hour (***HH***) values to use when setting the clock for a.m. or p.m. times.

Note: The CLK12 and CLK24 formats affect clock time display outputs only. CLK12 and CLK24 have no effect on any numeric representations of time inputs or outputs in the X-register.

A.M./P.M.	Hours	Input
a.m.	12	00*
|	1	1
|	.	.
|	.	.
|	.	.
v	11	11
p.m.	12	±12
|	1	−1 or ±13
|	2	−2 or ±14
|	.	. .
|	.	. .
|	.	. .
v	11	−11 or ±23

*A −00.*mm* input will result in a 12:*mm* a.m. time setting

Example: To set the time module to 3:30:10 a.m. and then to 3:30:10 p.m.:

Keystrokes	Display	
3.301 SETIME	3.301000	Sets the time to 3:30:10 a.m.
15.301 SETIME	15.301000	Sets the time to 3:30:10 p.m.
or ...		
3.301 CHS	-3.301_	
SETIME	-3.301000	Sets the time to 3:30:10 p.m.
■ ON	3:30:** PM	Displays clock. Assumes time-only clock display.

With SETIME, many users can set the time to a precision approaching 0.1 second. When you want a more precise time setting than you can achieve using SETIME:

1. Set the time as precisely as possible by using SETIME.
2. Eliminate any difference between the calculator time and your source time by using the T+X function described under Adjusting the Current Time, page 17.

Clock Display Functions

Specifying Clock Display Contents

CLKTD

The CLKTD (*clock-time and date*) function switches the clock display from the time-only format to the time/date format.

CLKT

The CLKT (*clock-time only*) function switches the clock display from the time/date format to the time-only format.

The default clock display includes only the time. Executing CLKTD specifies a display of both the time and date. To return to the time-only clock display, execute CLKT. (These functions specify the contents of any subsequent clock display.) You must execute ■ ON or CLOCK to actually display the clock. The box below illustrates how the CLKT and CLKTD options would appear in 12- or 24-hour time display formats at exactly 3:15 p.m. on January 21. For an example of CLKT and CLKTD operation, refer to Using Your Calculator as a Clock and a Calendar, page 9.

Format	CLKT **(Default)**	CLKTD
CLK12	3:15:00 PM	3:15 PM 01/21
CLK24	15:15:00	15:15 01/21

Displaying the Clock

■ ON

CLOCK

When you press ■ ON or execute CLOCK (*display clock*), the calculator displays the clock. To switch from the clock display to the X-register, press ◆. (Pressing the key(s) for almost any other function while the clock is displayed will execute that function and replace the clock display with the result of the function.) The calculator's automatic turn-off feature is deactivated while the clock is displayed.

> **Note:** The clock display consumes a higher than usual amount of battery power. Refer to Power Consumption, page 61, and Low Power, page 61.

As described in the owner's manual for your calculator, certain user flags are either set or cleared each time the calculator is turned on. Executing CLOCK or pressing ■ ON affects these flags in the same way as turning on the calculator. This is because the calculator turns off momentarily before displaying the clock. (Refer to section 14, Flags, in the owner's handbook for your calculator.)

Example: Use [SETIME] and [SETDATE] to set the clock to 12:00 a.m. on January 1, 1900. Next, press ■ [ON] and [←] to display, then clear, the clock display. Also, use the ■ [ON] key in conjunction with executing a calculator function to see how the clock display is affected by keyboard activity. Finally, set the clock to display time and date, examine the results, and reset the clock to display time only.

Keystrokes	Display	
0 [SETIME]	0.000000	Sets the time to 12:00 a.m.
1.0119 [SETDATE]	1.011900	Sets the date to 1/01/1900.
■ [ON]	12:**:** AM	Clock displayed (assumes default [CLKT] mode).
[←]	1.011900	Clock display replaced by display of X-register.
45	45_	Places 45 in the X-register.
■ [ON]	12:**:** AM	Clock display.
[√x]	6.708204	Square root of 45.
[CLKTD]	6.708204	Specifies time and date display.
■ [ON]	12:**AM 01/01	Time and date clock display.
[CLKT]	6.708204	Clock set to display time only.
■ [ON]	12:**:** AM	Time-only clock display.

The time and date functions allow you to interact with and control clock inputs and outputs. All time and date functions, except ■ [ON], are programmable.

Adjusting the Current Time

[T+X] X [time change] (HHHH.MMSShh)

The [T+X] (*time plus X*) function increments or decrements the current time according to the number in the X-register.

The [T+X] function is used to input time changes to correct for [SETIME] errors due to keystroke variations, or time zone changes, or for other instances where your applications call for a change in the current time. (If you want to correct the accumulated error in the clock, use the [CORRECT] function described under Setting the Time and Automatically Adjusting the Accuracy Factor, page 57.)

How [T+X] Operates

Executing [T+X] changes the current time by the time change specified in the X-register. If the time change places the current time in a different day than the previous time—as would result if at 11:00 p.m. you advanced the clock by 2 hours—the date is also changed.

Example: Adjust for a 1.75 second (slow) timesetting error. Then decrement the current time by 1 hour for a time zone change.

Keystrokes	**Display**	
.000175	.000175_	Keys in the adjustment.
[T+X]	0.000175	Increments the clock by 1.75 seconds.
■ [ON]	✱✱:✱✱:✱✱ AM	Display the clock. (Assumes a.m. time and [CLKT] format remain from previous example.)
1	1_	Keys in a time change of 1 hour.
[CHS]	-1_	A negative value retards the current clock time.
[T+X]	-1.000000	Executes the time change.
■ [ON]	✱✱:✱✱:✱✱ AM	Displays the clock, which is decremented by 1 hour.

If executing [T+X] would result in a new date outside the range of 1/1/1900 $\leqslant d \leqslant$ 12/31/2199, an ***OUT OF RANGE*** error message will result.

Time or Date Changes When Alarms Are Set

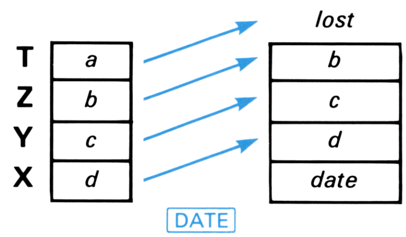
As described in section 4, Alarms, the time module allows you to store alarms in memory. If executing [SETDATE], [SETIME], or [T+X] results in a date or time setting that is later than the setting for any clock alarm in memory, the calculator will sound a pair of tones to indicate the existence of the bypassed alarm(s).* Refer to Detecting Past Due Alarms, page 52.

Recalling the Current Date or Time

Recalling the Date

[DATE]

Executing [DATE] places a number representing the current date in the X-register. The number is formatted according to the current [MDY] or [DMY] date format. The stack lifts in the same way that it does when a number is recalled from a data storage register.



(Assumes Stack Lift Enabled.)

When [DATE] is executed from the keyboard, the current date and the day of the week are also displayed (*MM/DD/YY DAY* or *DD.MM.YY DAY*).

Recalling the Time

[TIME]

Executing [TIME] places a number representing the current time in the X-register. The number is formatted according to the 24-hour/time format:

(H)H.MMSShh

*Unless flag 26—audio enable—is cleared.

When TIME is executed from the keyboard the current time is also displayed in whichever time display format is in effect (CLK12 or CLK24). Pressing ◀ switches the display to the X-register. Executing TIME lifts the stack in the same way as when you execute DATE.

Appending a Time to the ALPHA Register

Appending a 12-Hour Time to the ALPHA Register

ATIME	X: *time*	(*HH.MMSShh*)

The ATIME (*ALPHA time*) function appends the number in the X-register to the contents of the ALPHA register in the current time format (CLK12 or CLK24). The ATIME function is useful in programs that produce clock time outputs.

If the integer (hour) part of the number in the X-register is 23 or less, the number is formatted according to the current CLK12 or CLK24 setting. If the integer is 24 through 99, the number is always formatted according to the 24-hour (CLK24) setting. The number appended to the ALPHA register by ATIME is truncated according to the current display setting, as shown at the right. ATIME accepts *any* number in the range $-100 < t < 100$ as a valid input.

FIX, SCI, or ENG	Appends
0	*HH*
1-2	*HH:MM*
3-4	*HH:MM:SS*
5-7	*HH:MM:SS.hh*

The following keystrokes illustrate how ATIME is used. Notice that in FIX 4 display setting the number 10.123456 appears *rounded* to four significant digits, while ATIME (correctly) uses the *truncated* value of the number to four significant digits.

Keystrokes	Display	
CLA		Clears ALPHA register.
■ FIX 0		Sets FIX 0 display mode.
1.012345 ATIME	1.	Appends number in X-register to contents of ALPHA register (blank in this case) in time format.
ALPHA	1 AM	Displays ALPHA register.
◀ ALPHA	1.	Clears ALPHA register and displays X-register.
10.123456 ATIME	10.	Appends new number in X-register to contents of ALPHA register (blank) in time format.
ALPHA	10 AM	Displays ALPHA register.
◀ ALPHA	10.	Clears ALPHA register and displays X-register.
■ FIX 2 ATIME	10.12	Sets FIX 2 display mode and appends number in X-register to ALPHA register in time format.
ALPHA	10:12 AM	Displays ALPHA register.
◀ ALPHA	10.12	
■ FIX 4 ATIME	10.1235	Sets FIX 4 display mode and appends number in X-register to ALPHA register in time format.
ALPHA	10:12:34 AM	Displays ALPHA register.
◀ ALPHA	10.1235	
■ FIX 6 ◀	0.000000	

If there is not enough space left in the ALPHA register to accommodate its existing contents plus the characters appended by ATIME, a sufficient number of the leftmost characters in the ALPHA register will be bumped out (lost) to make room for the new characters added at the right.

If either ALPHA data or a number outside the range $-100 < x < 100$ is in the X-register when ATIME is executed, a **DATA ERROR** message will result.

Appending a 24-Hour Time to the ALPHA Register

ATIME24	X	*time*	(*HH.MMSShh*)

Executing ATIME24 (*ALPHA time-24*) appends the number in the X-register to the contents of the ALPHA register in CLK24 time display format. (The current time format—CLK12 or CLK24—is ignored.) ATIME24 accepts *any* number in the range $-100 < t < 100$ as a valid input.

The ATIME24 function can be used (when the calculator is *not* in Stopwatch mode) for printing splits or elapsed time values.

Appending a Date to the ALPHA Register

ADATE	X	*date*	(*MM.DDYYYY* or *DD.MMYYYY*)

ADATE (*ALPHA date*) appends the number in the X-register to the contents of the ALPHA register in the current date format. The number of digits placed in the ALPHA register is determined by the number of digits specified in the current FIX, SCI, or ENG display mode. (Refer to the table on page 19.) If the FIX, SCI, or ENG display setting specifies three or four digits, only the last two digits of the year ***YY*** will appear in the date appended to the ALPHA register. The current MDY or DMY setting determines the ADATE format.

ADATE accepts *any* number in the range $-100 < x < 100$ as a valid date input. Other numbers or ALPHA data will cause an error condition.

The Time and Date on Program Listings

When a program is printed using the HP 82160A HP-IL Module functions PRP or LIST, the time and date always appear in the calculator display and are printed at the head of the program listing.

Calendar Functions

The time module enhances your calendar applications capabilities with three functions that perform the following:

- Add or subtract a number of days from a date and determine the resulting date.
- Calculate the number of days between two dates.
- Calculate the day of the week for a given date.

The format for a calendar function date input should be the same as the current date format (MDY or DMY).

Valid Dates

Any date from October 15, 1582 (the beginning of the Gregorian calendar) through September 10, 4320 can be used in a calendar function. In any date input:

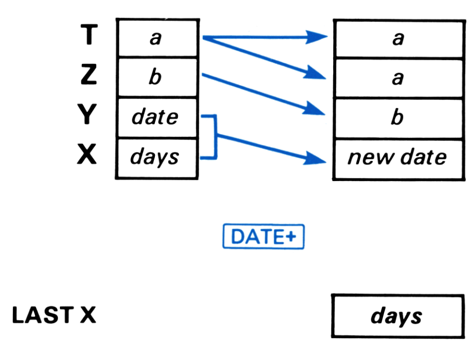
- All trailing digits to the right of the year digits (***YYYY***) must be zeroes.
- The sign must be positive.

If either of the above conditions is not met, an error message will result. (Refer to appendix B, Error Messages.)

Date Arithmetic

DATE+	Y	***date***	(***MM.DDYYYY*** or ***DD.MMYYYY***)
	X	***days***	

The DATE+ (*date plus days*) function adds the number of days in the X-register to a date specified in the Y-register. Only the integer portion of the number in the X-register is used. (A negative value in the X-register will be subtracted from the date.) The resultant date is placed in the X-register in the current date format.



Example: Paul Leroy plans to begin a bicycle trip from San Francisco to Montreal on July 17, 1982. If he allows 135 days for the trip, what is his estimated date of arrival in Montreal and what is the midpoint date of the trip?

Keystrokes	Display	
7.171982 [ENTER↑]	7.171982	Keys in starting date. (Assumes [MDY] format.)
135	135_	Keys in number of days.
[DATE+]	11.291982	The arrival date is November 29, 1982.
68 [CHS]	–68_	The number of days between arrival date and the midpoint date.
[DATE+]	9.221982	The midpoint date of the trip (September 22, 1982).

Days Between Dates

[DDAYS]	Y	*date*	(*MM.DDYYYY* or *DD.MMYYYY*)
	X	*date*	(*MM.DDYYYY* or *DD.MMYYYY*)

The [DDAYS] (*delta days*) function calculates the number of days between a pair of dates in the X- and Y-registers and places the result in the X-register. (The stack drops in the same way that it does when [DATE+] is executed.) The dates must be entered in the current date input format ([MDY] or [DMY]).

Example: Calculate the number of days between the first nonstop transatlantic flight (May 21, 1927) and the first transatlantic jet passenger flight (October 4, 1958). (Example assumes [MDY] format.)

Keystrokes	Display	
5.211927 [ENTER↑]	5.211927	First date.
10.041958	10.041958_	Second date.
[DDAYS]	11,459.00000	Number of days between flights.

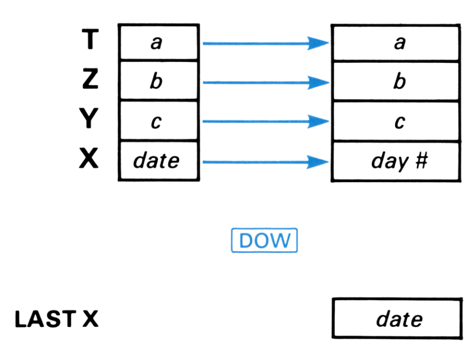
If the date in the Y-register is later than the date in the X-register, the number of days calculated will be a negative number.

Day of the Week

[DOW]	X	*date*	(*MM.DDYYYY* or *DD.MMYYYY*)

The [DOW] (*day-of-week*) function calculates the day of the week for a date given in the X-register.

To calculate the day of the week for a given date, place the date in the X-register using the current date input format, then execute [DOW]. The date will be replaced with a number indicating the day of the week: 0 for Sunday through 6 for Saturday. When executed from the keyboard, [DOW] also displays the name of the day of the week.



Example: Calculate the day of the week on which the total solar eclipse of July 31, 1981 took place. (Example assumes [MDY] format.)

Keystrokes	Display	
7.311981	7.311981_	Keys in the date.
[DOW]	FRI	Executing [DOW] from the keyboard displays the day and ...
[←]	5.000000	... pressing [←] switches the display to the corresponding [DOW] value (5 = Friday).

Section 3

Stopwatch Functions

Recall from the introduction to this manual that the stopwatch in your HP 82182A Time Module is separate from the clock. In Stopwatch mode (stopwatch displayed) the calculator becomes a digital stopwatch and the keyboard is redefined for stopwatch control; that is, to record, compare, and review splits. All other functions are suspended. Because the stopwatch can be running whether or not it is displayed, you can also use it as an internal timing device while you execute programs or keyboard calculations, or while the calculator is turned off. You can also use the stopwatch as a timer.

Before proceeding in this section, place the Stopwatch keyboard overlay on your calculator's keyboard.

> **Note:** Because the displayed results of executing stopwatch functions depends upon the timing of your keystrokes, many of the example displays in this section will differ from the calculator displays you actually see when you execute the examples.

The Stopwatch in Operation

The following examples are provided to quickly demonstrate basic stopwatch operation. Detailed explanations of the features used in the examples, plus other stopwatch features, will be found under the subsequent headings in this section. Ensure that registers R_{00} through R_{04} are available before you begin.

First, let's see how to start, halt, and clear the stopwatch.

Keystrokes	Display	
[SW]	00:00:00.00 ⟩- R00	Sets the calculator to Stopwatch mode.
[R/S]	00:**:**.* ⟩- R00	Starts the stopwatch.
[R/S]	00:*MM*:*SS*.*hh* ⟩- R00	Halts the stopwatch.
[←]	00:00:00.00 ⟩- R00	Clears the stopwatch.

Splits are stored in the registers indicated by the register pointer at the right of the display. Let's run the stopwatch and take some splits at intervals of approximately 15 seconds. In the following example, each time you press the [ENTER↑] key, hold it down long enough to read the display. Also, watch the changes in the ⟩- R00 register pointer on the right side of the display.

[R/S]	00:**:**.* ⟩- R00	Starts the stopwatch.
[ENTER↑] (held)	00:00:15.*hh* ⟩- R00	Stores first split in R_{00}.
(released)	00:**:**.* ⟩- R01	Display returns to running stopwatch. Next split will be stored in R_{01}.
[ENTER↑] (held)	00:00:30.*hh* ⟩- R01	Stores second split in R_{01}.
(released)	00:00:**.* ⟩- R02	
[ENTER↑] (held)	00:00:45.*hh* ⟩- R02	Stores third split in R_{02}.
[R/S] [←]	00:00:00.00 ⟩- R03	Halts and clears stopwatch.

Now review the splits that you recorded. Notice that the symbol preceding **R*nn*** at the right side of the display changes from ⟩- to ⁼ when you press [RCL] to indicate a switch from recording splits to reviewing splits.

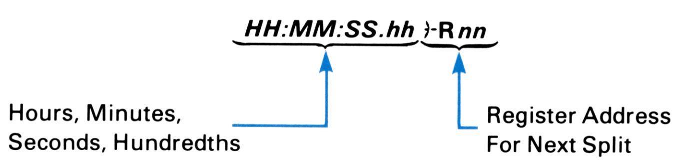
[RCL]	00:00:15.*hh* ⁼ R00	Switch from display of stopwatch to display of splits. In this case, displays split stored in R_{00}.
[SST]	00:00:30.*hh* ⁼ R01	Displays split stored in R_{01}.
[SST]	00:00:45.*hh* ⁼ R02	Displays split stored in R_{02}.

Now let's compare the differences between those same splits. Notice that the **R** in the register pointer changes to **D** when you press [CHS] to display split differences.

01	00:00:30.*hh* ⁼ R01	Resets register pointer to R_{01}.
[CHS]	00:00:*SS*.*hh* ⁼ D01	Switches to display of difference between split in current register and split in preceding register. In this case, displays difference between splits in R_{01} and R_{00}.
[SST]	00:00:*SS*.*hh* ⁼ D02	Displays difference between splits in R_{01} and R_{02}.
[CHS]	00:00:45.*hh* ⁼ R02	Switches from display of difference between splits back to display of split stored in specified register. (Notice that the register Pointer changes from **D** back to **R**.)
[RCL]	00:00:00.00 ⟩- R03	Switch from display of split stored in specified register to display of stopwatch. (Notice that the register pointer changes from ⁼ ***R02*** back to ⟩- ***R03***.)
■ [←]		Exit Stopwatch mode.

Stopwatch Mode

When you set the calculator to Stopwatch mode, the stopwatch is displayed, along with the number of the next data storage register to receive a split:

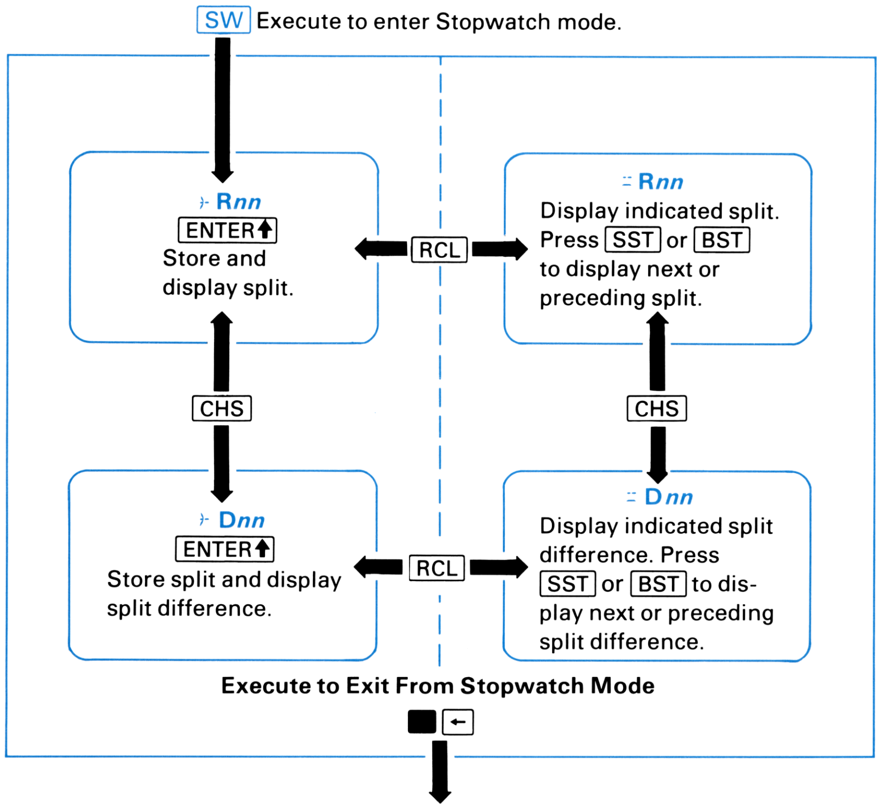


Also, the keyboard is redefined to perform only the stopwatch functions. These functions are printed on the keyboard overlay you received with your time module. All other key functions except [ON] are suspended while the calculator is set to Stopwatch mode.*

In Stopwatch mode you can store splits and display splits and split differences in various ways. The automatic turn-off feature is deactivated while the calculator is in Stopwatch mode.

Before execution of any other calculator or time module functions (including activation of clock alarms), you must exit from Stopwatch mode. The following diagram outlines these operations.

*While the calculator is in Stopwatch mode and the stopwatch is running, pressing almost any key except the digit keys and other keys that are assigned to stopwatch functions temporarily freezes the display without halting the stopwatch. When the key is released, the display switches back to the running stopwatch. This feature can be employed to view split *approximations*; however, because this method only halts the updating of the display by the calculator, a time displayed in this way may be in error by 0.1 second or more.



Stopwatch Mode Operation

Note: The stopwatch display consumes a higher than usual amount of battery power; refer to Power Consumption, page 61.

Entering and Exiting Stopwatch Mode

[SW]

The [SW] (*stopwatch*) function places the calculator in Stopwatch mode. When you execute the (programmable) [SW] function, the digital stopwatch display appears and the keyboard is redefined as shown by the stopwatch overlay. If the stopwatch has been previously cleared or has not been used since you last plugged in the module, the stopwatch setting will appear with all zeros displayed. The storage register pointer will *always* be set to 00 following execution of [SW]. Executing [SW] does not affect the current status of the stopwatch (running or halted).

■ [←]

Pressing ■ [←] removes the calculator from Stopwatch mode.

You can exit from Stopwatch mode to normal keyboard control by pressing ■ [←]. The X-register will then be displayed and the key assignments that were active before the calculator went into Stopwatch mode will be restored. (An exit from Stopwatch mode can be performed only from the keyboard.)

Note: If you exit from Stopwatch mode without first halting the running stopwatch, the stopwatch will continue to run even though it is not displayed.

Starting, Halting, and Clearing the Stopwatch

[R/S]

Pressing [R/S] while in Stopwatch mode starts and halts the stopwatch.

As you saw in the example at the beginning of this section, when the calculator is set to Stopwatch mode, the [R/S] key is used both to start and to stop the stopwatch. Notice that when you press [R/S] to start the stopwatch running, the stopwatch resumes from where it was last halted; that is, pressing [R/S] to start the stopwatch does *not* reset it to zero. If the stopwatch is not halted, it will run continuously. When it passes 99h 59m 59.99s, it automatically starts again from zero.

[◆]

When the stopwatch is displayed and halted, pressing [◆] clears the stopwatch to zero.

The Register Pointers

Recognizing the Pointers

Splits taken during Stopwatch mode are stored sequentially in the calculator's data storage registers. In Stopwatch mode the register pointers indicate which type of access is occurring *and* which register is being accessed. The box at the right shows these pointers and their corresponding operations. *Every time you execute* [SW] *to place the calculator in Stopwatch mode, the register pointers are reset to register* R_{00}.

⊦ R*nn*	Store Split
⊦ D*nn*	Store Split; Display Difference
⊏ R*nn*	Recall Split
⊏ D*nn*	Recall Split Difference

Notice that the ⊦ symbol preceding the register designator always indicates either *storage* of a split (⊦R*nn*) or *storage* of a split and display of the difference between that split and the preceding split (⊦D*nn*). The ⊏ symbol always indicates *recall* of a split (⊏R*nn*) or *recall* of the difference between two splits (⊏D*nn*).

The stopwatch storage register pointer ⊦R*nn* (or ⊦D*nn*) and the Recall register pointer ⊏R*nn* (or ⊏D*nn*) are maintained separately. This allows you to switch between split storage and split recall as often as you like without affecting either register pointer.

Changing a Register Pointer

There are four ways to change the register pointer while in Stopwatch mode:

- To take a split and move to the next data register, press [ENTER↑].
- To move to the next data register, press [SST].
- To move to the preceding data register, press ■ [BST].
- To randomly move to any available data register (*nn* or *nnn*), press the digit keys that specify that register. (To specify $R_{(100)}$ through $R_{(318)}$ refer to Stopwatch Access of $R_{(100)}$ Through $R_{(318)}$, page 35.)

You can change the register pointer whether the stopwatch is running or halted.

Example: Switch the calculator to Stopwatch mode and set the register pointer to various data registers. (Ensure that R_{00} through R_{10} are available.)

Keystrokes	Display	
[SW] [R/S]	00:00:**.* }-R00	Sets Stopwatch mode and runs stopwatch.
[SST]	00:**:**.* }-R01	Steps to R_{01}.
[R/S]	00:*MM*:*SS*.*hh* }-R01	Halts stopwatch.
■ [BST]	*HH.MM:SShh* }-R00	Backsteps to R_{00}.
0	*HH.MM:SShh* }-R0_	Switches to R_{05}.
5	*HH.MM:SShh* }-R05	
[R/S]	00:**:**.* }-R05	Runs stopwatch.
1	00:**:**.* }-R1_	Switches to R_{10}.
0	00:**:**.* }-R10	
[R/S] [←]	00:00:00.00 }-R10	Halts and clears stopwatch.
■ [←]		Exits from Stopwatch mode.

Whenever you use the digit keys to change the register pointer, you must specify all digits of the new data register (*nn* or *nnn*) before executing the next stopwatch operation. If you do not specify all digits of a register number, you will not be able to execute most other stopwatch keyboard functions.

Storing Splits

In Stopwatch mode, the number of splits you can store in the calculator is limited only by the number of currently available data storage registers. When storing splits using the Store Split operation, the data storage register to receive the next split is indicated by the digits in the }-R*nn* register pointer at the right-hand side of the stopwatch display.

[ENTER↑]

In Stopwatch mode, when you press [ENTER↑], the current stopwatch time is stored in the data storage register indicated by the current split storage register pointer. Any value previously stored in that register is lost. While [ENTER↑] is held down, the stopwatch display shows the split that was stored and the register it was stored in. When [ENTER↑] is released, the calculator switches back to the elapsed time stopwatch display and indicates the next register to be used for split storage. The example on page 27 demonstrates the storage of splits.

When you are using [ENTER↑] to take splits, a tone will sound when there is only one register left in memory for split storage. The tone will sound again when there are no registers left. If [ENTER↑] is pressed when }-R*nn* points to a nonexistent register, **NONEXISTENT** will be displayed and Stopwatch mode will be terminated. (The stopwatch will continue to run even though it is no longer displayed.) The calculator will sound the same tone if you use the digit keys to shift the register pointer to the last available register or to a nonexistent register.

Recalling Splits

[RCL]

In Stopwatch mode, with the stopwatch halted or running, pressing [RCL] switches the display into or out of Split Recall operation.

Pressing [RCL] switches the calculator from stopwatch display to a display of the split contained in the register indicated by the register pointer (∸R*nn*). Pressing [RCL] again switches the display back to stopwatch display. Splits will be displayed in ***HH:MM:SS.hh*** format.* Pressing [SST] increments ∷ **R*nn*** to the next data storage register and displays the contents of that register. Pressing ■ [BST] decrements ∷ **R*nn*** to the previous data storage register and displays the contents of that register. The first time you switch to Split Recall operation, the Split Recall register pointer will be set to R_{00}. Subsequently setting the Split Recall pointer to another register and switching out of, then back into, Split Recall operation will not move the pointer from that register. (When you switch out of Stopwatch mode, all stopwatch register pointers are reset to R_{00}.)

Example: Store a series of random splits in R_{00} through R_{05}, then set the calculator to Split Recall display and review those splits.

Keystrokes	Display	
[SIZE] 006		Allocates R_{00} through R_{05} to data storage registers.
[SW]	00:00:00.00 ⟩- R00	Sets Stopwatch mode.
[R/S]	00:00:**.* ⟩- R00	Starts stopwatch.
[ENTER↑]	00:**:**.* ⟩- R01	Stores a split in R_{00}.
[ENTER↑]	00:**:**.* ⟩- R02	Stores a split in R_{01}.
[ENTER↑]	00:**:**.* ⟩- R03	Stores a split in R_{02}.
[ENTER↑]	00:**:**.* ⟩- R04	Stores a split in R_{03}.
[ENTER↑]	00:**:**.* ⟩- R05	Stores a split in R_{04}. Tone indicates that R_{05} is the last available storage register.
[ENTER↑]	00:**:**.* R06	Stores a split in R_{05}. Tone indicates that R_{06} does not exist.
[RCL]	00:*MM*:*SS*.*hh* ∷R00	Split Recall display of R_{00}.
[SST]	00:*MM*:*SS*.*hh* ∷R01	Step forward to and display contents of R_{01}.
[SST]	00:*MM*:*SS*.*hh* ∷R02	Displays split in R_{02}.
[SST]	00:*MM*:*SS*.*hh* ∷R03	Displays split in R_{03}.
05	00:*MM*:*SS*.*hh* ∷R05	Displays split in R_{05}. Tone indicates R_{05} is the last available data storage register.
■ [BST]	00:*MM*:*SS*.*hh* ∷R04	Displays split in R_{04}.

If you attempt to recall a split from a nonexistent storage register, the tone will sound, **NONEXISTENT** will be displayed, and the calculator will exit from Stopwatch mode.

Keystrokes	Display	
06	NONEXISTENT	R_{06} is nonexistent. Calculator automatically exits from Stopwatch mode. (Since we did not halt the running stopwatch in this example, the stopwatch continues to run internally.)
[←]		Clears error message; X-register is displayed.

The Split Storage register pointer (⟩-**R*nn*** / ⟩-**D*nn***) and the Split Recall register pointer (∷**R*nn*** / ∷**D*nn***) are separately maintained. This means that you can store several splits, switch to split recall to view the splits, and then resume storing splits where you left off.

*Splits are always stored in the ***HH.MMSShh*** format. Thus, if you use the [RCL] function to recall a value representing a split from a register when the calculator is not set to Stopwatch mode, the value will be displayed as an ***HH.MMSShh*** number. Conversely, a value stored in a register when not in Stopwatch mode will be displayed in ***HH:MM:SS.hh*** format if recalled to the display while the calculator is in Stopwatch mode. In this case, an error message—**ERROR ∷ R*nn***—will be displayed if the integer portion of the number contains three or more digits.

Example: Return to Stopwatch mode and store two splits. Then review the splits and record two additional splits.

Keystrokes	**Display**	
[SW]	00:**:**.* ⟩- R00	Sets Stopwatch mode. The stopwatch is still running from the preceding example.
[ENTER↑] [ENTER↑]	00:**:**.* ⟩- R02	Stores splits in R_{00} and R_{01}.
[RCL]	00:*MM*:*SS*.*hh* ≍ R00	Sets calculator to Split Recall and displays split stored in R_{00}.
[SST]	00:*MM*:*SS*.*hh* ≍ R01	Displays split stored in R_{01}.
[RCL]	00:**:**.* ⟩- R02	Returns calculator to running stopwatch and returns register pointer to indication of next register to be used for split storage. Notice that the Split Storage pointer remains set to the data register to which it was set before you switched from the running stopwatch to Split Recall.
[ENTER↑] [ENTER↑]	00:**:**.* ⟩- R04	Stores splits in R_{02} and R_{03}.
[RCL]	00:*MM*:*SS*.*hh* ≍ R01	Sets calculator to Split Recall. Notice that the Split Recall pointer remains set to the data register to which it was set before you switched from Split Recall to the running stopwatch.
[SST]	00:*MM*:*SS*.*hh* ≍ R02	Displays split stored in R_{02}.
[SST]	00:*MM*:*SS*.*hh* ≍ R03	Displays split stored in R_{03}.
[RCL]	00:**:**.* ⟩- R04	Returns calculator to running stopwatch and returns register pointer to indication of next register to be used for split storage.
[R/S] [←]	00:00:00.00 ⟩- R04	Halt and clear stopwatch. Split storage register pointer and split recall pointer remain at last settings until changed or until you exit from Stopwatch mode.
■ [←]		Exits from Stopwatch mode.

While the stopwatch is set to recall splits, pressing [R/S] or [ENTER↑] switches the calculator back to the stopwatch display and executes the appropriate operation (start or stop stopwatch, or store a split). If a split is stored, it will be stored in the register indicated by ⟩-R*nn* in the same way as described under Storing Splits, page 31.

Delta Split

[CHS]

In Stopwatch mode, [CHS] switches the display into or out of Delta Split operation.

All splits are stored in the calculator as accumulated times. The Delta Split operation allows you to display the difference between a pair of splits stored in successive data storage registers without interrupting stopwatch operation. Delta split can be used whether the calculator is being used to record splits or to recall splits:

- When you are storing splits with Delta Split active, pressing and holding the [ENTER↑] key records a split and displays the difference between that split and the split in the previous data storage register. Releasing [ENTER↑] returns the display to the running stopwatch.

- When you are recalling splits (Split Recall operation) with Delta Split active, using the [SST], [BST], or digit keys to specify a data storage register will display the time difference between the specified register and the register immediately preceding it.

In either of the preceding cases, when the register pointer is set to R_{00} or when the register indicated by D*nn* contains a positive value and the register preceding the one indicated by D*nn* contains zero, the split difference will be the same as the contents of the current register.

Example: With the calculator set to Stopwatch mode, activate Delta Split operation, then run the stopwatch and take four splits at intervals of approximately 15 seconds. As you take each split, hold down the [ENTER↑] key long enough to read the displayed difference between the current split and the preceding split.

Keystrokes	Display		
[SW]	00:00:00.00	R00	Switches calculator to Stopwatch mode.
[CHS]	00:00:00.00	D00	Activates Delta Split.
[R/S]	00:00:**.*	D00	Starts the stopwatch.
[ENTER↑] (held)	00:00:15.*hh*	D00	First split. Because R_{00} is the lowest-numbered register, the current elapsed time is displayed.
(released)	00:00:**.*	D01	Running stopwatch display.
[ENTER↑] (held)	00:00:15.*hh*	D01	Second split; difference between first and second split displayed.
(released)	00:00:**.*	D02	
[ENTER↑] (held)	00:00:15.*hh*	D02	Third split; difference between second and third split displayed.
(released)	00:00:**.*	D03	
[ENTER↑] (held)	00:00:15.*hh*	D03	Fourth split; difference between third and fourth split displayed.
(released)	00:01:**:*	D04	
[R/S] [←]	00:00:00.00	D04	Halts and clears stopwatch.
[CHS]	00:00:00.00	R04	Deactivates Delta Split.

Now let's switch the calculator to Split Recall operation and reexamine the split differences. (Because the stopwatch register pointers are reset to R_{00} whenever the calculator is placed in Stopwatch mode, our current Split Recall register pointer will be set to R_{00}.)

[RCL]	00:00:15.*hh*	R00	Split Recall display.
[CHS]	00:00:15.*hh*	D00	Elapsed time of first split.
[SST]	00:00:15.*hh*	D01	Recalls R_{00}/R_{01} split difference.
[SST]	00:00:15.*hh*	D02	Recalls R_{01}/R_{02} split difference.
[SST]	00:00:15.*hh*	D03	Recalls R_{02}/R_{03} split difference.
[■] [←]			Exits from Stopwatch mode.

Like the register pointers for split storage, the register pointer for Split Recall (with or without split difference) will automatically reset to zero when you exit from stopwatch mode.

If a number that is not in the form ***HH.MMSShh*** is in a register accessed by Delta Split, or if Delta Split would result in a negative split difference, the message ERROR D*nn* appears in the display. To clear the error message, reset the register pointer to another data storage register. (If you press [←] to clear an error message, the calculator will switch from a Split Recall display to a display of the stopwatch; Delta Split remains active.)

Stopwatch Access of $R_{(100)}$ Through $R_{(318)}$

■ [EEX]

In Stopwatch mode, pressing ■ [EEX] switches the register pointer from two digits to three digits. Pressing ■ [EEX] again changes the pointer back to two digits.

If your calculator is configured to contain more than 100 data storage registers,* you may want to use these higher-numbered registers for some of your stopwatch operations. To enable the stopwatch to access $R_{(100)}$ through $R_{(318)}$, press ■ [EEX] to switch the register pointer from two digits to three digits. Then use the digit keys or [SST] to move the register pointer to the desired data storage register. If your stopwatch operations begin with a two-digit register pointer and proceed sequentially to a three-digit register pointer, it is not necessary to use ■ [EEX]. The pointer will automatically switch to three digits when access moves from R_{99} to $R_{(100)}$.

To reset the register pointer to two-digit data storage register access, press ■ [EEX] again. When you do so, the leading digit in the three-digit register pointer will be truncated.

Suppressing the Displayed Register Pointer

[EEX]

In Stopwatch mode, pressing [EEX] suppresses the displayed register pointer. (While the pointer is suppressed, it is maintained internally.) Pressing [EEX] again or changing register pointer status restores the register pointer to the display.

When the register pointer contains three digits and/or a negative stopwatch time is in use, the last digit of a halted stopwatch display and/or the tenths (of a second) digit in a running stopwatch may not be displayed. In these circumstances, suppressing the register pointer allows you to view the undisplayed digit. This feature is also useful if you want to use the stopwatch without displaying the register pointer.

Example: Start the stopwatch. Then, suppress the register pointer, take some splits, and return the pointer to the display.

Keystrokes	Display	
[SW] [R/S]	00:**:**.* }-R00	Starts the stopwatch.
[EEX]	00:**:**.*	Suppresses register pointer.
[ENTER↑] [ENTER↑]		
[ENTER↑]	00:**:**.*	Takes three splits rapidly. (They are stored in R_{00} through R_{02}.)
[EEX]	00:**:**.* }-R03	Displays register pointer.
[EEX]	00:**:**.*	Suppresses pointer.
[RCL]	00:*MM*:*SS.hh* =R00	Activates split recall display; split recall pointer appears.
[EEX]	00:*MM*:*SS.hh*	Suppresses split recall pointer.
[R/S]	00:*MM*:*SS.hh* }-R03	Halts stopwatch; split storage pointer appears.
[←]	00:00:00.00 }-R03	Clears stopwatch.
■ [←]		Exits from Stopwatch mode.

*The HP-41CV or an HP-41C equipped with an HP 82170A Quad Memory Module or one or more HP 82106A Memory Modules.

Printing Split Data

If you use an HP 82143A Printer or an HP 82162A Thermal Printer and wish to produce printouts of splits, you can do so using ATIME24 and the PRA (*print ALPHA*) function. (Refer to page 19, Appending a Time to the ALPHA Register, and to the appropriate printer and/or HP-IL manual.) A program for printing a block of splits is included on page 74 of this manual.

Even though you cannot print split differences directly while in Stopwatch mode, you can print split differences using the calculator's HMS- function. For example, to print the difference between a nonnegative split stored in R_{00} and a later split stored in R_{01}:

1. Exit from Stopwatch mode.
2. Recall the number in R_{01} (the later split value).
3. Recall the number in R_{00} (the earlier split value).
4. Execute HMS- .
5. Clear the ALPHA register of any current ALPHA data. (This step is optional.)
6. Execute ATIME24 and print the contents of the ALPHA register.

Using the Stopwatch When Not in Stopwatch Mode

In addition to SW , which switches the calculator into Stopwatch mode, there are four programmable functions that enable you to control the stopwatch without switching to Stopwatch mode. These four functions allow you to set and run the stopwatch, recall current times as numbers in the X-register, and halt the stopwatch. You can also specify a timer alarm by setting the stopwatch to a negative starting time. All programmable stopwatch functions operate only while the calculator is *not* set to Stopwatch mode.

Input/Output Format

When you access the stopwatch without switching to Stopwatch mode, the format used for stopwatch inputs and outputs is:

±***HH.MMSShh***

A negative input or output represents a negative stopwatch value.

Setting, Starting, and Stopping the Stopwatch

SETSW	X	***time***	(***HH.MMSShh***)

The SETSW (*set stopwatch*) function sets the stopwatch to the specified time.

To set the stopwatch for internal timer operation, place the initial stopwatch setting in the X-register and execute SETSW . The starting time can be any valid time (***HH.MMSShh*** number) between −99.595999 and 99.595999. An invalid number will result in an error message. Digits to the right of the hundredths of a second digits (***hh***) will be ignored. If the stopwatch is already running when SETSW is executed, the stopwatch will be reset to the specified time and continue running.

RUNSW

The RUNSW (*run stopwatch*) function starts the halted stopwatch when the calculator is not set to Stopwatch mode.

STOPSW

The STOPSW (*stop stopwatch*) function halts the stopwatch when the calculator is not set to Stopwatch mode.

Recalling the Current Stopwatch Time

RCLSW

The RCLSW (*recall stopwatch*) function recalls the current stopwatch time to the X-register. The stack will lift in the same way that it would if you recalled a number from a data storage register using RCL.

Section 4

Alarms

The time module provides you with the capability to set alarms for reminding you of appointments and for executing programs or plug-in device functions. All clock alarms are set using one powerful, programmable function: XYZALM (*XYZ alarm*). Like the clock itself, clock alarms operate whether the calculator is turned on or off. An alarm that comes due while the calculator is executing any function—including SW (calculator set to Stopwatch mode)—will activate when execution of the function is completed.

In addition to the clock alarms you can set using XYZALM, the time module also enables you to use the stopwatch to set a single timer alarm.

Basic Clock Alarm Operation

XYZALM	**Z**	*repeat interval*	***(HHHH.MMSSt)***	**ALPHA**	*Blank, Message, Label, or Function*
	Y	*date*	***(MM.DDYYYY or DD.MMYYYY)***		
	X	*time*	***(HH.MMSSt)***		

Each execution of XYZALM sets a separate alarm using the data in the X-, Y-, Z-, and ALPHA registers as alarm parameters. The information in the X-, Y-, and Z-registers specifies the alarm time parameters, as described in the following chart. (Notice that, unlike other time input functions, XYZALM uses tenths—rather than hundredths—of a second.)

Alarm Time Parameters

Z-Register: Alarm Repeat Interval

This parameter (r) causes the alarm to repeat itself after the specified interval.

Format of r	***HHHH.MMSSt***
Range of r	10 Seconds $\leqslant r <$ 10,000 Hours
No Repeat	Use $r = 0$

Y-Register: Alarm Date

This parameter (d) is the date on which you want the alarm to activate.

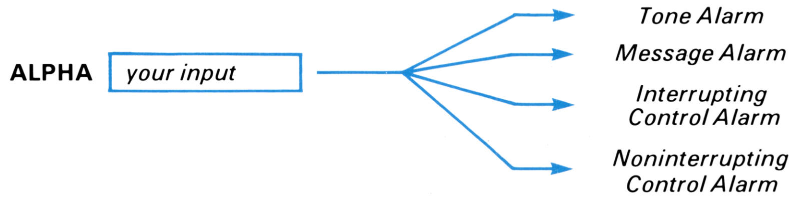
Format of d	***MM.DDYYYY*** or ***DD.MMYYYY***
Range of d	January 1, 1900 through December 31, 2199
Current Date	Use $d = 0$

X-Register: Alarm Time

This parameter (T) is the time of day at which you want the alarm to be activated.

Format of T	***HH.MMSSt***
Range of T	$-23.59599 \leqslant T \leqslant 23.59599$

The information in the ALPHA register when you execute XYZALM determines the alarm type.



Thus, for each alarm you set, you must specify one of four options in the ALPHA register, as shown in the following chart:

Alarm Type Parameters

Tone Alarm

Alarm produces a series of tones and a flashing time/date display.

ALPHA Register	Empty

This alarm is intended to activate when it comes due, whether the calculator is on, off, or executing a program. A tone alarm serves only to alert you at the time you specify. It does not affect the contents of the stack, ALPHA, or data storage registers.

Message Alarm

Alarm produces a flashing Alpha string message and a series of tones.

ALPHA Register	Alpha String Message (Up to 24 Characters)

This alarm operates in the same way as a tone alarm, except that it can be personalized to remind you of specific appointments or events.

Interrupting Control Alarm

Executes a program or a *plug-in device* function that you specify.

ALPHA Register	↑↑*program label* or ↑↑*function name*

This alarm is intended for use when you want a program, or a programmable function from a plug-in device, to be executed at a specific time (whether the calculator is on, off, running a program or displaying the clock).

Noninterrupting Control Alarm

Executes a program or a plug-in device function only while the calculator is turned off or is displaying the clock.

ALPHA Register	↑*program label* or ↑*function name*

This alarm operates like the interrupting control alarm except:

- The alarm will not interrupt a running program. Instead, the calculator sounds a pair of tones and the alarm becomes past due.*
- If the calculator is turned on and the clock not displayed, it is assumed that calculations may be in progress. The alarm activates as a message alarm only. The alarm's program or function is not executed.

Because of this operation, a noninterrupting control alarm enables you to avoid disrupting data relevant to current calculations (data in the stack, ALPHA, and data storage registers).

*A past-due alarm is an alarm that is set to a time which is earlier than the current time. Past-due alarms and the ways in which they can occur are described later in this section and in appendix D, More About Past-Due Alarms.

To summarize, *each* time you use XYZALM to set an alarm, the calculator uses the data in the X-, Y-, Z-, and ALPHA registers for alarm parameters. For this reason:

- When you do *not* want the alarm to have a repeat interval, enter a zero in the Z-register.
- When you want the alarm to activate later on the *current* date, enter a zero in the Y-register.
- When you do *not* want a unique message displayed and do *not* want a program or plug-in device function executed when the alarm activates, clear the ALPHA register.

When you are satisfied that the X-, Y-, Z-, and ALPHA registers contain the alarm parameters you want for a particular alarm, set the alarm by executing XYZALM.

Setting Tone Alarms

A tone alarm is the simplest of the four types of clock alarms. To set a tone alarm, perform the following steps:

1. Clear the ALPHA register (execute CLA).
2. Enter a repeat interval parameter in the Z-register. (If you do not want a repeat interval, enter zero.)
3. Enter an alarm date in the Y-register. (If you want the alarm to come due on the current date, enter zero.)
4. Place the desired alarm time in the X-register.
5. Execute XYZALM.

To give you some practice in using XYZALM, try the following three examples of tone alarms. As you will see, each of the alarms differs from the others in accordance with the parameters placed in the stack registers.

> **Note:** To demonstrate alarm operation in this manual, almost every alarm example uses SETIME to change the clock to a time that immediately precedes the alarm time used in the example. This clock manipulation serves only to ensure that the alarms you set while executing the examples printed in the manual will activate within one or two minutes after you set them. When you set alarms for use in your own real-time applications, you should not use SETIME.

Setting an Alarm to a Later Time on the Current Date.

Example: Set the current time to 1:00 a.m., then *immediately* key in an alarm for 1:01 a.m. on the current date. When the current time reaches 1:01 a.m., the alarm will activate.

Z	0
Y	0
X	1.01
ALPHA	Blank

Executing XYZALM sets a nonrepeating alarm for 1:01 a.m. on the current date.

Keystrokes	Display	
1 SETIME	1.000000	Sets time to 1:00 a.m.
ALPHA ← ALPHA	1.000000	Clears ALPHA register.
0 ENTER↑ ENTER↑	0.000000	Enters zero in the Y- and Z-registers. (That is, specifies current date and no repeat interval.)
1.01 XYZALM	1.010000	Sets alarm to 1:01 a.m.

When the alarm activates, the calculator will sound a pair of tones* and display the time and date. When the display begins to flash the time and date, press the [←] key to acknowledge and terminate the alarm.

Keystrokes	Display	
	1:01AM *MM/DD*	Alarm activates at 1:01 a.m. (The month and day to which your calculator is currently set will appear instead of the ***MM/DD*** shown here.)
[←]	1.010000	Pressing [←] while the display is flashing acknowledges the alarm and displays the X-register.

If you do not acknowledge the alarm within approximately 1 second after the display begins flashing, the calculator starts sounding a series of 16 pairs of tones. If you do not acknowledge the alarm before the tones halt (and the display stops flashing), the alarm becomes a *past-due*† alarm and remains in memory.

If you did not acknowledge the alarm in the above example by pressing [←] before the display stopped flashing (and the tones stopped sounding), reset the clock to 1:00 a.m. and wait for the alarm to activate again. When the alarm activates and *while the display is flashing*, press the [←] key as shown in the last step above. This will delete the alarm from memory. (The procedure described in this paragraph alters the clock and should be used only when you are experimenting with random alarms and clock times. Later in this section, under The Alarm Catalog, you will see the method you should normally use to delete unwanted alarms.)

Setting an Alarm for a Future Date.

Example: If your time module is not already set to [MDY] date format, execute [MDY] now. Then set an alarm for 10:00 p.m. on August 31, 1990.

Z	0
Y	8.31199
X	−10
ALPHA	Blank

Executing [XYZALM] sets a nonrepeating alarm for 10:00 p.m. on August 31, 1990.

Keystrokes	Display	
[MDY]	1.010000	Sets [MDY] format. (The number in the display remains from the previous example.)
[ALPHA] [←] [ALPHA]	1.010000	Ensures that ALPHA register is cleared.
0 [ENTER↑]	0.000000	Enters repeat interval of zero (no repeat).
8.31199 [ENTER↑]	8.311990	Enters date of alarm (8/31/1990).
10 [CHS]	−10_	Places alarm time (10:00 p.m.) in X-register.
[XYZALM]	−10.000000	Sets alarm to 10:00 p.m. on August 31, 1990; no repeat interval.

*Unless flag 26—audio enable—is cleared. Refer to section 14, Flags, in your calculator owner's manual.

†Refer to the footnote at the bottom of the chart on page 40.

Setting an Alarm to Repeat at Specified Intervals.

Example. Set your calculator to 1:00 a.m., then set the alarm to activate at 11:00 a.m. and to repeat at 15-minute intervals.

Z	0.15
Y	0
X	11
ALPHA	Blank

Executing [XYZALM] sets a 15-minute repeating alarm to initially activate at 11:00 a.m. on the current date.

Keystrokes	Display	
1 [SETIME]	1.000000	Sets clock to 1:00 a.m.
[ALPHA] [←] [ALPHA]	1.000000	Ensures that ALPHA register is cleared.
.15 [ENTER↑]	0.150000	Enters repeat interval (15 minutes).
0 [ENTER↑]	0.000000	Enters alarm date (current date).
11 [XYZALM]	11.000000	Set alarm time to 11:00 a.m.

The first alarm example (an alarm for a later time on the current date, page 41) included activation and acknowledgement, and the alarm should no longer be in the calculator's memory. But if you have just executed the two preceding alarm examples, both alarms should now exist in your calculator's memory. The following topic, The Alarm Catalog, describes how to keep track of such alarms and how to delete them from memory.

The Alarm Catalog

[ALMCAT]

The [ALMCAT] (*alarm catalog*) function enables you to:

- List by alarm time (earliest to latest) all clock alarms currently in memory (including any past-due alarms).
- Examine the parameters of any clock alarm.
- Bypass the next activation of a repeating alarm by resetting it to a later activation time.
- Compare alarm times to the current time.
- Delete unwanted alarms.

When you execute [ALMCAT], the calculator switches to Alarm Catalog mode, displays each alarm setting (time and date, followed by any Alpha message, function name, or program label included in the alarm), then exits from Alarm Catalog mode and displays the X-register.

If a printer is active and set to Trace mode when you execute [ALMCAT], the parameters of each alarm will be printed.

Now let's use [ALMCAT] to access the pending alarms that we set in the two previous examples.

Keystrokes	Display	
	11.000000	Previous display.
[ALMCAT]	11:00AM *MM/DD*	Enters Alarm Catalog mode and displays
	10:00PM 08/31	alarms remaining from preceding examples.
	11.000000	Exits Alarm Catalog mode and displays X-register.

When you want to closely examine the Alarm Catalog listing, delete an alarm, or reset a repeating alarm to its next future alarm time, press [R/S] immediately after executing [ALMCAT]. This halts the calculator in Alarm Catalog mode and *temporarily* redefines the keyboard to perform only the following Alarm Catalog operations:

- These key assignments access the alarm to which the alarm catalog is currently set (the [ALPHA] key is not used):

[T]	Displays the time to which the alarm is set to activate.
[D]	Displays the alarm date.
[R]	Displays the repeat interval.
■ [R]	Resets the alarm to the next future occurrence as determined by the repeat interval specified when the alarm was set.
[M]	Displays alarm message, label, or function, if any.
■ [C]	Deletes the alarm from memory.* *The* ■ [C] *key sequence provides the only direct method for deleting a repeating alarm.*

- These key assignments are also active:

■ [T]	Displays the current time at the moment that [T] is released.
[SST]	Single-steps to the next alarm. (Displays alarm time and date momentarily, then displays the alarm's message, label, or function—if any.) If the calculator is set to the last alarm in memory, repeats the display of that alarm.
■ [BST]	Back-steps to the previous alarm. If the calculator is set to the first alarm in memory, repeats the display of that alarm.
[R/S]	Resumes the [ALMCAT] listing.
[←]	Exits alarm catalog mode.

All other keys and/or key assignments (except [ON]) are deactivated while the calculator is set to Alarm Catalog mode. When the calculator is removed from Alarm Catalog mode, the key assignments that were active before you executed [ALMCAT] are restored.

Note: If the calculator is halted in Alarm Catalog mode and a key is not pressed for approximately 2 minutes, the calculator automatically exits from Alarm Catalog mode and waits for input from the keyboard. If approximately 10 more minutes pass without a key being pressed, the calculator turns itself off. If [ALMCAT] is executed in a running program, execution of the program will resume following termination of [ALMCAT].

Example: Try the preceding operations using the alarm settings that remain from earlier examples. First, set the calculator to Alarm Catalog mode by executing [ALMCAT], then press [R/S] as soon as the first alarm setting appears in the display. (This example assumes that only the alarms set in the two preceding examples exist in the calculator. If other alarms exist, they will alter the results shown in the example.)

* All alarms can be deleted by turning off the calculator, removing the time module, and turning the calculator on then off. This returns all other time module settings, except the date format, to their default values.

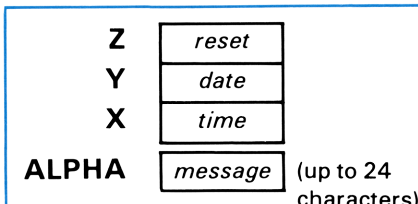
Keystrokes	Display	
[ALMCAT]	11:00AM MM/DD	
[R/S]	11:00AM MM/DD	Alarm catalog halted at the earliest alarm setting. (If the calculator advanced to the second alarm—10:00PM—before you pressed [R/S], just press ■ [BST] to move back to the first alarm.)
[T]	11:00:00.0 AM	Displays all digits of alarm setting.
■ [T]	*HH:MM:SS* AM	Displays the current time.
[D]	*MM/DD/YY* DAY	Displays alarm date and day.
[R]	00:15:00.0	Displays alarm repeat interval.
■ [R]	11:15AM *MM/DD*	Resets alarm according to repeat interval and displays resulting time and date.
[M]		Blank display indicates no message was in the ALPHA register when the alarm was set.
[SST]	10:00PM 08/31	Steps calculator to the next alarm in memory.
■ [BST]	11:15AM *MM/DD*	Back steps to previous alarm.
■ [C]	10:00PM 08/31	Deletes first alarm from memory; resets catalog to remaining alarm.
■ [C]	11.000000	Deletes second alarm from memory. Because no other alarms remain in memory, calculator automatically exits from Alarm Catalog mode and displays the X-register. (Remember: To manually exit from Alarm Catalog mode, press [←] or [R/S].)

Setting Alarms That Use Information in the ALPHA Register

When you execute [XYZALM], the contents of the ALPHA register determine the type of alarm that is set. Tone alarms like the ones you set earlier in this section are specified by a blank ALPHA register. When you want to set an alarm that displays a message or executes a program or function, you must place the appropriate message, program label, or function name in the ALPHA register before executing [XYZALM].

Message Alarms

A message alarm is set in the same way as a tone alarm, except that the desired message is placed in the ALPHA register prior to executing [XYZALM]. When activated, the alarm performs in the same way as a tone alarm, except that the first 12 characters of the message are displayed instead of the time and date. When you press a key to acknowledge the alarm, the first 12 characters appear steadily in the display. When you release the key, the second 12 characters (if any) are displayed for approximately 3 seconds.



To Set an Alarm With a Message

Example: You must leave your home at 4:00 a.m. to allow enough time to board a space shuttle flight to your company's orbiting research station. Set a nonrepeating message alarm to alert you at 3:45. (To ensure that the current time is earlier than the alarm time for this example, set the time module to 3:43 a.m. before setting the alarm.)

Keystrokes	Display	
3.43 [SETIME]	3.430000	Sets time to 3:43 a.m.
[ALPHA] GET READY TO DEPART		
[ALPHA]	3.430000	Keys message into ALPHA register.
0 [ENTER↑] [ENTER↑]	0.000000	Places zero in Y- and Z- registers to specify current date and no repeat interval.
3.45 [XYZALM]	3.450000	Sets alarm to 3:45 a.m. (Now wait for alarm to activate.)
	GET READY TO	Alarm activates. Acknowledge by pressing any key except [←], [STO], or [ON].
[LN] (held)	GET READY TO	Pressing a key (such as [LN]) displays the first 12 characters.
(released)	DEPART	Displays second 12 characters.
	3.450000	After approximately three seconds, the X-register is displayed.

Control Alarms

Control alarms enable you to set alarms for executing programs and for executing programmable functions that are provided in devices that are plugged into the calculator. This capability provides you with time control of program execution and execution of plug-in device functions.

Note: Programmable functions built into the calculator can be executed in a program that is started by an alarm, but cannot be executed directly by an alarm.

There are two types of control alarms: *interrupting* control alarms and *noninterrupting* control alarms. Both types of control alarms are set using [XYZALM] in the same way as other alarms, except that they require you to place one or two ↑ symbols (refer to the back label on the calculator), followed by the desired program label or device function name, in the ALPHA register.

Global Labels. The identifying labels of programs referred to by control alarms should be global (nonlocal) Alpha labels; that is, any Alpha labels except local labels [LBL] A through [LBL] J and [LBL] a through [LBL] e. (Refer to Local Labels in your calculator owner's handbook.)

Now let's look at the difference between interrupting control alarms and noninterrupting control alarms.

Interrupting Control Alarms. An interrupting control alarm causes the calculator to execute the specified program or function whether the calculator is turned off, turned on, executing a program, or displaying the clock. (If the calculator is executing a function, the alarm will be delayed until that function has been completed.*)

To set an interrupting control alarm, place *two* ↑ symbols followed by the program label or device function name in the ALPHA register, place the desired repeat interval, date, and time parameters in the appropriate stack registers, then execute [XYZALM]. (Refer to the charts on pages 39 and 40.)

ALPHA [↑↑ *program label*] or ALPHA [↑↑ *function name*]

*For [ALMCAT], [SW], and some plug-in device functions, the delay could be several seconds or longer, depending upon when the function is completed.

The program label or function name you specify for an interrupting control alarm should have no more than six characters.* To set an *interrupting* control alarm to execute a program or function that is identified by a seven-character label or name, create a short "calling" program that executes the program or function you want, then set the alarm to execute the calling program.

If an interrupting control alarm comes due while a program is running (including a program started by another control alarm), execution of the running program will be temporarily suspended while the program or function referenced by the interrupting alarm is executed.† When the alarm references a program, the calculator runs the program as a subroutine of the program that was interrupted (and uses one subroutine level—refer to section 12, Subroutines, in your calculator owner's handbook for more information).

Example: Use an interrupting control alarm with a short program to interrupt execution of a continuously executing loop program. The following (trivial) program provides you with a continuously executing loop.

Keystrokes	Display
[PRGM]	
■ [GTO] [·] [·]	00 REG *nn*
■ [LBL] [ALPHA] LOOP [ALPHA]	01 LBL^{T}LOOP
■ [GTO] [ALPHA] LOOP [ALPHA]	02 GTO^{T}LOOP

To provide a program which the alarm can use to interrupt the preceding program, key in the following program that sounds four tones and displays ***.

Keystrokes	Display
■ [GTO] [·] [·]	00 REG *nn*
■ [LBL] TEST	01 LBL^{T}TEST
[ALPHA] ■ [×]	02^{T} *_
■ [×] ■ [×]	02^{T} ***_
[ALPHA]	02^{T} ***
[TONE] 5	03 TONE 5
[TONE] 6	04 TONE 6
[TONE] 7	05 TONE 7
[TONE] 4	06 TONE 4
[AON]	07 AON
[PSE]	08 PSE
[AOFF]	09 AOFF
■ [RTN]	10 RTN
[PRGM]	

Now, to see how an interrupting control alarm operates when another program is running, first set an interrupting control alarm that will call the TEST program, then immediately start the continuously looping program.

Keystrokes	Display	
1 [SETIME]	1.000000	Sets clock time to 1:00 a.m.
[ALPHA] ■ ↑ ■ ↑	↗↗_	The ↑↑ specifies an interrupting control alarm.
TEST	↗↗TEST	
[ALPHA]	1.000000	

*If a seven-character program label or function name is specified in an interrupting alarm, the seventh character is ignored (even though it appears when you view the alarm in Alarm Catalog mode). When the alarm activates, the calculator searches for a program label or function name corresponding to the first *six* characters you specified when you set the alarm. If a matching label or name is not found, NONEXISTENT is displayed.

†The actual interruption will occur following execution of any function that is in the process of being executed when the alarm comes due. Also, the alarm will not interrupt until the stack lift is enabled by a function in a running program. (Refer to Appendix C, Stack Lift Conditions and Termination of Keyboard Entry, in your calculator owner's handbook for more information.)

Keystrokes	Display	
0 [ENTER↑] [ENTER↑]	0.000000	Enters repeat interval and date parameters.
1.02 [XYZALM]	1.020000	Sets alarm for 1.02 a.m.
[XEQ] [ALPHA] LOOP	XEQ LOOP_	Execute loop before the alarm comes due.
[ALPHA]	}- ———► }-	
	***	At 1:02 a.m. the alarm activates and temporarily interrupts the looping program.
	}- ———► }-	After program TEST (called by the alarm) has been executed, the looping program resumes.
[R/S]	1.020000	Halts looping program.

The preceding example shows how a running program is suspended by an interrupting control alarm that starts a second program. When the second program finishes execution, the calculator resumes execution of the first program. If the second program executes an [OFF] function the calculator will turn off without resuming execution of the first program. For an example of this operation, insert an [OFF] instruction after line 09 in the TEST program. Then repeat the part of the preceding example that sets the time and alarm, and executes the LOOP program.

Noninterrupting Control Alarms. The calculator's response to a noninterrupting control alarm depends upon the current calculator operating state.

- If the calculator is turned off or is displaying the clock, the specified program or function is executed in the same way as for an interrupting control alarm.
- If the calculator is executing a program (including a program that was executed by another alarm), the alarm activates only by sounding a pair of tones to indicate that it came due.* The program that was executing is not interrupted; the alarm becomes a past-due alarm.
- If the calculator is turned on, but not in either of the two preceding states, the alarm activates as a message alarm, with ↑ and the label or function name appearing as the message.

Calculator State	Response of Noninterrupting Control Alarm
Off or Displaying Clock	Executes Specified Program
Executing a Program	Becomes Past Due
All Other Times	Activates as a Message Alarm

To specify a noninterrupting control alarm, place *one* ↑ symbol and the program label or device function name in the ALPHA register before executing [XYZALM]:

ALPHA [↗ ***program label***] or **ALPHA** [↗ ***function name***]

The program label or function name you specify with this type of alarm can have up to seven characters (which is the maximum allowed by the calculator).

Example: As described above, in cases when the calculator is turned off or is displaying the clock, a noninterrupting control alarm activates in the same way as an interrupting control alarm. Let's use the programs from the preceding example to demonstrate how a noninterrupting control alarm operates in the two other cases when the calculator is: (1) turned on, but *not* displaying the clock, and (2) running a program.

*If flag 26—audio enable—is cleared, no tones will sound. Refer to section 14, Flags, in your calculator owner's handbook.

Keystrokes	Display	
1 [SETIME]	1.000000	Sets time to 1:00 a.m.
[ALPHA] ■ ↑	↗ _	The single ↑ specifies a noninterrupting control alarm.
TEST	↗ TEST_	
[ALPHA]	1.000000	
0 [ENTER↑] [ENTER↑]	0.000000	Enters "no repeat" and "current date" alarm parameters.
1.01 [XYZALM]	1.010000	Sets alarm for 1:01 a.m.

At 1:01 a.m. the alarm activates as a message alarm. The program specified by the alarm is *not* activated.

Keystrokes	Display	
	↗TEST	Alarm Activates.
[←]	1.010000	Acknowledge the alarm *before* the display stops flashing. (If the display stops flashing before you acknowledge the alarm, the alarm will be retained in memory as an activated past-due alarm.*)

Now set the time and noninterrupting control alarm again to see the response when this type of alarm comes due while the calculator is running a program.

Keystrokes	Display	
1 [SETIME]	1.000000	Sets the time to 1:00 a.m.
[ALPHA] ■ ↑TEST	↗TEST_	Specifies a noninterrupting control alarm.
[ALPHA]	1.000000	
0 [ENTER↑] [ENTER↑]	0.000000	Enters "no repeat" and "current date" alarm parameters.
1.01 [XYZALM]	1.010000	Sets alarm for 1:01 a.m.
[XEQ] [ALPHA]		
LOOP [ALPHA]	}- ——→ }-	Begins execution of the LOOP program before the alarm comes due.
(alarm due)	}- ——→ }-	When the noninterrupting control alarm comes due, two tones sound and the alarm automatically becomes an activated past-due alarm.
[R/S]	1.010000	Halts running LOOP program.
[ON]	✱✱✱	When you press [ON] to turn the calculator off, a tone sounds and the past due alarm activates and runs the TEST program, thus deleting the alarm from memory.
	1.010000	The calculator remains turned on after the program specified by the past-due alarm is executed.

Note: The result shown for the final step in the example shown above assumes that the activated past-due alarm resulting from the preceding steps is the only past-due alarm in memory. If other past-due alarms also exist in memory, the calculator may respond differently than shown.

*The alarm activated as a message (or tone) alarm but was not acknowledged. The characteristics of activated past-due alarms are discussed under Past-Due Alarms, page 52, and in appendix D, More About Past-Due Alarms, page 81.

Program Execution Without Labels

You can set a program alarm to begin program execution from places in memory which do not have global Alpha labels. To do so, place the ⬆⬆ or ⬆ symbol(s) *without a program label or function name* in the ALPHA register, enter the other alarm parameters you want in the stack registers, and execute XYZALM. When the alarm activates, program execution will begin at the program line to which the calculator is set at that moment. This type of alarm allows a program, after suspending itself with an OFF instruction, to resume when the alarm activates. (As with other noninterrupting control alarms, a noninterrupting control alarm without a program or function designation will initiate program execution only if the alarm comes due while the calculator is turned off or is displaying the clock.)

When Alarms Affect Data

If a program executed by either type of control alarm affects any user flags or the ALPHA, stack, or data registers, you may want to make provisions in the program referenced by the alarm to restore the affected information. Otherwise, important information may be lost, which could result in errors during subsequent calculations.

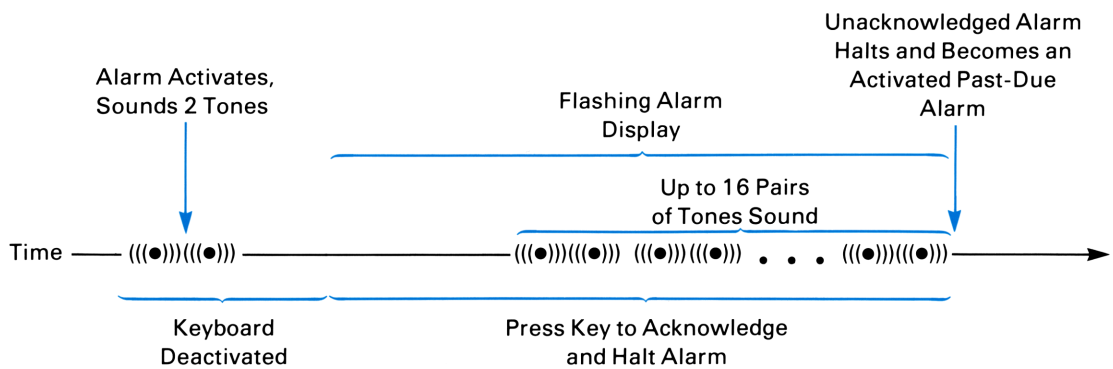
Alarms That Require Acknowledgement

An activating alarm that does not execute a program or function requires an acknowledgement from the keyboard. When an alarm is acknowledged, it is deleted from memory (or reset to a future time if the alarm has a repeat interval). The three types of alarms that require acknowledgement are:

- Tone alarm.
- Message Alarm.
- Noninterrupting Control Alarms, *if* the alarm comes due when the calculator is turned on, but is not displaying the clock or executing a program.

Recall that you acknowledged a tone and a noninterrupting alarm in the examples on pages 41 and 49, and a message alarm in the example on page 45.

When an alarm requiring acknowledgement activates, a pair of tones sounds,* followed by a period of approximately 1 second during which the keyboard is deactivated. When the display begins to flash, the keyboard is reactivated and the alarm can be acknowledged by pressing a key. If the alarm display flashes five times without a key being pressed, the calculator will sound up to 16 pairs of tones to give further notice that an alarm has activated. The following diagram shows the operation of alarms that require acknowledgement:



*If flag 26—audio enable—is cleared, no tones will sound. Refer to Section 14, Flags, in your calculator owner's handbook.

Acknowledging Alarms

When an alarm display is flashing, pressing any key except [←], [STO], or [ON] acknowledges the currently active alarm and displays the alarm's time and date (if a tone alarm) or message (if a message alarm). If a noninterrupting control alarm activates as a message alarm refer to Noninterrupting Control Alarms, page 48), the display will flash the alarm's ↑ and program label or function name as a message. The alarm can be acknowledged in the same way as a message or tone alarm. (Interrupting control alarms *always* execute a program or function and cannot be acknowledged from the keyboard.)

When you press a key to acknowledge an alarm, holding down the key retains the alarm display. After the key is released, the message will remain in the display for approximately 3 seconds. Pressing the same key again—or any other key except [←], [STO], or [ON]—before the alarm display is cleared retains the alarm display for an additional 3 seconds. Where an alarm includes a message of more than 12 characters, the first 12 will be displayed while the key is held down; the remaining characters will be displayed during the 3-second delay after the key is released.

Note: Be sure to wait until the alarm message is cleared before attempting to execute another function. Otherwise you may unintentionally delay the clearing of the alarm display.

Acknowledging Repeat Alarms

When you acknowledge a repeat alarm, the new setting for the alarm is determined from the alarm time, and *not* from the time at which the alarm is acknowledged.

Acknowledging With [←], [STO], and [ON]

As you saw in the example that begins on page 41, pressing [←] acknowledges the alarm without the 3-second display of the alarm message. The [ON] key operates in the same way. Pressing [STO] as the last or only acknowledgement key halts the alarm and also retains it as an (activated) *past-due alarm*. (This is useful when you want to preserve an alarm message for later reference.) Past due alarms are discussed on the next page.

Note: If you press [STO] to acknowledge a *repeat* alarm, the alarm will *not* be reset, but will be retained in memory as an (activated) past-due alarm.

Alarm Activation Delay

If an alarm comes due while an earlier alarm that requires acknowledgement is activating, the second alarm will be delayed until the first alarm has been acknowledged or completes its activation cycle.

Multiple Alarm Activation

If two or more alarms are set to the same time (the same day, hour, minute, second, tenth-of-a-second) the alarms will activate in the order in which they were set. Where all such alarms are tone or message alarms, each alarm will finish its cycle before the next alarm activates. However, if one or more control alarms that execute a program are followed in memory by any other alarms set to the same time, the alarm activation sequence will vary. This is because the programs referred to by the control alarms will be interrupted (temporarily suspended) while these other alarms begin their activation cycles. (If one of these other alarms is a noninterrupting control alarm, such an alarm activates as if the calculator was executing the suspended program—a pair of tones sounds and the alarm becomes past-due.) Where two or more alarms are set to different times, but are close enough together to overlap their activation cycles, the activation sequence will be affected in the same way as described above.

Past-Due Alarms

A *past-due alarm* is any clock alarm in memory having an alarm time that is earlier than the current time. The following information provides a basic description of past-due alarm operation. A more detailed description is provided in appendix D, More About Past-Due Alarms.

How Past-Due Alarms Are Created

Activated Past-Due Alarms. An activated past-due alarm results if:

- A tone or message alarm activates, but either is not acknowledged or is acknowledged with the [STO] key.
- A noninterrupting control alarm activates as a message alarm and either is not acknowledged or is acknowledged with the [STO] key. (Refer to Noninterrupting Control Alarms, page 48.)
- A noninterrupting control alarm activates while the calculator is executing a program.

Unactivated Past-Due Alarms. An *unactivated* past-due alarm results if a future alarm is bypassed by a time change or if an alarm is initially set to a time in the past. Since these situations are not likely to occur, unactivated past-due alarms are not likely to arise. For additional information, refer to appendix D, More About Past-Due Alarms.

Detecting Past-Due Alarms

If any past-due alarms exist when you press [ON] to turn on the calculator, a pair of tones will sound to remind you of these alarms. A pair of tones will also sound if an *unactivated* past-due alarm (described in the preceding paragraph) is created or already exists when you execute a time-change or [XYZALM] function.

Deleting Past-Due Alarms From Memory

The time module is designed so that past-due alarms remain in memory until activated (and acknowledged, if necessary) or until deleted.

When you want to delete *any* unwanted past due alarm from memory, place the calculator in Alarm Catalog mode, locate the alarm, and use the ■ [C] function to delete the alarm. (Refer to The Alarm Catalog, page 43.)

Activating Past-Due Alarms

There may be times when you will want to activate a past-due alarm instead of using the Alarm Catalog mode to delete the alarm. (Whenever a past-due alarm activates and is acknowledged, or activates and executes a function or program, it is deleted from memory—or reset if it has a nonzero repeat interval.)

Activating Past-Due Control Alarms.

[ALMNOW]

Executing [ALMNOW] (*alarm now*) activates the earliest past-due *control* alarm in memory.

The [ALMNOW] function enables you to activate past-due control alarms on command, either from the keyboard or in a running program. This function is convenient when you want a running program to check for and activate a past-due noninterrupting (⬆) control alarm that may have come due during program execution (provided there are no older past-due control alarms already in memory). When used in a program, [ALMNOW] operates in the same way as a subroutine. (Refer to Subroutine Limits in your calculator owner's manual.)

Automatic Past-Due Alarm Activation. If past-due alarms exist when you turn off the calculator or execute a clock display function, the calculator reminds you of these past-due alarms by activating one or more of them. (For additional information, refer to appendix D, More About Past-Due Alarms.) If a past-due control alarm is automatically activated, the turn-off or clock display will be cancelled.

> **Note:** When a past-due control alarm is activated automatically, the calculator turns off momentarily, then turns back on. When this occurs, some user and system flags may be affected. Refer to section 14, Flags, in your calculator owner's handbook.

When a past-due tone or message alarm activates, you can acknowledge the alarm in the same ways as described under Acknowledging Alarms, page 51—except for acknowledging with the [ON] key, which is described after the following example.

Example. To demonstrate a past-due alarm, allow a simple message alarm to become past-due. That is, let the alarm activate and cycle through the alarm response without being acknowledged. Then turn off the calculator. (If there are any other past-due alarms in the calculator, you should delete them from memory before proceeding with this example. Otherwise the calculator will not perform as indicated below.)

Keystrokes	Display	
9 [SETIME]	9.000000	Sets the clock to 9:00 a.m.
[ALPHA] ALARM [ALPHA]	9.000000	Place the message "ALARM" in the ALPHA register.
0 [ENTER↑] [ENTER↑]	0.000000	Specifies "no repeat" and "current date" for alarm parameters in Z- and Y-registers, respectively.
9.01 [XYZALM]	9.010000	Enters 9.01 (for 9:01 a.m.) in the X-register and sets the alarm.
	ALARM (flashing display)	Alarm activates. When the alarm activates, do *not* press any keys.

When the display stops flashing, the alarm has become an (activated) past-due alarm.

Keystrokes	Display	
[←]	9.010000	Clears message.
[ON]	ALARM	When you try to turn off the calculator, the past-due alarm activates again.

If you now acknowledge the alarm, it is deleted and the calculator turns off.* If you do not acknowledge the alarm before the alarm cycle terminates, the calculator turns off† and retains the alarm in memory as a past-due alarm. If a past-due alarm remains in memory, the next time you turn on the calculator it will sound a pair of tones to remind you that a past-due alarm exists.

For an example of automatic execution of a past-due noninterrupting control alarm, refer to page 49.

*If the calculator is inactive for approximately 10 minutes, it will turn itself off without activating any past-due alarms.

†Unless there are other past-due alarms waiting to activate. Also, if a control alarm should activate, the calculator turn-off will be aborted.

Halting Past-Due Alarm Activation

There may be times when you want the calculator to immediately turn off or switch to the clock display instead of reminding you of remaining past-due alarms. The following procedure performs this option, provided that a past-due program or function alarm does not activate between steps 1 and 2.

1. Turn off the calculator or execute a clock display function.
2. When a past-due tone or message alarm activates, wait until the display begins flashing, then press the [ON] key to again signal the calculator to turn off or display the clock.

The calculator will immediately turn off or display the clock. The past-due alarm that was activating when you pressed [ON] the second time will *not* be acknowledged. (It remains in memory as an activated past-due alarm.)

Note: If the clock is displayed and the next key you press is the [ON] key, the calculator will turn off *without* activating any remaining past-due alarms.

Past-Due Repeating Alarms

If a repeating tone or message alarm becomes past-due, it will not be reset until it is acknowledged. If such a past-due repeating alarm is acknowledged, it will automatically be reset as a future alarm* using multiples of the specified repeat interval to determine the new alarm time. A repeating control alarm that is past-due will be reset as a future alarm when the alarm is activated.

Alarms and Memory Space

Whenever one or more clock alarms exist in the time module, two memory registers† are used to maintain the alarm catalog, plus one or more registers per alarm, as shown at the right. Depending upon how many memory registers are available in your calculator, you can use up to 253 registers for clock alarms.

Parameter	Number of Registers Used
Time and Date	1
Reset (If ≠ 0)	1
Message or Program Label or Device Function	1 to 4 (Seven characters per register; 24 character maximum)

Using the Stopwatch for a Timer Alarm

Timer Alarm When Not in Stopwatch Mode

When you start the stopwatch from a negative time setting (refer to Setting, Starting, and Stopping the Stopwatch, page 36), if the calculator is not in Stopwatch mode when the stopwatch reaches zero, the timer alarm will active in the same way as a message alarm. You can acknowledge this alarm in the same way as a message alarm. However, if you do not terminate the alarm by pressing a key, the alarm will automatically be cleared at the end of the alarm period. (The TIMER ALARM message will remain in the display.) An unacknowledged timer alarm is not stored in the calculator's memory. (That is, it does not become a past-due alarm.)

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*In the rare circumstances where a past-due tone or message repeating alarm is acknowledged very close to a time that is a multiple of the repeat interval, using [ON] to halt additional past-due alarms and turn off the calculator could cause the repeating alarm to reset to a time that has already passed. For this reason, instead of pressing [ON] to turn off the calculator when the subsequent past-due alarms activate, acknowledge those alarms also, or allow them to complete their activation cycles.

†Registers used are taken from the registers currently available for program memory, not from those currently allocated for data storage. Refer to The HP-41C/41CV and Initial Configuration in section 7 of your calculator owner's manual.

Example: Use SETSW and RUNSW to set and run the stopwatch from a negative starting time. Then wait for the timer alarm to activate (when the stopwatch passes through zero).

Keystrokes	Display	
.0015 CHS	-.0015_	Keys the starting time into the X-register.
SETSW	-0.001500	Sets stopwatch to −00:00:15:00.
RUNSW	-0.001500	Runs stopwatch.
	TIMER ALARM	When stopwatch counts up to zero, the timer alarm activates; the stopwatch continues to run.
←	-0.001500	Acknowledges and clears timer alarm.
STOPSW	-0.001500	Halts stopwatch.

If you now execute RCLSW or place the calculator in Stopwatch mode you will see the time at which STOPSW halted the stopwatch.

Timer Alarm in Stopwatch Mode

If the running stopwatch passes through 00:00:00.0 while the calculator is set to Stopwatch mode, the calculator sounds a pair of identical tones.

Example: Use SETSW to set the stopwatch to a negative starting time, then switch to Stopwatch mode and run the stopwatch.

Keystrokes	Display	
.0015 CHS	-.0015_	Keys starting time into the X-register.
SETSW	-0.001500	Sets the stopwatch.
SW	-00:00:15.0 R00	Places the calculator in Stopwatch mode.
R/S	-00:00:**.* R00	Starts the stopwatch.

When the stopwatch passes through zero, two identical tones will sound.

Keystrokes	Display	
	00:00:**.* R00	The stopwatch continues to run.
R/S ←	00:00:00.00 R00	Halts and clears Stopwatch.
■ ←	-0.001500	Exits from Stopwatch mode.
←	0.000000	Clears displayed X-register.

Time Adjustments and the Accuracy Factor

The programmable time adjustment functions allow you to correct the current time setting and to set and monitor the clock accuracy factor.

The Accuracy Factor

Like most timekeeping devices, the accuracy and precision of the HP 82182A Time Module can be affected by variations in power supply, temperature, and manufacturing processes. While the effects of these variations are small, you will probably want to use the time module's accuracy factor to help compensate for the variations affecting your calculator system.

In many cases—including the examples in this manual—the uncompensated accuracy of the time module will be sufficient for initial applications. For this reason, you may want to bypass this portion of the manual for now and refer to it later when you have become familiar with time module operation.

The accuracy factor is the time interval in seconds at which one pulse (of approximately 9.8×10^{-5} second duration) is added to or subtracted from the clock's 10240 Hz time base. The table at the right shows the accuracy factor limits and format.

An accuracy factor of −10.5 would cause one pulse to be subtracted every 10.5 seconds. An accuracy factor of 0.1 would cause one pulse to be added every 0.1 seconds.

Accuracy Factor

SS.t	Effect
±99.9	Minimum Correction
⋮	⋮
± 0.1	Maximum Correction
0.0	No Correction (Default Value)

You can determine the appropriate accuracy factor through the automatic means provided in the [CORRECT] function described later in this section, or by calculation.

For information concerning time module precision and accuracy, refer to Specifications, page 61, and to Precision and Accuracy, page 62.

Setting the Time and Automatically Adjusting the Accuracy Factor

[CORRECT] **X** [*time*] **(*HH.MMSShh*)**

The [CORRECT] (*set time and correct accuracy factor*) function sets the time and automatically adjusts the accuracy factor. When you place a time value in the X-register and execute [CORRECT]:

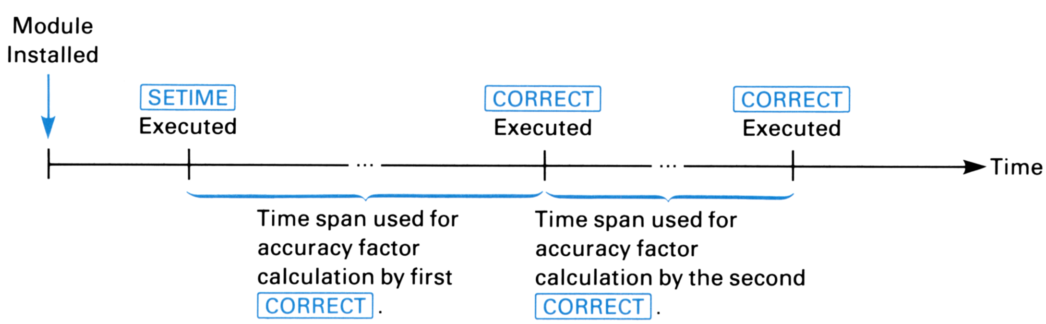
- The clock is set to the specified time in the same way that it is set when you execute [SETIME].
- The accuracy factor is automatically adjusted using an internal calculation based on drift* and the time span since [SETIME], [SETDATE], [SETAF], or [CORRECT] was last executed. The time module then begins to automatically and continually alter the clock time base according to the newly adjusted accuracy factor.

*Drift is deviation from the correct time due to variations in power supply, temperature, and material variables. The value that the time module uses for drift is the difference between the current clock time and the new clock time (specified in the X-register) at the moment that you execute [CORRECT].

When you execute CORRECT from the keyboard there may be a small error in the precision of the time-setting operation due to variations in your keystroke technique. (Execution takes place when the key that executes CORRECT is *released*.*) The time span between the most recent execution of SETIME, SETDATE, SETAF, or CORRECT and the subsequent execution of CORRECT must be long enough to render keystroke precision error insignificant. In most cases this time span should be a minimum of 30 hours. Further increases in the time span between executions of CORRECT increases the probability of a more reliable accuracy factor.†

> **Note:** The CORRECT function uses the time difference (drift) between the uncorrected and corrected time to determine the adjustment to the accuracy factor. If you wish to use CORRECT to improve the accuracy of the time module, you should *not* use T+X to remove time errors due to drift. (The alteration would not be detected by the CORRECT function.) Therefore, using T+X to correct errors due to drift after a time has been set and before execution of CORRECT, may result in a less reliable accuracy factor. (Refer to the footnote on page 57.)

The accuracy factor adjustment performed by CORRECT depends in part upon the difference (drift) between the current time setting and the new time setting at the moment that you execute CORRECT. If the time has not been previously set using SETIME, executing CORRECT can result in an unfavorable accuracy factor. However, once the time has been initially set using SETIME, you can use CORRECT as often as is practicable.



Because operation of CORRECT and the accuracy factor cannot be illustrated in an example of short time duration, you may wish to experiment with CORRECT. Remember that increasing the time span between execution of SETIME or CORRECT and execution of the next CORRECT will result in a more effective accuracy factor.

Recalling, Setting, and Clearing the Accuracy Factor

RCLAF

The RCLAF (*recall accuracy factor*) function recalls the current accuracy factor to the X-register. The stack is lifted in the same way as when you recall a number from a data storage register. If you want to remove the time module from the calculator while preserving the accuracy factor, use RCLAF to retrieve the accuracy factor before unplugging the time module. When you plug the time module back in, you can use the SETAF function to restore the accuracy factor.

* Approximately ±0.1 second is the maximum keystroke precision for most users. You can reduce precision error by executing CORRECT as a function assigned to a key instead of by XEQ ALPHA CORRECT ALPHA. This is because the calculator takes less time to internally locate and execute a function assigned to a single key.

†The longer you wait to execute CORRECT, the smaller the error due to keystroke variation becomes in proportion to any error resulting from a combination of all error factors. A practical time span for many applications is 1 week.

SETAF	X	*accuracy factor*	(*SS.t*)

The SETAF (*set accuracy factor*) uses a value you place in the X-register to set the accuracy factor. The accuracy factor is always rounded to the nearest tenth of a second, or set to zero, as follows:

- If the value x in the X-register is in the range $-0.1 \leqslant x \leqslant 0.1$, and $x \neq 0$, the accuracy factor will be set to ± 0.1.
- If the value x in the X-register is in the range $0.1 < x < 99.949$ or $-99.95 < x < -0.1$ the accuracy factor will be rounded to the nearest tenth, then set.
- The accuracy factor will be set to 0.0 if the value x in the X-register is zero, or if x is greater than or equal to 99.95 or is less than or equal to -99.95.

When you execute SETAF, the time module begins to automatically and continuously alter the clock time base according to the accuracy factor you specified.

To clear the accuracy factor, place 0 in the X-register and execute SETAF.

Accuracy Factor Calculation

The CORRECT function provides a convenient means to correct the time module's time base (through automatic calculation of the average accumulated error). However, if you want to establish an accuracy factor over a relatively short period of time (such as a 36-hour interval), any keystroke error that occurs when you execute CORRECT can have a more significant effect than when CORRECT is executed after longer intervals. By calculating the accuracy factor yourself, then entering it using SETAF, you can often implement a more effective accuracy factor over a shorter interval than you could by using CORRECT. Also, if you alter the drift by executing T+X, the accuracy factor that results from subsequently executing CORRECT is likely to be ineffective. Thus, where drift has been altered by T+X, the best method of determining an effective accuracy factor would be by performing your own calculation.

You can calculate the accuracy factor using the following formula:

$$AF = \frac{1}{\dfrac{1}{IAF} - \dfrac{10240}{86400} ERR_{spd}}$$

where: IAF = initial accuracy factor
(If IAF is zero, substitute "0" for $1/IAF$.)
ERR_{spd} = the current error in seconds per day
(A "slow" time module has a negative error, and a "fast" time module has a positive error.)
10240 = time module internal time base pulse rate
86400 = the number of seconds in a day

After you calculate an accuracy factor, it should be rounded to one significant digit to the right of the decimal point, then set using the SETAF function.

Specifications, Warranty, and Service Information

Specifications

Power Consumption

While installed in your calculator, the time module continuously draws power from the calculator's batteries. The actual rate of power consumption depends upon how the module is being used at any given time. There are three basic power consumption modes (calculator and time module combined):

> **Note:** The following information applies only to use of the time module with the calculator. It does not apply to other calculator operations or to use of the calculator with other plug-in devices.

- High current drain (5 to 20 mA). Exists when the ALMCAT function (alarm catalog) is active or when the calculator is set to Stopwatch mode (stopwatch displayed). This mode corresponds to a calculator running a program.
- Moderate current drain (0.5 to 2.0 mA). Exists when the clock is displayed. This mode corresponds to when the calculator and display are turned on and the calculator is waiting for input from the keyboard.
- Low current drain (0.01 to 0.05 mA). Exists when the display and calculator are turned off. (The time module's precision oscillator runs continuously to maintain the clock and, if running, the stopwatch.) This mode corresponds to when the calculator is turned off.

A freshly charged HP 82120A Rechargable Battery Pack has a capacity of 65 mAH (milliampere-hours). A fresh set of alkaline batteries provides approximately 500 mAH. To calculate typical battery lifetimes, divide your calculator's battery capacity by the current consumed by the calculator and time module.

Effects of "Master Clear," Power Interruptions, and Low Power

Master Clear. Executing Master Clear (← / ON) does not affect the time module clock and stopwatch. However, all alarms will be cleared and the user flags will be returned to their default settings. (Flag 26, which controls the audio alarm response, and flag 31, which controls the MDY / DMY format, plus all other user flags, will be returned to the settings that result when power is first applied to the calculator's circuitry.)

Temporary Power Interruption. A power interruption may introduce various errors into time module operation, depending upon the duration of the power interruption and the current status of the calculator and the time module. For this reason it is recommended that after any power interruption, you clear the time module entirely by removing and replacing the module in the calculator.

Low Power. When battery power is too low to operate the clock display, executing CLOCK or ■ ON turns off the calculator (the clock will continue to keep time internally.) In most cases, this will not occur unless the BAT annunciator is lit. If the BAT annunciator is lit, further use of the time module may exhaust battery power and cause the calculator (and time module) to lose all or part of memory, and become unreliable.

Precision and Accuracy

Precision. Time-setting from the keyboard can be performed with a precision of up to 0.1 second, but this can vary depending upon human response time. The precision of the current *clock* setting can be adjusted with a precision of up to 0.01 seconds through use of the T+X function.

Accuracy. A crystal-stabilized time base provides accuracy control for the time module. As with any crystal-based timepiece, actual stability at any time is a function of operating temperature and voltage variations. If you operate your time module in a consistent routine, the total inaccuracy can be made negligible through appropriate application and maintenance of the accuracy factor. The overall accuracy of the time module at 25°C is ±3.02 seconds per day (±35 ppm); not to age more than an additional ±1.30 seconds per day (±15 ppm).

Stopwatch Precision. The stopwatch is intended only for hand operation from the keyboard. Stopwatch precision may vary from 0.00 to −0.03 seconds. The difference between splits is more precise, with an error range of 0.00 to −0.01 seconds. For maximum accuracy, splits should be taken at intervals of no less than 0.08 seconds; otherwise, an error due to delays in internal processing time could result. Rapidly pressing the keys in Stopwatch mode can cause temporary suppression of all or part of the stopwatch display, but does not affect stopwatch timekeeping ability.

Module Care

CAUTION

Always turn off the calculator before connecting or disconnecting any module or peripheral. Failure to do so could result in damage to the calculator or disruption of the system's operation.

- Keep the contact area of the module free of obstructions. Should the contacts become dirty, carefully brush or blow the dirt out of the contact area. Do not use any liquid to clean the contacts.
- Store the module in a clean, dry place.
- Always turn off the calculator before installing or removing any module or peripherals.
- Observe the following temperature specifications:

  Operating: 0° C to 45° C (32° F to 113° F).

  Storage: −30° C to 60° C (−22° F to 140° F).

Limited One-Year Warranty

What We Will Do

The HP 82182A Time Module is warranted by Hewlett-Packard against defects in materials and workmanship affecting electronic and mechanical performance, but not software content, for one year from the date of original purchase. If you sell your unit or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original one-year period. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to a Hewlett-Packard service center.

What Is Not Covered

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than an authorized Hewlett-Packard service center.

No other express warranty is given. The repair or replacement of a product is your exclusive remedy. **ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE ONE-YEAR DURATION OF THIS WRITTEN WARRANTY.** Some states, provinces, or countries do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. **IN NO EVENT SHALL HEWLETT-PACKARD COMPANY BE LIABLE FOR CONSEQUENTIAL DAMAGES.** Some states, provinces, or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state, province to province, or country to country.

Warranty for Consumer Transactions in the United Kingdom

This warranty shall not apply to consumer transactions and shall not affect the statutory rights of a consumer. In relation to such transactions, the rights and obligations of Seller and Buyer shall be determined by statute.

Obligation to Make Changes

Products are sold on the basis of specifications applicable at the time of manufacture. Hewlett-Packard shall have no obligation to modify or update products once sold.

Warranty Information

If you have any questions concerning this warranty or service, please contact an authorized Hewlett-Packard dealer or a Hewlett-Packard sales and service office. Should you be unable to contact them, please contact:

- In the United States:

Hewlett-Packard
Corvallis Division
1000 N.E. Circle Blvd.
Corvallis, OR 97330
Telephone: (503) 758-1010
Toll-Free Number: (800) 547-3400 (except in Oregon, Hawaii, and Alaska)

- In Europe:

Hewlett-Packard S.A.
7, rue du Bois-du-Lan
P.O. Box
CH-1217 Meyrin 2
Geneva
Switzerland
Telephone: (022) 83 81 11
Note: Do *not* send units to this address for repair.

- In other countries:

Hewlett-Packard Intercontinental
3495 Deer Creek Rd.
Palo Alto, California 94304
U.S.A.
Telephone: (415) 857-1501
Note: Do *not* send units to this address for repair.

Service

Obtaining Repair Service in the United States

The Hewlett-Packard United States Service Center for handheld and portable calculator products is located in Corvallis, Oregon:

Hewlett-Packard Company
Corvallis Division Service Department
P.O. Box 999/1000 N.E. Circle Blvd.
Corvallis, Oregon 97330, U.S.A.
Telephone: (503) 757-2000

Obtaining Repair Service in Europe

Service centers are maintained at the following locations. For countries not listed, contact the dealer where you purchased your unit.

AUSTRIA
HEWLETT-PACKARD GmbH
Kleinrechner-Service
Wagramerstr.-Lieblgasse
A-1220 VIENNA
Telephone: (222) 23 65 11

BELGIUM
HEWLETT-PACKARD BELGIUM SA/NV
Boulevard de la Woluwe 100
Woluwelaan
B-1200 BRUSSELS
Telephone: (2) 762 32 00

DENMARK
HEWLETT-PACKARD A/S
Datavej 52
DK-3460 BIRKEROD (Copenhagen)
Telephone: (02) 81 66 40

EASTERN EUROPE
Refer to the address listed under Austria.

FINLAND
HEWLETT-PACKARD OY
Revontulentie 7
SF-02100 ESPOO 10 (Helsinki)
Telephone: (90) 455 02 11

FRANCE
HEWLETT-PACKARD FRANCE
Division Informatique Personnelle
S.A.V. Calculateurs de Poche
F-91947 Les Ulis Cedex
Telephone: (1) 907 78 25

GERMANY
HEWLETT-PACKARD GmbH
Kleinrechner-Service
Vertriebszentrale
Berner Strasse 117
Postfach 560 140
D-6000 FRANKFURT 56
Telephone: (611) 50041

ITALY
HEWLETT-PACKARD ITALIANA S.P.A.
Casella postale 3645 (Milano)
Via G. Di Vittorio, 9
I-20063 CERNUSCO SUL NAVIGLIO (Milan)
Telephone: (2) 90 36 91

NETHERLANDS
HEWLETT-PACKARD NEDERLAND B.V.
Van Heuven Goedhartlaan 121
N-1181 KK AMSTELVEEN (Amsterdam)
P.O. Box 667
Telephone: (020) 472021

NORWAY
HEWLETT-PACKARD NORGE A/S
P.O. Box 34
Desterndalen 18
N-1345 OESTERAAS (Osio)
Telephone: (2) 17 11 80

SPAIN
HEWLETT-PACKARD ESPANOLA S.A.
Calle Jerez 3
E-MADRID 16
Telephone: (1) 458-2600

SWEDEN
HEWLETT-PACKARD SVERIGE AB
Enighetsvagen 3
Box 205 02
S 161 BROMMA 20 (Stockholm)
Telephone: (8) 730 05 50

SWITZERLAND
HEWLETT-PACKARD (SCHWEIZ) AG
Kleinrechner-Service
Allmend 2
CH-8967 WIDEN
Telephone: (057) 50111

UNITED KINGDOM
HEWLETT-PACKARD Ltd.
King Street Lane
GB-WINNERSH, WOKINGHAM
BERKSHIRE RG11 5AR
Telephone: (734) 784774

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Error Messages

This appendix contains a list of error messages that are related to time module operations. Refer to your calculator owner's handbook for a list of all standard error messages.

Display	Functions	Meaning
ALPHA DATA	ADATE ATIME ATIME24 CORRECT DOW SETAF SETDATE SETIME SETSW SW T+X	The X-register contains Alpha data.
	DATE+ DDAYS	The X- or Y-register contains Alpha data.
	XYZALM	The X-, Y-, or Z-register contains Alpha data.
DATA ERROR	ADATE ATIME ATIME24 CORRECT DOW SETDATE SETIME SETSW	Invalid number in the X-register.
	T+X	A number in the X-register is outside the range $-9999.595999 \leqslant x \leqslant 9999.595999$ or is not an ***HHHH.MMSS*** number within this range.
DATA ERROR X	DDAYS	The X-register contains an invalid or negative date or contains nonzero trailing digits after the year digits.
	XYZALM	The X-register contains a number greater than or equal to 24 or is not an ***HH.MMSS*** value.
DATA ERROR Y	DATE+ DDAYS XYZALM	The Y-register contains an invalid or negative date, or contains a date that has nonzero trailing digits after the years digits.
DATA ERROR Z	XYZALM	The number in the Z-register is greater than or equal to 10,000 hours or is not an ***HHHH.MMSS*** value.

Display	Functions	Meaning
ERROR = D*nn*	[SW]	The number stored in the register indicated by ***nn*** or the number stored in register ***nn***−1 is not a legal split (***HH.MMSS*** format); or the split stored in register ***nn*** is smaller than the split stored in register ***nn***−1.
ERROR = R*nn*	[SW]	The number stored in register ***nn*** contains three or more digits to the left of the decimal.
NONEXISTENT	[ALMNOW]	The program label called by the alarm does not exist or the alarm calls a nonprogrammable function or an HP-41 calculator function.
	Control Alarms	A control alarm called a nonexistent program or device function, a nonglobal program label, a calculator function, or a nonprogrammable device function.
	[SW]	The register indicated by the [RCL] register pointer (=**R** ***nn***) does not exist, or an attempt was made to store a split in a nonexistent register.
NO ROOM	[XYZALM]	Insufficient registers are available in calculator memory to set an alarm. Create more memory registers by reducing the number of data storage registers ([SIZE]), clearing a program from memory, or adding a memory module and executing [SIZE]. If 253 registers are already in use for storing alarms, no more alarms can be set until one or more of the existing alarms are cleared.
OUT OF RANGE	[DATE+]	Resulting date would be outside of the range October 15, 1582 through September 10, 4320.
	[T+X]	Resulting time would be outside of the calendar range (1-1-1900 through 12-31-2199).

Appendix C

Programming Time Module Functions

Useful Routines

The time module is a very powerful addition to the HP-41 system. The applications potential of the module's time monitoring and time-based control features can be significant for almost every HP-41 calculator user. The program routines in this section provide some methods to help you to incorporate this potential into your everyday applications. A more advanced series of time module applications programs is provided in the HP-41 Users' Library Solutions Book entitled *Time Solutions I*. For further information, contact your authorized Hewlett-Packard dealer.

Using a Program to Set an Alarm

The SETALM program sets a clock alarm using the parameters you enter. When you execute the program it prompts you for:

1. Alarm time.
2. Alarm message or ⬆⬆ or ⬆ with a program label or plut-in device function.
3. Alarm date.
4. Repeat interval.

When you are prompted by TIME ? key in a time in ***HH.MMSS*** format. If you do not enter a time, the program will terminate.

When you are prompted by MESSAGE ? enter a message or an ⬆⬆ or ⬆ followed by a program label or a plug-in device function. If you do not want to enter a message, label, or function, just press [R/S].

When you are prompted by DATE ? key in the date parameter. If the current date is the desired date, just press [R/S].

When you are prompted by RESET ? key in a repeat interval in ***HHHH.MMSS*** format. If you do not want a repeat interval, just press [R/S].

When you execute SETALM, all data previously stored in the stack and the ALPHA register will be lost, and flag 22 will be cleared. If you execute SETALM when a printer is not plugged into the calculator, flag 21—the Printer Enable flag—must be clear.

User Instructions

Step	Instructions	Input	Function	Display
1	Run SETALM.		[XEQ] SETALM	TIME?
2	Key in alarm time in ***HH.MMSS*** format.	*time*	[R/S]	MESSAGE?
3	Key in message (or just press [R/S] if no message is desired).	*message*	[R/S]	DATE?
4	Key in date in ***MM.DDYYYY*** or ***DD.MMYYYY*** format, as determined by status of flag 31 (or just press [R/S] to specify the current date).	*date*	[R/S]	RESET?
5	Key in repeat interval in ***HHHH.MMSS*** format (or just press [R/S] to specify no repeat interval).	*repeat interval*	[R/S]	

Program Listing

`01♦LBL "SETALM"`	
`02 CF 22`	
`03 "TIME ?"`	
`04 PROMPT`	Input the time.
`05 FC?C 22`	
`06 RTN`	
`07 "DATE ?"`	Set up further prompts.
`08 ASTO T`	
`09 "RESET?"`	
`10 ASTO Y`	
`11 "MESSAGE ?"`	
`12 AVIEW`	
`13 CLA`	
`14 AON`	
`15 STOP`	Input message.
`16 AOFF`	
`17 VIEW T`	
`18 STOP`	Input date.
`19 FC?C 22`	
`20 0`	
`21 VIEW Z`	
`22 STOP`	Input reset interval.
`23 FC?C 22`	
`24 0`	
`25 X<> Z`	
`26 XYZALM`	Set the alarm.
`27 END`	

Setting an Alarm Relative to the Current Time

The ALMREL program sets an alarm relative to the current time. This is useful when you want to set an alarm that will activate at a time that is relative to the current time. When you execute the program it prompts you for:

1. The time offset in ***HHHH.MMSS*** format.

2. A message or an ↑↑ or ↑ alarm with a program label or plug-device function.

The time offset begins when you press [R/S] after the message prompt. The time offset can be as short as 3 seconds or as long as 9999^{H} 59^{M} 59^{S} 99^{hh}. If the time offset is not keyed in, is not an ***HHHH.MMShh*** number, or is outside the time range, the alarm will not be set. If you do not want to make an entry in response to the MESSAGE*?* prompt, press [R/S] when the prompt appears.

When you execute ALMREL, all data previously stored in the stack and ALPHA registers will be lost, and flag 22 will be cleared. If you execute ALMREL when a printer is not plugged into the calculator, flag 21—the Printer Enable flag—must be clear.

User Instructions

Step	Instructions	Input	Function	Display
1	Run ALMREL.		[XEQ] ALMREL	+HH.MMSS?
2	Key in time offset in ***HHHH.MMSS*** format.	*time offset*	[R/S]	MESSAGE?
3	Key in message (or just press [R/S] if no message desired).	*message*	[R/S]	

Program Listing

`01◆LBL "ALMREL"`	
`02 CF 22`	
`03 "+ HH.MMSS ?"`	
`04 PROMPT`	Input time offset.
`05 FC?C 22`	
`06 RTN`	
`07 X<0?`	
`08 RTN`	
`09 "MESSAGE ?"`	
`10 AVIEW`	
`11 CLA`	
`12 AON`	
`13 STOP`	Input message.
`14 AOFF`	
`15 TIME`	Calculate time or date of alarm.
`16 HMS+`	
`17 ENTER↑`	
`18 ENTER↑`	
`19 24`	
`20 /`	
`21 INT`	
`22 DATE`	
`23 X<>Y`	
`24 DATE+`	
`25 LASTX`	
`26 24`	
`27 *`	
`28 ST- Z`	
`29 CLX`	No Reset Interval.
`30 STO T`	
`31 RDN`	Sets up stack to set the alarm.
`32 X<>Y`	
`33 XYZALM`	
`34 END`	

Converting the Date to a String in the ALPHA Register

With a number in the X-register representing a date, the ADOW program

- Places the day of the week in the ALPHA register.
- Replaces the date in the X-register with a number corresponding to the day of the week (0 = Sunday ... 6 = Saturday).

ADOW clears the ALPHA register of existing contents. However, ADOW can easily be altered so that the day of the week is appended to the existing contents of the ALPHA register. The program assumes that the date is in the X-register; that is, no data input prompt will appear. The date must be a legitimate date in the range October 15, 1582 through September 10, 4320. ADOW does not affect the contents of the Y-, Z-, and T-registers.

User Instructions

Step	Instructions	Input	Function	Display
1	Key in the date in ***MM.DDYYYY*** or ***DD.MMYYYY*** format, as determined by status of flag 31.	*date*		***date number***
2	Calculate day of week.		[XEQ] ADOW	***day number***
3	View the ALPHA register (optional).		[ALPHA]	***day of week***

Program Listing

```
01♦LBL "ADOW"
02 DOW                Get number for day of week.
03 GTO IND X          Branch to appropriate day.
04♦LBL 00
05 "SUN"
06 RTN
07♦LBL 01
08 "MON"
09 RTN
10♦LBL 02
11 "TUE"
12 RTN
13♦LBL 03
14 "WED"
15 RTN
16♦LBL 04
17 "THU"
18 RTN
19♦LBL 05
20 "FRI"
21 RTN
22♦LBL 06
23 "SAT"
24 END
```

Printing a Block of Splits

This program requires the use of either an HP 82143A Printer ,or an HP 82162A Thermal Printer and the HP 82160A HP-IL Module.

The SPLITS program prints the contents of a specified block of data storage registers in time format (***HH:MM:SS:hh***). The value in each data storage register must be less than 100; otherwise an error message will result and the program will be terminated.

When you execute the program, it prompts you for:

1. The beginning register number.

2. The ending register number.

To default the beginning register to R_{00}, press [R/S] without keying in a number.

When you execute the SPLITS program, any data previously stored in the stack and ALPHA register will be lost. The program will also leave the calculator in [FIX] 6 display mode and clear flag 29. Flag 21—the Printer Enable Flag—must be set.

User Instructions

Step	Instructions	Input	Function	Display
1	To print splits:		[XEQ] SPLITS	**BEGIN REG?**
2	Key in the beginning register number.	*register number* (*nn*)	[R/S]	**END REG?**
3	Key in ending register number.	*register number* (*nn*)	[R/S]	

Program Listing

```
01♦LBL "SPLITS"
02 0
03 "BEGIN REG ?"
04 PROMPT
05 "END REG ?"
06 PROMPT
07 ADV
08 X<>Y
09♦LBL 00
10 FIX 0
11 CF 29
12 "R"
13 100
14 X<=Y?
15 GTO 01
16 SQRT
17 "├ "
18 X>Y?
19 "├0"
20♦LBL 01
21 RDN
22 ARCL X
23 "├ = "
24 RCL IND X
25 FIX 6
26 ATIME24
27 PRA
28 RDN
29 1
30 +
31 X<=Y?
32 GTO 00
33 .END.
```

Input beginning and ending register numbers. (steps 01–08)

Output register number. (steps 09–23)

Output register contents in time format. (steps 24–33)

Bar Code For Applications Programs

SETALM

Program Registers Needed: 11

ROW 1 (1 : 3)

ROW 2 (3 : 7)

ROW 3 (7 : 9)

ROW 4 (10 : 12)

ROW 5 (13 : 22)

ROW 6 (23 : 27)

ALMREL

Program Registers Needed: 11

ROW 1 (1 : 3)

ROW 2 (3 : 5)

ROW 3 (5 : 9)

ROW 4 (9 : 19)

ROW 5 (20 : 28)

ROW 6 (29 : 34)

ADOW

Program Registers Needed: 8

ROW 1 (1 : 4)

ROW 2 (5 : 11)

ROW 3 (11 : 17)

ROW 4 (17 : 23)

ROW 5 (23 : 24)

SPLITS

Program Registers Needed: 12

ROW 1 (1 : 3)

ROW 2 (3 : 5)

ROW 3 (5 : 10)

ROW 4 (10 : 17)

ROW 5 (17 : 23)

ROW 6 (23 : 30)

ROW 7 (31 : 33)

Programmable Functions

All time module functions are programmable except:

- ■ [ON].
- The functions that are automatically assigned to the keyboard when you execute [SW].
- The functions that are automatically assigned to the keyboard when you halt the calculator in Alarm Catalog mode.

The time module's programmable functions can be entered in a program whenever the module is plugged into the calculator. While the module is plugged in, program lines containing time module functions are displayed and printed using the normal function names.

If the module is disconnected later, these program lines are displayed and printed as XROM functions—with two identification numbers. This indicates that the function belongs to a plug-in accessory. The first number identifies the accessory. (XROM accessory number 26 corresponds to the time module.) The second number identifies the function for that accessory. When the time module is removed, the time module functions have the following XROM numbers.

Function	XROM Number	Function	XROM Number
[ADATE]	26,01	[DOW]	26,16
[ALMCAT]	26,02	[MDY]	26,17
[ALMNOW]	26,03	[RCLAF]	26,18
[ATIME]	26,04	[RCLSW]	26,19
[ATIME24]	26,05	[RUNSW]	26,20
[CLK12]	26,06	[SETAF]	26,21
[CLK24]	26,07	[SETDATE]	26,22
[CLKT]	26,08	[SETIME]	26,23
[CLKTD]	26,09	[SETSW]	26,24
[CLOCK]	26,10	[STOPSW]	26,25
[CORRECT]	26,11	[SW]	26,26
[DATE]	26,12	[T+X]	26,27
[DATE+]	26,13	[TIME]	26,28
[DDAYS]	26,14	[XYZALM]	26,29
[DMY]	26,15	■ [ON]	Not Programmable

If a time module function is entered, using [XEQ], into a program line while the time module is not connected, the function is recorded, displayed, and printed as **XEQ**^{T} followed by the function name. Program execution is slowed by lines of this form because the calculator will search for a matching ALPHA label or function name—first in program memory, then in each module plugged in.

More About Past-Due Alarms

When an alarm becomes past-due for one of the reasons described under How Past-Due Alarms Are Created, page 52, it is maintained in memory until it is activated or until you delete it using ■ [C] in Alarm Catalog mode. This operation helps to remind you of an alarm that has not been allowed to serve its intended purpose. If you allow several past-due alarms to accumulate in memory, sequences of automatic (and possibly unexpected) past-due alarm activations may occur. (If any unactivated past-due alarms are in memory, the order in which past-due alarms activate may become complex.) If you plan to use past-due alarms in your applications, the information in this appendix will be helpful.

If past-due alarms are present (refer to Past-Due Alarms, page 52), they will automatically begin to activate whenever you turn off the calculator or display the clock. This operation is intended to remind you that one or more past-due alarms exist. If an alarm comes due while any *unactivated* past-due alarms exist (refer to Unactivated Past-Due alarms, page 52), all of the unactivated past due alarms will activate ahead of the alarm that came due. This appendix describes the rules governing the activation sequences in these two cases.

Conditions That Cause Execution of Past-Due Alarms

Off/Clock Condition

Turning off the calculator or displaying the clock initiates the Off/Clock condition. If any past-due alarms exist when this condition occurs, the calculator *attempts* to activate all of them, beginning with the earliest alarm. (If any past-due control alarm is encountered, the calculator turns off momentarily—which aborts the Off/Clock condition—then turns back on in the Alarm condition described under the next heading. The control alarm is then executed in the Alarm condition.) In the Off/Clock condition you can expect the following calculator/alarm operation:

- As long as no past-due control alarms are encountered, any past-due tone or message alarms will activate in chronological order, beginning with the earliest alarm time. Each alarm will finish its activation cycle before the next alarm activates. Such alarms will not interrupt each other.
- If the [ON] key is pressed while a past-due tone or message alarm is activating, the alarm halts without being acknowledged and the calculator turns off or displays the clock (as described under Halting Past-Due Alarm Activation, page 54).
- If not control alarms are past-due, and [ON] is not pressed during activation, the calculator turns off or displays the clock after activating all the past-due alarms.

Alarm Condition

The Alarm condition is initiated when:

- A future alarm comes due.
- A past-due control alarm from the Off/Clock condition starts a program or executes a function.

In the Alarm condition the calculator activates only the unactivated past-due alarms in memory (beginning with the earliest alarm and proceding in chronological order of the alarm times). Previously activated past-due alarms are ignored and remain in memory. When a future alarm comes due while there are unactivated past-due alarms, the calculator switches to the Alarm condition and the future alarm also becomes an unactivated past-due alarm. (It will be activated in its turn, after all of the earlier unactivated past-due alarms are activated by the calculator.)

Past-Due Alarm Responses in the Alarm Condition

Listed below are terms used in the rest of this appendix to describe modes of the calculator that affect alarm response.

- Off: The calculator is turned off.
- Clock: The clock is displayed.
- Keyboard: The calculator is turned on but is not displaying the clock or running a program.
- Running: A program is running.

When the Alarm condition occurs, the calculator's response to the various unactivated past-due alarms is determined by the current mode of the calcualtor and by the alarm type. The following table summarizes the calculator's response when an alarm comes due in each of the modes described above.

<table>
<tr><th rowspan="2">Alarm Type</th><th colspan="4">Calculator Mode</th></tr>
<tr><th>Off</th><th>Clock</th><th>Keyboard</th><th>Running</th></tr>
<tr><td>Noninterrupting Control (↑)</td><td>Run program.</td><td>Run program.</td><td>Tone series and flashing display.</td><td>Sounds two tones and become an activated past-due alarm.</td></tr>
<tr><td>Interrupting Control (↑↑)</td><td colspan="3">Run program.</td><td>Run program as a subroutine of current program.</td></tr>
<tr><td>Tone or Message</td><td colspan="4">Tone series and flashing display.</td></tr>
</table>

Mode Changes

The program or function specified by an activating control alarm can change the calculator operating mode:

- If any control alarm starts a program, the calculator immediately switches to Running mode. (The mode change occurs before the first program instruction is executed.)
- A function executed by a control alarm can also change the mode. For example, if the clock is displayed when an alarm that executes the printer function PRX (*print X*) activates, the calculator will change from Clock mode to Keyboard mode. Similarly, if the calculator is executing a program when an alarm that executes the CLOCK function activates, the calculator will change from Running mode to Clock mode.

Interruption of a Past-Due Alarm by Another Past-Due Alarm

- A program started by any past-due control alarm will be temporarily suspended by any subsequent unactivated past-due alarms before the first program instruction is executed.
- An activating tone alarm, message alarm, or control alarm that executes a device function will complete its cycle or function before subsequent unactivated past-due alarms can activate.

Alarms and Subroutine Levels

Any program alarm which interrupts a previous program alarm will operate as a subroutine. If there are several unactivated, past-due, interrupting control alarms that execute programs (which is unlikely in most applications*), then several subroutine levels will be used.

Acknowledging Past-Due Alarms

When the calculator is in the Alarm condition, and an alarm is sounding a tone series and flashing the display, the [ON] key operates just like the [←] key. The [STO], [←], and other keys operate as described under Alarms That Require Acknowledgement, page 50.

Example of a Past-Due Alarm Sequence

Suppose that the calculator is turned *off*, the current time is 9:59 a.m., and the following four alarms are set:

ALPHA Register	Time	Status
MESSAGE1	4:00 a.m.	Activated Past-Due
↑ABC	5:00 a.m.	Unactivated Past-Due
↑↑XYZ	6:00 a.m.	Unactivated Past-Due
MESSAGE2	10:00 a.m.	Set to a Future Time

Note: The situation given in this example is unlikely (since unactivated past-due alarms do not occur in most applications.) However, this mix of alarms helps to illustrate additional aspects of alarm response.

Because there are unactivated past-due alarms, when the current time reaches 10:00 a.m. the MESSAGE2 alarm causes the Alarm condition to occur. This results in the following sequence:

1. Alarm ↑ABC (the oldest *un*activated past-due alarm) turns on the calculator and starts program ABC. (This is the first alarm to activate. The earlier MESSAGE1 alarm is a previously activated past-due alarm and therefore will not be activated.)
2. Alarm ↑↑XYZ immediately suspends program ABC and starts program XYZ as a subroutine of ABC.
3. Alarm MESSAGE2 (which is now an unactivated past-due alarm) immediately suspends program XYZ, begins flashing MESSAGE2 in the display, and, if not acknowledged from the keyboard, begins sounding a series of tones.

*Any past-due interrupting control alarm will be an *unactivated* past-due alarm. The only ways that an interrupting control alarm can become past-due is for you either to have originally set the alarm to a past time or to have bypassed a future interrupting control alarm with a time-change function (SETIME, SETDATE, T+X or CORRECT).

4. After alarm MESSAGE2 is acknowledged (or finishes its cycle), program XYZ executes. Control then returns to program ABC (assuming that program XYZ did not turn off the calculator or use too many subroutine levels).
5. Program ABC executes.

If program XYZ turns off the calculator (by executing an OFF function), program ABC will not be resumed. Since alarm ↑ABC has already activated, it no longer exists in memory.

If alarm XYZ had been a noninterrupting control alarm it would have sounded a pair of tones and become an activated past-due alarm (since alarm ↑ABC would have switched the calculator to Running mode). Refer to the Calculator Mode table and Mode Changes, both on page 82. As a general guideline, whenever a past-due control alarm activates and starts a program, *any* subsequent past-due noninterrupting control alarm(s) will activate only by sounding the pair of tones and becoming activated past due alarm(s).

If the calculator had been in Keyboard mode rather than Off, alarm ↑ABC would have activated like a message alarm, displaying "↑ABC." Program XYZ would then have started (but not as a subroutine), been interrupted by alarm MESSAGE2, and finally executed.

Subject Index

Page numbers in **bold** type indicate primary references; page numbers in regular type indicate secondary references.

Addendum

This addendum contains information for the *HP 82182A Time Module Owner's Manual*, part number 82182-90001, dated January 1982.

Page 43, under The Alarm Catalog. When printing the alarm catalog, port 3 of the calculator should be empty or contain one of the following accessories only: the HP 82143A Printer, the HP 82160A HP-IL Module, or the time module. Improper operation may occur if another module or accessory is plugged into this port while the Alarm Catalog is being printed.

Function Index

HEWLETT PACKARD

Portable Computer Division
1000 N.E. Circle Blvd., Corvallis, OR 97330, U.S.A.

European Headquarters
150, Route du Nant-D'Avril
P.O. Box, CH-1217 Meyrin 2
Geneva-Switzerland

HP-United Kingdom
(Pinewood)
GB-Nine Mile Ride, Wokingham
Berkshire RG11 3LL

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