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Timing software enables the user to specify a preset length of time and to signal the user when that time has elapsed. In theory, up to 255 software timers are available to the user.

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The Z80-CPU's non-maskable interrupt (NMI) input, which comes from the VDP interrupt output, forms the time base for all the timers. In the U.S., it is about every 1/60 second. In the European version, it is about every 1/50 second. TIME_MGR is the routine responsible for generating the time base at the desired intervals.

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All timer routines use a CRAM area designated as the TIMER_TABLE. The size of this table depends on the number of timers in use and their types. There are two types of timers, non-repeating and repeating.

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The user will be notified of the status of the timer only when he checks it.

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1 5.1 Non-Repeating Timers

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3 These timers will not repeat themselves after time out.

4 The user will be notified and their timers are set free.

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6 5.2 Repeating Timers

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8 These timers only need to be set once. After each time

9 out they will notify the user and repeat themselves.

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11 For both types of timers, the timer length can be either

12 short or long:

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- 14 (a) Short - 1 to 255 units of time base.
- 15 (b) Long - 256 to 65535 units of time base.
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17 5.3 TIMER_TABLE:

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19 As a timer is requested, it is placed into TIMER_TABLE.

20 Each timer consists of a Mode_Byte and a two-byte

21 Value_Word.

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The appropriate amount of CRAM should be reserved using the following formula:

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TIMER_TABLE      DEFS      Num_of_Timers * 3  
TIMER_DATA_BLOCK DEFS      Num_of_Long_Repeating * 4
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NOTE: Num_of_Timers is the total number of timers.

5.3.1 Mode_Byte

Mode_Byte is one byte of data for each timer containing the information of done bit, repeat bit, free bit, long bit and last-timer-in-table bit (Refer to Appendix G for details).

5.3.2 Value_Word

A two-byte value which can have several meanings depending on the type of timer.

(a) Short Timers:

The Value_Word is the actual timer in this case.

1 The first byte is the value to be decremented and
2 the second byte is the initial timer value. In the
3 case of a repeating timer, the second byte is used
4 to restart the timer.
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6 (b) Long Non-Repeating Timers:

7 The Value_Word is the value of the timer and is
8 decremented as a two-byte quantity.
9

10 (c) Long Repeating Timers:

11 The Value_Word is the address of the location in
12 the TIMER_DATA_BLOCK where the first word is the
13 value to be decremented and the second word is the
14 initial timer value.
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16 5.3.3 TIMER_DATA_BLOCK
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18 This is the data area in CRAM where four bytes are
19 designated for each long repeating timer. The table's
20 size is expandable under user control, so care should be
21 taken not to write over other pertinent data.
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3 5.4 INIT_TIMER

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5 Calling Sequence:

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7 LD HL, TIMER_TABLE

8 LD DE, TIMER_DATA_BLOCK

9 CALL INIT_TIMER

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11 Description:

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13 INIT_TIMER initializes timer data areas to the locations
14 defined as inputs.

15

16 Parameters:

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18 TIMER_TABLE

This is the CRAM address where the
19 timer information will be placed.

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22 TIMER_DATA_BLOCK

This is the address where long
23 repeating timer data will be
24 placed.

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Side Effects:

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- Destroys DE and HL.

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2 5.5 TIME_MGR
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Calling Sequence:

CALL TIME_MGR

Description:

TIME_MGR is responsible for maintaining all OS software timers. The task of maintenance is defined as updating all timers, setting the proper signal code when a timer times out, and restarting repeating timers.

Each call to TIME_MGR will cause all active timers to be decremented by one. There is no limit as to when the routine could be called, but typically it is every NMI from VDP which forms the system time base.

An active timer is defined as a timer with its repeat bit set or its done bit not set, or both.

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1 If an entire timer value decrements to zero, the done
2 bit will be set in Mode_BYTE. In addition, the timer
3 will be restarted if it is a repeating type.
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5 Parameters: None.
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7 Side Effects:
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9 - Destroys AF, DE and HL.
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3 5.6 REQUEST_SIGNAL

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5 Calling Sequence:

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7 LD HL, TIMER_LENGTH
8 LD A, REPEAT
9 CALL REQUEST_SIGNAL

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11 Description:

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13 REQUEST_SIGNAL accepts a time interval and a repeat code
14 (Boolean) as input. The REPEAT parameter, when set,
15 instructs TIME_MGR to re-initialize the timer when it
16 times out instead of relinquishing the timer memory
17 locations.

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19 REQUEST_SIGNAL sets up a timer and assigns that timer a
20 number in the accumulator. The routine also determines
21 the type of timer and allocates space in the TIMER_TABLE
22 accordingly.

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1 Short Timer:

2 A short timer has a counter value of 255 or less and
3 uses one Mode_Byte and Value_Word.

4 Long Timer:

5 A long timer has counter values greater than 255.

6 (a) Non-Repeating:

7 A non-repeating timer uses a Mode_Byte and
8 Value_Word.

9 (b) Repeating:

10 A repeating timers uses a Mode_Byte and Value_Word
11 in addition to four bytes starting at the first
12 available location in the TIMER_DATA_BLOCK.

13 The user should save the timer number. This value,
14 referred to as SIGNAL_NUM, should subsequently be used
15 when calling TEST_SIGNAL to find the status of the
16 signal or when calling FREE_SIGNAL to release a timer.

1 Parameters:

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3 TIMER_LENGTH

4 The number of the time base units
5 of a timer. Values range from 1
6 (shortest) to OFFFFH (longest).

7 REPEAT

8 1 = repeating timer;
9

10 0 = non-repeating timer.

11 Output:

12 Value of timer number returned in
13 accumulator. User should save it
14 in CRAM location SIGNAL_NUM.

15 Side Effects:

- 16
- 17 - Destroys AF, BC, DE, and HL.

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5.7 TEST_SIGNAL

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Calling Sequence:

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LD A, SIGNAL_NUM

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CALL TEST_SIGNAL

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Description:

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TEST_SIGNAL takes a signal number and tests to see whether the indicated timer has timed out since the last time it was tested. If so, it returns with "true" in the accumulator; otherwise, it returns "false". The zero flag reflects the contents of the accumulator.

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If the timer of SIGNAL_NUM tested has its Done bit set and the timer is non-repetitive, then the Free bit will be set to release the timer for further use.

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If no timer of a particular signal number exists then the routine will return a false.

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1 Although it has been defined that testing a non-existing
2 signal number will return a false value, a common error
3 in use of timing routines is the testing of an undefined
4 signal.

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6 The error occurs when one module, with a given
7 SIGNAL_NUM, calls TEST_SIGNAL with that SIGNAL_NUM as
8 input. If this module receives a "true" from
9 TEST_SIGNAL, then another module which is rightfully
10 using a timer with that SIGNAL_NUM will not receive
11 a "done" signal.

12 Parameters:

13 SIGNAL_NUM Timer number.

14 Side Effects:

15 - Destroys AF (output), BC, DE, and HL.

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5.8 FREE_SIGNAL

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5 Calling Sequence:

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7 LD A, SIGNAL_NUM

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CALL FREE_SIGNAL

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10 Description:

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12 FREE_SIGNAL takes a SIGNAL_NUM value as input and upon
13 finding a timer assigned to that number, releases it to
14 the free list. If no timer of that SIGNAL_NUM is found,
15 no action will be taken. This routine will free a timer
16 regardless of its current value or its REPEAT parameter.

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18 Special case of long repeating timer:

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20 This routine will release a portion of the
21 TIMER_DATA_BLOCK that a particular timer uses and moves
22 the remaining contents up. The Value_Words of other

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1 repeating timers will also be modified to reflect this
2 move.

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4 NOTE: In this special case, TIME_MGR, or any other
5 routine that accesses or modifies the
6 TIMER_TABLE, should NOT be called during the exe-
7 cution of FREE_SIGNAL. (This may occur if
8 TIME_MGR was called on interrupt). ColecoVision
9 Bulletin No. 0010 (Appendix D) suggests the
10 solution of using DEF_INT to defer interrupts.
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13 Parameters:

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15 SIGNAL_NUM Previously defined output from
16 REQUEST_SIGNAL.
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18 Side Effects:

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20 - Destroys AF, BC, DE and HL.
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