

## ***$\mu$ C/OS-II Configuration Manual***

This chapter provides a description of the configurable elements of  $\mu$ C/OS-II. Because  $\mu$ C/OS-II is provided in source form, configuration is done through a number of `#define` constants, which are found in `OS_CFG.H` and should exist for each project/product that you develop. In other words, configuration is done via conditional compilation.

Instead of creating an `OS_CFG.H` file from scratch, it is recommended that you copy and modify one of the `OS_CFG.H` files provided in one of the examples that came with  $\mu$ C/OS-II. `OS_CFG.H` is independent of the type of CPU used.

This section describes each of the `#define` constants in `OS_CFG.H`.

### ***17.00 Miscellaneous***

#### **OS\_ARG\_CHK\_EN**

`OS_ARG_CHK_EN` indicates whether you want most of  $\mu$ C/OS-II functions to perform argument checking. When set to 1,  $\mu$ C/OS-II will ensure that pointers passed to functions are non-NULL, that arguments passed are within allowable range and more. `OS_ARG_CHK_EN` was added to reduce the amount of code space and processing time required by  $\mu$ C/OS-II. Set `OS_ARG_CHK_EN` to 0 if you must reduce code space to a minimum. In general, you should always enable argument checking and thus set `OS_ARG_CHK_EN` to 1.

#### **OS\_CPU\_HOOKS\_EN**

`OS_CPU_HOOKS_EN` indicates whether `OS_CPU_C.C` declares the hook function (when set to 1) or not (when set to 0). Recall that  $\mu$ C/OS-II expects the presence of nine functions that can be defined either in the port (i.e., in `OS_CPU_C.C`) or by the application code. These functions are

<code>OSInitHookBegin()</code>	<code>OSTaskDelHook()</code>	<code>OSTCBInitHook()</code>
<code>OSInitHookEnd()</code>	<code>OSTaskIdleHook()</code>	<code>OSTimeTickHook()</code>
	<code>OSTaskStatHook()</code>	
<code>OSTaskCreateHook()</code>	<code>OSTaskSwHook()</code>	

## **OS\_DEBUG\_EN**

When set to 1, this #define adds ROM constants located in OS\_DEBUG.C to help support kernel aware debuggers. Specifically, a number of named ROM variables can be queried by a debugger to find out about compiled-in options. For example, the debugger can find out the size of an OS\_TCB,  $\mu$ C/OS-II's version number, the size of an event flag group (OS\_FLAG\_GRP) and much more.

## **OS\_EVENT\_NAME\_SIZE**

This constant determines the maximum number of characters that would be used to assign a name to either a semaphore, a mutex, a mailbox or a message queue. The name of these 'objects' would thus have to be smaller (in size) than this value. If OS\_EVENT\_NAME\_SIZE is set to 0, this feature is disabled. OS\_EVENT\_NAME\_SIZE needs to accommodate a NUL terminated ASCII string. You should note that need to use OSEventNameSet() to set the name of either a semaphores, a mutex, a mailbox or a message queue. You need to use OSEventNameGet() to obtain the name of either a semaphores, a mutex, a mailbox or a message queue.

## **OS\_LOWEST\_PRIO**

OS\_LOWEST\_PRIO specifies the lowest task priority (i.e., highest number) that you intend to use in your application and is provided to reduce the amount of RAM needed by  $\mu$ C/OS-II. As of V2.80  $\mu$ C/OS-II priorities can go from 0 (highest priority) to a maximum of 254 (lowest possible priority). Setting OS\_LOWEST\_PRIO to a value less than 254 means that your application cannot create tasks with a priority number higher than OS\_LOWEST\_PRIO. In fact,  $\mu$ C/OS-II reserves priorities OS\_LOWEST\_PRIO and OS\_LOWEST\_PRIO-1 for itself; OS\_LOWEST\_PRIO is reserved for the idle task, OS\_TaskIdle(), and OS\_LOWEST\_PRIO-1 is reserved for the statistic task, OS\_TaskStat(). The priorities of your application tasks can thus take a value between 0 and OS\_LOWEST\_PRIO-2 (inclusive). The lowest task priority specified by OS\_LOWEST\_PRIO is independent of OS\_MAX\_TASKS. For example, you can set OS\_MAX\_TASKS to 10 and OS\_LOWEST\_PRIO to 32 and have up to 10 application tasks, each of which can have a task priority value between 0 and 30 (inclusive). Note that each task must still have a different priority value. You must always set OS\_LOWEST\_PRIO to a value greater than the number of application tasks in your system. For example, if you set OS\_MAX\_TASKS to 20 and OS\_LOWEST\_PRIO to 10, you can not create more than eight application tasks (0 to 7) since priority 8 is the statistics task and priority 9 is the idle task. You are simply wasting RAM.

## **OS\_MAX\_EVENTS**

OS\_MAX\_EVENTS specifies the maximum number of event control blocks that can be allocated. An event control block is needed for every message mailbox, message queue, mutual exclusion semaphore, or semaphore object. For example, if you have 10 mailboxes, five queues, four mutexes, and three semaphores, you must set OS\_MAX\_EVENTS to at least 22. OS\_MAX\_EVENTS must be greater than 0. See also OS\_MBOX\_EN, OS\_Q\_EN, OS\_MUTEX\_EN, and OS\_SEM\_EN.

## **OS\_MAX\_FLAGS**

OS\_MAX\_FLAGS specifies the maximum number of event flags that you need in your application. OS\_MAX\_FLAGS must be greater than 0. To use event-flag services, you also need to set OS\_FLAG\_EN to 1.

## **OS\_MAX\_MEM\_PART**

OS\_MAX\_MEM\_PART specifies the maximum number of memory partitions that your application can create. To use memory partitions, also need to set OS\_MEM\_EN to 1. If you intend to use memory partitions, OS\_MAX\_MEM\_PART must be set to at least the number of partitions you wish to create. For example, by setting OS\_MAX\_MEM\_PART to 3, you are allowed to create and use up to three memory partitions. Setting OS\_MAX\_MEM\_PART to a number greater than the number of memory partitions your application uses will not cause problems but is unnecessary and a waste of RAM.

## **OS\_MAX\_QS**

OS\_MAX\_QS specifies the maximum number of message queues that your application can create. To use message queues, you also must set OS\_Q\_EN to 1. If you intend to use message queues, OS\_MAX\_QS must be set to at least the number of queues you wish to create. For example, if you set OS\_MAX\_QS to 3, you are allowed to create and use up to three message queues. Setting OS\_MAX\_QS to greater than the number of message queues your application uses will not cause problems but is unnecessary and a waste of RAM.

## **OS\_MAX\_TASKS**

OS\_MAX\_TASKS specifies the maximum number of *application* tasks that can exist in your application. Note that OS\_MAX\_TASKS cannot be greater than 253 (as of V2.80) because  $\mu$ C/OS-II currently reserves two tasks for itself (see OS\_N\_SYS\_TASKS in uCOS\_II.H). If you set OS\_MAX\_TASKS to the exact number of tasks in your system, you need to make sure that you revise this value when you add additional tasks. Conversely, if you make OS\_MAX\_TASKS much higher than your current task requirements (for future expansion), you are wasting valuable RAM.

## **OS\_SHED\_LOCK\_EN**

This constant enables (when set to 1) or disables (when set to 0) code generation for the two functions OSShedLock() and OSShedUnlock().

## **OS\_TICKS\_PER\_SEC**

OS\_TICKS\_PER\_SEC specifies the rate at which you call OSTimeTick(). It is up to your initialization code to ensure that OSTimeTick() is invoked at this rate. This constant is used by OSStatInit(), OS\_TaskStat(), and OSTimeDlyHMSM().

## **OS\_TICK\_STEP\_EN**

$\mu$ C/OS-View (a Micrium product that allows you to display run-time data about your tasks on a Windows-based PC) can now ‘halt’  $\mu$ C/OS-II’s tick processing and allow you to issue ‘step’ commands from  $\mu$ C/OS-View. In other words,  $\mu$ C/OS-View can prevent  $\mu$ C/OS-II from calling OSTimeTick() so that timeouts and time delays are no longer processed. However, through a keystroke from  $\mu$ C/OS-View, you can execute a single tick at a time. If OS\_TIME\_TICK\_HOOK\_EN (see below) is set to 1, OSTimeTickHook() is still executed at the regular tick rate in case you have time critical items to take care of in your application.

## **OS\_VIEW\_MODULE**

We now expect the presence of OS\_VIEW\_MODULE in your OS configuration file. This is such that you can more easily add  $\mu$ C/OS-View to your product. Defining OS\_VIEW\_MODULE to 1 indicates that you will include  $\mu$ C/OS-View in your product’s build. Setting OS\_VIEW\_MODULE to 0 indicates that you will not be using  $\mu$ C/OS-View.

## ***17.01 Event Flags***

### **OS\_FLAG\_EN**

OS\_FLAG\_EN enables (when set to 1) or disables (when set to 0) code generation of **all** the event-flag services and data structures, which reduces the amount of code and data space needed when your application does not require the use of event flags. When OS\_FLAG\_EN is set to 0, you do not need to enable or disable any of the other #define constants in this section.

### **OS\_FLAG\_ACCEPT\_EN**

OS\_FLAG\_ACCEPT\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSFlagAccept().

### **OS\_FLAG\_DEL\_EN**

OS\_FLAG\_DEL\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSFlagDel().

### **OS\_FLAG\_NAME\_SIZE**

This constant determines the maximum number of characters that would be used to assign a name to an event flag group. The name of event flags would thus have to be smaller (in size) than this value. If OS\_FLAG\_NAME\_SIZE is set to 0, this feature is disabled. OS\_FLAG\_NAME\_SIZE needs to accommodate a NUL terminated ASCII string.

### **OS\_FLAG\_WAIT\_CLR\_EN**

OS\_FLAG\_WAIT\_CLR\_EN enables (when set to 1) or disables (when set to 0) the code generation used to wait for event flags to be 0 instead of 1. Generally, you want to wait for event flags to be set. However, you might also want to wait for event flags to be clear, and thus you need to enable this option.

### **OS\_FLAG\_QUERY\_EN**

OS\_FLAG\_QUERY\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSFlagQuery().

### **OS\_FLAGS\_NBITS**

OS\_FLAGS\_NBITS has been introduced in V2.80 and specifies the number of bits used in event flags and **MUST** be either **8**, **16** or **32**.

## ***17.02 Message Mailboxes***

### **OS\_MBOX\_EN**

This constant enables (when set to 1) or disables (when set to 0) the code generation of **all** message-mailbox services and data structures, which reduces the amount of code space needed when your application does not require the use of message mailboxes. When `OS_MBOX_EN` is set to 0, you do not need to enable or disable any of the other `#define` constants in this section.

### **OS\_MBOX\_ACCEPT\_EN**

This constant enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMboxAccept()`.

### **OS\_MBOX\_DEL\_EN**

This constant enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMboxDel()`.

### **OS\_MBOX\_POST\_EN**

`OS_MBOX_POST_EN` enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMboxPost()`. You can disable code generation for this function if you decide to use the more powerful function `OSMboxPostOpt()` instead.

### **OS\_MBOX\_POST\_OPT\_EN**

`OS_MBOX_POST_OPT_EN` enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMboxPostOpt()`. You can disable code generation for this function if you do not need the additional functionality provided by `OSMboxPostOpt()`. `OSMboxPost()` generates less code.

### **OS\_MBOX\_QUERY\_EN**

`OS_MBOX_QUERY_EN` enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMboxQuery()`.

## ***17.03 Memory Management***

### **OS\_MEM\_EN**

OS\_MEM\_EN enables (when set to 1) or disables (when set to 0) **all** code generation of the  $\mu$ C/OS-II partition-memory manager and its associated data structures. This feature reduces the amount of code and data space needed when your application does not require the use of memory partitions.

### **OS\_MEM\_NAME\_SIZE**

This constant determines the maximum number of characters that would be used to assign a name to a memory partition. The name of memory partitions would thus have to be smaller (in size) than this value. If OS\_MEM\_NAME\_SIZE is set to 0, this feature is disabled and no RAM is used in the OS\_MEM for the memory partition. OS\_MEM\_NAME\_SIZE needs to accommodate a NUL terminated ASCII string.

### **OS\_MEM\_QUERY\_EN**

OS\_MEM\_QUERY\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSMemQuery().

## ***17.04 Mutual Exclusion Semaphores***

### **OS\_MUTEX\_EN**

OS\_MUTEX\_EN enables (when set to 1) or disables (when set to 0) the code generation of **all** mutual-exclusion-semaphore services and data structures, which reduces the amount of code and data space needed when your application does not require the use of mutexes. When OS\_MUTEX\_EN is set to 0, you do not need to enable or disable any of the other `#define` constants in this section.

### **OS\_MUTEX\_ACCEPT\_EN**

OS\_MUTEX\_ACCEPT\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMutexAccept()`.

### **OS\_MUTEX\_DEL\_EN**

OS\_MUTEX\_DEL\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMutexDel()`.

### **OS\_MUTEX\_QUERY\_EN**

OS\_MUTEX\_QUERY\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSMutexQuery()`.

## *17.05 Message Queues*

### **OS\_Q\_EN**

OS\_Q\_EN enables (when set to 1) or disables (when set to 0) the code generation of **all** message-queue services and data structures, which reduces the amount of code space needed when your application does not require the use of message queues. When OS\_Q\_EN is set to 0, you do not need to enable or disable any of the other #define constants in this section. Note that if OS\_Q\_EN is set to 0, the #define constant OS\_MAX\_QS is irrelevant.

### **OS\_Q\_ACCEPT\_EN**

OS\_Q\_ACCEPT\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQAccept().

### **OS\_Q\_DEL\_EN**

OS\_Q\_DEL\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQDel().

### **OS\_Q\_FLUSH\_EN**

OS\_Q\_FLUSH\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQFlush().

### **OS\_Q\_POST\_EN**

OS\_Q\_POST\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQPost(). You can disable code generation for this function if you decide to use the more powerful function OSQPostOpt() instead.

### **OS\_Q\_POST\_FRONT\_EN**

OS\_Q\_POST\_FRONT\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQPostFront(). You can disable code generation for this function if you decide to use the more powerful function OSQPostOpt() instead.

### **OS\_Q\_POST\_OPT\_EN**

OS\_Q\_POST\_OPT\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQPostOpt(). You can disable code generation for this function if you do not need the additional functionality provided by OSQPostOpt(). OSQPost() generates less code.

### **OS\_Q\_QUERY\_EN**

OS\_Q\_QUERY\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSQQuery().

## ***17.06 Semaphores***

### **OS\_SEM\_EN**

OS\_SEM\_EN enables (when set to 1) or disables (when set to 0) **all** code generation of the  $\mu$ C/OS-II semaphore manager and its associated data structures, which reduces the amount of code and data space needed when your application does not require the use of semaphores. When OS\_SEM\_EN is set to 0, you do not need to enable or disable any of the other `#define` constants in this section.

### **OS\_SEM\_ACCEPT\_EN**

OS\_SEM\_ACCEPT\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSSemAccept()`.

### **OS\_SEM\_DEL\_EN**

OS\_SEM\_DEL\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSSemDel()`.

### **OS\_SEM\_QUERY\_EN**

OS\_SEM\_QUERY\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSSemQuery()`.

### **OS\_SEM\_SET\_EN**

OS\_SEM\_SET\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function `OSSemSet()`.

## ***17.07 Task Management***

### **OS\_TASK\_CHANGE\_PRIO\_EN**

`OS_TASK_CHANGE_PRIO_EN` enables (when set to 1) or disables (when set to 0) the code generation of the function `OSTaskChangePrio()`. If your application never changes task priorities after they are assigned, you can reduce the amount of code space used by  $\mu\text{C}/\text{OS-II}$  by setting `OS_TASK_CHANGE_PRIO_EN` to 0.

### **OS\_TASK\_CREATE\_EN**

`OS_TASK_CREATE_EN` enables (when set to 1) or disables (when set to 0) the code generation of the `OSTaskCreate()` function. Enabling this function makes  $\mu\text{C}/\text{OS-II}$  backward compatible with the  $\mu\text{C}/\text{OS}$  task-creation function. If your application always uses `OSTaskCreateExt()` (recommended), you can reduce the amount of code space used by  $\mu\text{C}/\text{OS-II}$  by setting `OS_TASK_CREATE_EN` to 0. Note that you must set at least `OS_TASK_CREATE_EN` or `OS_TASK_CREATE_EXT_EN` to 1. If you wish, you can use both.

### **OS\_TASK\_CREATE\_EXT\_EN**

`OS_TASK_CREATE_EXT_EN` enables (when set to 1) or disables (when set to 0) the code generation of the function `OSTaskCreateExt()`, which is the extended, more powerful version of the two task-creation functions. If your application never uses `OSTaskCreateExt()`, you can reduce the amount of code space used by  $\mu\text{C}/\text{OS-II}$  by setting `OS_TASK_CREATE_EXT_EN` to 0. Note that you need the extended task-create function to use the stack-checking function `OSTaskStkChk()`.

### **OS\_TASK\_DEL\_EN**

`OS_TASK_DEL_EN` enables (when set to 1) or disables (when set to 0) code generation of the function `OSTaskDel()`, which deletes tasks. If your application never uses this function, you can reduce the amount of code space used by  $\mu\text{C}/\text{OS-II}$  by setting `OS_TASK_DEL_EN` to 0.

### **OS\_TASK\_IDLE\_STK\_SIZE**

`OS_TASK_IDLE_STK_SIZE` specifies the size of the  $\mu\text{C}/\text{OS-II}$  idle-task stack. The size is specified not in bytes but in number of elements. This is because a stack is declared to be of type `OS_STK`. The size of the idle-task stack depends on the processor you are using and the deepest anticipated interrupt-nesting level. Very little is being done in the idle task, but you should allow at least enough space to store all processor registers on the stack and enough storage to handle all nested interrupts.

### **OS\_TASK\_NAME\_SIZE**

This constant determines the maximum number of characters that would be used to assign a name to a task. The name of tasks would thus have to be smaller (in size) than this value. If `OS_TASK_NAME_SIZE` is set to 0, this feature is disabled and no RAM is used in the `OS_TCB` for the task name. `OS_TASK_NAME_SIZE` needs to accommodate a NUL terminated ASCII string.

### **OS\_TASK\_PROFILE\_EN**

This constant allows variables to be allocated in each task's `OS_TCB` that hold performance data about each task. Specifically, if `OS_TASK_PROFILE_EN` is set to 1, each task will have a variable to keep track of the number of context switches, the task execution time, the number of bytes used by the task and more.

## **OS\_TASK\_STAT\_EN**

`OS_TASK_STAT_EN` specifies whether or not you can enable the  $\mu$ C/OS-II statistic task, as well as its initialization function. When set to 1, the statistic task `OS_TaskStat()` and the statistic-task-initialization function are enabled. `OS_TaskStat()` computes the CPU usage of your application. When enabled, it executes every second and computes the 8-bit variable `OSCPUUsage`, which provides the percentage of CPU use of your application. `OS_TaskStat()` calls `OSTaskStatHook()` every time it executes so that you can add your own statistics as needed. See `OS_CORE.C` for details on the statistic task. The priority of `OS_TaskStat()` is always set to `OS_LOWEST_PRIO-1`.

The global variables `OSCPUUsage`, `OSIdleCtrMax`, `OSIdleCtrRun`, `OSTaskStatStk[]`, and `OSStatRdy` are not declared when `OS_TASK_STAT_EN` is set to 0, which reduces the amount of RAM needed by  $\mu$ C/OS-II if you don't intend to use the statistic task. `OSIdleCtrRun` contains a snapshot of `OSIdleCtr` just before `OSIdleCtr` is cleared to zero every second. `OSIdleCtrRun` is not used by  $\mu$ C/OS-II for any other purpose. However, you can read and display `OSIdleCtrRun` if needed.

## **OS\_TASK\_STAT\_STK\_CHK\_EN**

This constant allows the statistic task to determine the actual stack usage of each active task. If `OS_TASK_STAT_EN` is set to 0 (the statistic task is not enabled) but, you can call `OS_TaskStatStkChk()` yourself from one of your tasks. If `OS_TASK_STAT_EN` is set to 1, stack sizes will be determined every second by the statistic task.

## **OS\_TASK\_STAT\_STK\_SIZE**

`OS_TASK_STAT_STK_SIZE` specifies the size of the  $\mu$ C/OS-II statistic-task stack. The size is specified not in bytes but in number of elements. This is because a stack is declared as being of type `OS_STK`. The size of the statistic-task stack depends on the processor you are using and the maximum of the following actions:

- The stack growth associated with performing 32-bit arithmetic (subtraction and division)
- The stack growth associated with calling `OSTimeDly()`
- The stack growth associated with calling `OSTaskStatHook()`
- The deepest anticipated interrupt-nesting level

If you want to run stack checking on this task and determine its actual stack requirements, you must enable code generation for `OSTaskCreateExt()` by setting `OS_TASK_CREATE_EXT_EN` to 1. Again, the priority of `OS_TaskStat()` is always set to `OS_LOWEST_PRIO-1`.

## **OS\_TASK\_SW\_HOOK\_EN**

Normally,  $\mu$ C/OS-II requires that you have a context switch hook function called `OSTaskSwHook()`. When set to 0, this constant allows you to omit `OSTaskSwHook()` from your code. This configuration constant was added to reduce the amount of overhead during a context switch in applications that doesn't require the context switch hook. Of course, you will also need to remove the calls to `OSTaskSwHook()` from `OSTaskStartHighRdy()`, `OSCtxSw()` and `OSIntCtxSw()` in `OS_CPU_A.ASM`.

## **OS\_TASK\_SUSPEND\_EN**

`OS_TASK_SUSPEND_EN` enables (when set to 1) or disables (when set to 0) code generation of the functions `OSTaskSuspend()` and `OSTaskResume()`, which allows you to explicitly suspend and resume tasks, respectively. If your application never uses these functions, you can reduce the amount of code space used by  $\mu$ C/OS-II by setting `OS_TASK_SUSPEND_EN` to 0.

### **OS\_TASK\_TMR\_PRIO (APP\_CFG.H)**

OS\_TASK\_TMR\_PRIO specifies the priority of the timer management task. You can set the priority of the timer task to anything you want. Note that timer callback functions are executed by the timer task. OS\_TASK\_TMR\_PRIO needs to be set in your application file called APP\_CFG.H.

### **OS\_TASK\_TMR\_STK\_SIZE**

OS\_TASK\_TMR\_STK\_SIZE specifies the size of the  $\mu$ C/OS-II timer task stack. The size is specified not in bytes but in number of elements. This is because a stack is declared to be of type OS\_STK. The size of the timer-task stack depends on the processor you are using, the 'callback' functions that will be executed when each of the timer times out and the deepest anticipated interrupt-nesting level.

### **OS\_TASK\_QUERY\_EN**

OS\_TASK\_QUERY\_EN enables (when set to 1) or disables (when set to 0) code generation of the function OSTaskQuery(). If your application never uses this function, you can reduce the amount of code space used by  $\mu$ C/OS-II by setting OS\_TASK\_QUERY\_EN to 0.

## ***17.08 Time Management***

### **OS\_TIME\_DLY\_HMSM\_EN**

OS\_TIME\_DLY\_HMSM\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSTimeDlyHMSM(), which is used to delay a task for a specified number of hours, minutes, seconds, and milliseconds.

### **OS\_TIME\_DLY\_RESUME\_EN**

OS\_TIME\_DLY\_RESUME\_EN enables (when set to 1) or disables (when set to 0) the code generation of the function OSTimeDlyResume().

### **OS\_TIME\_GET\_SET\_EN**

OS\_TIME\_GET\_SET\_EN enables (when set to 1) or disables (when set to 0) the code and data generation of the functions OSTimeGet() and OSTimeSet(). If you don't need to use the 32-bit tick counter OSTime, then you can save yourself 4 bytes of data space and code space by not having the code for these functions generated by the compiler.

### **OS\_TIME\_TICK\_HOOK\_EN**

Normally,  $\mu$ C/OS-II requires the presence of a function called OSTimeTickHook() which is called at the very beginning of the tick ISR. When set to 0, this constant allows you to omit OSTimeTickHook() from your code. This configuration constant was added to reduce the amount of overhead during a tick ISR in applications that doesn't require this hook.

## ***17.09 Timer Management***

Note that timer management requires semaphores and thus, you need to set `OS_SEM_EN` to 1.

### **OS\_TMR\_EN**

Enables (when set to 1) or disables (when set to 0) the code generation of the timer management services.

### **OS\_TMR\_CFG\_MAX**

Determines the maximum number of timers you can have in your application. Depending on the amount of RAM available in your product, you can have hundreds or even thousands of timers (max. is 65500). 36 entries are reserved.

### **OS\_TMR\_CFG\_NAME\_SIZE**

This constant determines the maximum number of characters that would be used to assign a name to a timer. The name of timers would thus have to be smaller (in size) than this value. If `OS_TMR_CFG_NAME_SIZE` is set to 0, this feature is disabled and no RAM is used in the `OS_TMR` for the timer name. `OS_TMR_CFG_NAME_SIZE` needs to accommodate a NUL terminated ASCII string.

### **OS\_TMR\_CFG\_WHEEL\_SIZE**

Timers are updated using a rotating wheel. This ‘wheel’ allows to reduce the number of timers that need to be updated by the timer manager task. The size of the wheel should be a fraction of the number of timers you have in your application. In other words:

$$\text{OS\_TMR\_CFG\_WHEEL\_SIZE} \leq \text{OS\_TMR\_CFG\_MAX}$$

This value should be a number between 2 and 1024. Timer management overhead is somewhat determined by the size of the wheel. A large number of entries might reduce the overhead for timer management but would require more RAM. Each entry requires a pointer and a count (16-bit value). We recommend a number that is NOT a multiple of the tick rate. If your application has many timers then it’s recommended that you have a high value. As a starting value, you could use `OS_TMR_CFG_MAX / 4`.

### **OS\_TMR\_CFG\_TICKS\_PER\_SEC**

This configuration constant determines the rate at which timers are updated (in Hz). Timer updates should be done at a fraction of the tick rate (i.e. `OS_TICKS_PER_SEC`). We recommend that you update timers at 10 Hz.

## 17.10 Function Summary

Table 17.1 lists each  $\mu$ C/OS-II function by type (**Service**), indicates which variables enable the code (**Set to 1**), and lists other configuration constants that affect the function (**Other Constants**).

Of course, `OS_CFG.H` must be included when  $\mu$ C/OS-II is built, in order for the desired configuration to take effect.

**Table 17.1**  *$\mu$ C/OS-II functions and #define configuration constants.*

<i>Service</i>	<i>Set to 1</i>	<i>Other Constants</i>
<b>Miscellaneous</b>		
<code>OSEventNameGet()</code>	<code>OS_EVENT_NAME_SIZE</code> (>1)	N/A
<code>OSEventNameSet()</code>	<code>OS_EVENT_NAME_SIZE</code> (>1)	N/A
<code>OSInit()</code>	N/A	<code>OS_MAX_EVENTS</code> <code>OS_Q_EN</code> and <code>OS_MAX_QS</code> <code>OS_MEM_EN</code> <code>OS_TASK_IDLE_STK_SIZE</code> <code>OS_TASK_STAT_EN</code> <code>OS_TASK_STAT_STK_SIZE</code>
<code>OSSchedLock()</code>	<code>OS_SCHED_LOCK_EN</code>	N/A
<code>OSSchedUnlock()</code>	<code>OS_SCHED_LOCK_EN</code>	N/A
<code>OSStart()</code>	N/A	N/A
<code>OSStatInit()</code>	<code>OS_TASK_STAT_EN</code> && <code>OS_TASK_CREATE_EXT_EN</code>	<code>OS_TICKS_PER_SEC</code>
<code>OSVersion()</code>	N/A	N/A
<b>Interrupt Management</b>		
<code>OSIntEnter()</code>	N/A	N/A
<code>OSIntExit()</code>	N/A	N/A
<b>Event Flags</b>		
<code>OSFlagAccept()</code>	<code>OS_FLAG_EN</code>	<code>OS_FLAG_ACCEPT_EN</code>
<code>OSFlagCreate()</code>	<code>OS_FLAG_EN</code>	<code>OS_MAX_FLAGS</code>
<code>OSFlagDel()</code>	<code>OS_FLAG_EN</code>	<code>OS_FLAG_DEL_EN</code>
<code>OSFlagNameGet()</code>	<code>OS_FLAG_EN</code>	<code>OS_FLAG_NAME_SIZE</code> (>1)
<code>OSFlagNameSet()</code>	<code>OS_FLAG_EN</code>	<code>OS_FLAG_NAME_SIZE</code> (>1)
<code>OSFlagPend()</code>	<code>OS_FLAG_EN</code>	<code>OS_FLAG_WAIT_CLR_EN</code>
<code>OSFlagPost()</code>	<code>OS_FLAG_EN</code>	N/A
<code>OSFlagQuery()</code>	<code>OS_FLAG_EN</code>	<code>OS_FLAG_QUERY_EN</code>

### Message Mailboxes

OSMboxAccept()	OS_MBOX_EN	OS_MBOX_ACCEPT_EN
OSMboxCreate()	OS_MBOX_EN	OS_MAX_EVENTS
OSMboxDel()	OS_MBOX_EN	OS_MBOX_DEL_EN
OSMboxPend()	OS_MBOX_EN	N/A
OSMboxPost()	OS_MBOX_EN	OS_MBOX_POST_EN
OSMboxPostOpt()	OS_MBOX_EN	OS_MBOX_POST_OPT_EN
OSMboxQuery()	OS_MBOX_EN	OS_MBOX_QUERY_EN

### Memory Partition Management

OSMemCreate()	OS_MEM_EN	OS_MAX_MEM_PART
OSMemGet()	OS_MEM_EN	N/A
OSMemNameGet()	OS_MEM_EN	OS_MEM_NAME_SIZE (>1)
OSMemNameSet()	OS_MEM_EN	OS_MEM_NAME_SIZE (>1)
OSMemPut()	OS_MEM_EN	N/A
OSMemQuery()	OS_MEM_EN	OS_MEM_QUERY_EN

### Mutex Management

OSMutexAccept()	OS_MUTEX_EN	OS_MUTEX_ACCEPT_EN
OSMutexCreate()	OS_MUTEX_EN	OS_MAX_EVENTS
OSMutexDel()	OS_MUTEX_EN	OS_MUTEX_DEL_EN
OSMutexPend()	OS_MUTEX_EN	N/A
OSMutexPost()	OS_MUTEX_EN	N/A
OSMutexQuery()	OS_MUTEX_EN	OS_MUTEX_QUERY_EN

### Message Queues

OSQAccept()	OS_Q_EN	OS_Q_ACCEPT_EN
OSQCreate()	OS_Q_EN	OS_MAX_EVENTS OS_MAX_QS
OSQDel()	OS_Q_EN	OS_Q_DEL_EN
OSQFlush()	OS_Q_EN	OS_Q_FLUSH_EN
OSQPend()	OS_Q_EN	N/A
OSQPost()	OS_Q_EN	OS_Q_POST_EN
OSQPostFront()	OS_Q_EN	OS_Q_POST_FRONT_EN
OSQPostOpt()	OS_Q_EN	OS_Q_POST_OPT_EN
OSQQuery()	OS_Q_EN	OS_Q_QUERY_EN

### Semaphore Management

OSSemAccept()	OS_SEM_EN	OS_SEM_ACCEPT_EN
OSSemCreate()	OS_SEM_EN	OS_MAX_EVENTS
OSSemDel()	OS_SEM_EN	OS_SEM_DEL_EN
OSSemPend()	OS_SEM_EN	N/A
OSSemPost()	OS_SEM_EN	N/A
OSSemQuery()	OS_SEM_EN	OS_SEM_QUERY_EN
OSSemSet()	OS_SEM_EN	OS_SEM_SET_EN

## Task Management

OSTaskChangePrio()	OS_TASK_CHANGE_PRIO_EN	OS_LOWEST_PRIO
OSTaskCreate()	OS_TASK_CREATE_EN	OS_MAX_TASKS
OSTaskCreateExt()	OS_TASK_CREATE_EXT_EN	OS_MAX_TASKS OS_TASK_STK_CLR
OSTaskDel()	OS_TASK_DEL_EN	OS_MAX_TASKS
OSTaskDelReq()	OS_TASK_DEL_EN	OS_MAX_TASKS
OSTaskResume()	OS_TASK_SUSPEND_EN	OS_MAX_TASKS
OSTaskNameGet()	OS_TASK_NAME_SIZE (>1)	N/A
OSTaskNameSet()	OS_TASK_NAME_SIZE (>1)	N/A
OSTaskStkChk()	OS_TASK_CREATE_EXT_EN	OS_MAX_TASKS
OSTaskSuspend()	OS_TASK_SUSPEND_EN	OS_MAX_TASKS
OSTaskQuery()	OS_TASK_QUERY_EN	OS_MAX_TASKS
OS_TaskStatStkChk()	OS_TASK_STAT_STK_CHK_EN	N/A

## Time Management

OSTimeDly()	N/A	N/A
OSTimeDlyHMSM()	OS_TIME_DLY_HMSM_EN	OS_TICKS_PER_SEC
OSTimeDlyResume()	OS_TIME_DLY_RESUME_EN	OS_MAX_TASKS
OSTimeGet()	OS_TIME_GET_SET_EN	N/A
OSTimeSet()	OS_TIME_GET_SET_EN	N/A
OSTimeTick()	N/A	N/A

## Timer Management

OSTmrCreate()	OS_TMR_EN	OS_SEM_EN
OSTmrDel()	OS_TMR_EN	OS_SEM_EN
OSTmrNameGet()	OS_TMR_EN	OS_SEM_EN
OSTmrRemainGet()	OS_TMR_EN	OS_SEM_EN
OSTmrStart()	OS_TMR_EN	OS_SEM_EN
OSTmrStop()	OS_TMR_EN	OS_SEM_EN
OSTmrSignal()	OS_TMR_EN	OS_SEM_EN OS_TMR_CFG_TICKS_PER_SEC

## User-Defined Functions

OSTaskCreateHook()	OS_CPU_HOOKS_EN	N/A
OSTaskDelHook()	OS_CPU_HOOKS_EN	N/A
OSTaskStatHook()	OS_CPU_HOOKS_EN	N/A
OSTaskSwHook()	OS_CPU_HOOKS_EN	OS_TASK_SW_HOOK_EN
OSTimeTickHook()	OS_CPU_HOOKS_EN	OS_TIME_TICK_HOOK_EN

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