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pC/OS Reference

V1.87b

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To this for beginners at the fastest to understand real time operating system belongs μ C/OS from Jean J. Labrosse (see <http://www.micrium.com>).

In the versions 1.xx it can administer up to 63 applikationtasks with ever different priorities and belongs to the real time operating systems with the lowest storage demand.

pC/OS was based on the original version μ C/OS 1.00 from the Embedded Systems Programming Magazine(1992) developed further.

Since is exchanged by direct transfer of pointers in the original version data between the tasks, and consequently no guarantee for the free usability of the sending-buffers after transfer to another task exists and, much important, the recipient a pointer in the data field of another tasks gets (pointer-error / longitudinal mistake / manipulations among others) I altered the mechanisms for Message-Box and Queue accordingly in a way that the data about a kernel-internal Buffer now are handed over to the recipient. This means that the kernel copies to transferring data into an individual buffer and this copies also again itself with transfer to the recipient in the buffer prepared through the recipient. This admittedly entails a higher storage demand for Queue, secures the processes for it most extensive, however (for real-mode) of each other from.

Kernel constants were transferred in the CODE-Area for security reasons furthermore.

Furthermore I have add pipes, eventgroups, timerservice and dynamic memory management.

In order to declare these alterations unequivocally, I have altered the name, ajar at the always bigger nascent original " μ C/OS", on pC/OS like "pico-C..".

Special to: [Priority Inversion, the problem and the solutions](#) (actual only in german - sorry !)

known bug:

If a task with lower priority waits for a recourse, and a task with higher priority this recourse places, so the asleep Task is put into the ready-state. Since the task with higher priority further-runs, this cannot finish reading again the same recourse since the lower task 'prematurely' comes with implementation with the return-code OS_TIMEOUT back otherwise.

Please note that some functions are declared under the same name as the original but with modified parameters or pointers.

User-Functions:

Task-Control:	Description
OS_Init	Initialization of the kernel
OS_Start	Begin the kernel services
OS_TaskCreate	Generating of a task
OS_ChangePrio	Alteration of the priority of the active task
OS_TaskChangePrio	Alteration of the priority of a active/ready task
OS_TaskDelete	Deletion of a active/ready task
OS_TaskIdDelete	Deletion of a active/ready task by unique ID
OS_TaskGetStatus	returns the current status of the task
OS_TaskIdGetStatus	returns the current status of a task by unique ID
OS_TaskGetID	returns the unique ID of a task
OS_TaskGetPrio	returns the priority of a task
OS_TaskIdDestroy	Deletion of a task by unique ID, even if he waits for an IPC or a mutex has occupied & release all memory allocations
OS_TaskSuspend	Suspending of a task
OS_TaskIdSuspend	Suspending of a task by unique ID
OS_TaskResume	Reactivation of a suspended task
OS_TaskIdResume	Reactivation of a suspended task by unique ID
OS_TimeDly	Put current task for certain time sleeps
OS_TimeDlyResume	Reactivation of an asleep task before course of the put in time
OS_TimeDlyIdResume	Reactivation of an asleep task by unique ID before course of the put in time

OS_Lock	It suppresses the Sheduler (no taskswitch)
OS_Unlock	Reactivation of the Sheduler (taskswitch at event or time)
OS_GetRev	Returns pointer on kernel revision

Dynamic-Memory:	Description
OS_MemoryInit	Generates of the memory pool
OS_MemAlloc	Allocation of memory
OS_MemFree	Release of allocated memory
OS_MemFreeSize	It returns the amount of free memory

Mailboxes:	Description
OS_MboxInit	Initialisation of a Mailbox
OS_MboxPost	Send data to task with higher priority recipients of this Mailbox
OS_MboxPostAbort	Aborts waiting of a sending task (highest waiting prio) onto a mailbox
OS_MboxPend	Wait for data from a Mailbox
OS_MboxPendAbort	Aborts waiting of a receiving Tasks (highest waiting prio) on a Mailbox

Queues:	Description
OS_QueueInit	Initialisation of a Queue
OS_QueueInfo	Information about a Queue catches up with
OS_QueuePost	Send data into a Queue
OS_QueueFrontPost	Send data to the beginning of a Queue
OS_QueuePostAbort	Aborts waiting of a sending task (highest waiting prio) onto a queue
OS_QueuePend	Wait for data from a Queue
OS_QueuePendAbort	Aborts waiting of a receiving Tasks (highest waiting prio) on a Queue
OS_QueueClear	Delete all data in a Queue

Pipes:	Description
OS_PipeInit	Initialisation of a Pipe
OS_PipeInfo	Information about a Pipe catches up with
OS_PipePost	Send data into a Pipe
OS_PipeFrontPost	Send data to the beginning of a Pipe
OS_PipePostAbort	Aborts waiting of a sending task (highest waiting prio) onto a pipe
OS_PipePend	Wait for data from a Pipe
OS_PipePendAbort	Aborts waiting of a receiving Tasks (highest waiting prio) on a Pipe
OS_PipeClear	Delete all data in a Pipe

Semaphores:	Description
OS_SemInit	Initialisation of a Semaphore
OS_SemAccept	wait for event and returns number

OS_SemPost	Decontrol of a busy Semaphores / places event
OS_SemPend	Cover one Semaphore / waits on event
OS_SemPendAbort	Aborts waiting of a Tasks (highest waiting prio) on a Semaphore
OS_SemClear	Clear the Semaphore-Counter

Mutexes:	Description
OS_MutexCreate	Generating of a Mutex
OS_MutexPost	Decontrol of a Mutex
OS_MutexPend	Cover the Mutex
OS_MutexPendAbort	Aborts waiting of a Tasks (highest waiting prio) on a Mutex

Event-Groups:	Description
OS_EvgInit	Initialisation of a Eventgroup
OS_EvgPost	Place one/many events of an Evengroup
OS_EvgPend	Wait for arriving an or several events of an Eventgroup
OS_EvgPendAbort	Aborts waiting of a task (highest waiting prio) onto a Eventgroup

Timer-Service:	Description
OS_TimerCreate	Generating of a Timer
OS_TimerDelete	Delete of a generated Timer
OS_TimerStart	(Re-)Start of a generated Timer
OS_TimerStop	Stop of a generated Timer
OS_TimerGetState	returns the status of a generated Timer
OS_TimerGetRemain	returns the remaining time of a running Timer

System-Ticks:	Description
OS_TimeSet	Set ticker to value
OS_TimeGet	returns current ticker-value

Interrupts:	Description
OS_IntEnter	Registration of a called ISR
OS_IntExit	End of a called ISR

History:	Description
OS_HistoryPost	Write entry in History
OS_HistoryRead	return first History-entry and delete this in the table

Error-Codes:

Name	Decimal_Value	Description
OS_SUCCESS / OS_NO_ERR	0	no errors
OS_TIMEOUT	10	timeout condition occurs during waiting for a resource
OS_MBOX_FULL	20	Mailbox fully (with OS_NO_SUSP)
OS_MBOX_NODATA	21	no message in Mailbox (with OS_NO_SUSP)
OS_Q_FULL	30	Queue fully (with OS_NO_SUSP)
OS_Q_NODATA	31	no byte in Queue (with OS_NO_SUSP)
OS_Q_CLEAR	32	Queue was cleared during waiting
OS_PRIO_EXIST	40	under this priority, a other Task is registered
OS_TASK_NOT_EXIST	41	under this priority, no Task is registered
OS_SEM_ERR	50	internal error in Semaphore-handling
OS_SEM_NODATA	51	Semaphore occupy / no event (with OS_NO_SUSP)
OS_SEM_OVF	52	Error in the Semaphore-handling (Counter too big)
OS_MUX_ERR	55	Error in Mutex-handling
OS_MUX_NOACC	56	Mutex occupied (with OS_NO_SUSP)
OS_MUX_USED	57	to change Task have a Mutex occupied
OS_P_FULL	60	Pipe fully (with OS_NO_SUSP)
OS_P_NODATA	61	no package in Pipe (with OS_NO_SUSP)
OS_P_CLEAR	62	Pipe was cleared during waiting
OS_P_LEN_ERR	63	Package too long
OS_MEM_ERR	70	parameter error / internal error
OS_MEM_OVF	71	memeory overflow
OS_EVG_ERR	80	Error in Event-Group handling
OS_EVG_NOE	81	Event(s) appeared not (with OS_NO_SUSP)
OS_HIS_END	90	no (more) entry existing
OS_SUSPEND_IDLE	100	the Idle-Task cannot be suspended
OS_PRIO_INVALID	101	the value of priority is bigger OS_MIN_PRIO
OS_TIME_NOT_DLY	102	the task doesn't sleep
OS_TASK_SUSP_PRIO	103	under this priority, no Task is registered
OS_TASK_NOT_SUSP	104	the task is not suspended
OS_TASK_NOT_RDY	105	the task is not ready
OS_TMR_NO_TIME	106	no time given on TimerCreate
OS_TMR_NOT_EXIST	107	timer was not created / registered
OS_TMR_EXIST	108	timer was still created / registered

Configuration of the kernel

The pC/OS kernel can be configured in addition to the to-use hardware port some numbers of ways to configure Services/IPCs as well as to reduce the memory requirements - code-size for the compilers "unused code" may not clearly identify and RAM - available. These are in the file "OS_cfg.h" together.

components configuration	description
OS_SYSTEM_TICKS_PER_SEC	system ticks per second
OS_TIMER_TICKS_PER_SEC	timer ticks per second (see Timer-Service / TIMERS), can be tick faster than the kernel(system)-ticks
OS_TASK_EXT_EN	include code for extended TASKS services
OS_TASK_DESTROY_EN	include code for destroy pending/waiting TASKS, needs OS_TASK_EXT_EN too
OS_SEM_EN	include code for SEMAPHORES
OS_SEM_EXT_EN	include code for extended SEMAPHORES services
OS_MUX_EN	include code for MUTEXES
OS_MBOX_EN	include code for MAILBOXES
OS_Q_EN	include code for QUEUES
OS_P_EN	include code for PIPES
OS_EVG_EN	include code for EVENTGROUPS
OS_TMR_EN	include code for TIMERS
OS_MEM_EN	include code for MEMORY-MANAGER
OS_HIS_EN	include code for HISTORY
OS_STK_CHECK_EN	check end-of-stack of old task during context switch
OS_STK_CHECK_FILL	fill stack with 0xEF pattern to get the deep of use

user configuration	description
OS_MAX_TASKS	max created tasks in hole system --> max 64 !
OS_MIN_PRIO	lowest possible prio --> max 64 !
OS_IDLE_STK_SIZE	idle stack size in OS_STK_TYPE with fix (OS_MIN_PRIO - 1) as prio for idle task
OS_TMR_PRIO	timer task prio, if OS_TMR_EN is not 0
OS_TMR_STK_SIZE	timer stack size in OS_STK_TYPE, if OS_TMR_EN is not 0
OS_MAX_HISTORY	history entries, if OS_HIS_EN is not 0
OS_STK_RESERVE	space between real end-of-stack and check-point in OS_STK_TYPE, if OS_STK_CHECK_EN is not 0

to OS_MAX_TASKS and OS_MIN_PRIO:

If a system is needed with 5 tasks, 2 of which tasks are using a shared mutex, you need OS_MAX_TASKS = 7 (including a Mutex and Idle-Task) and OS_MIN_PRIO = 8 whereas the Idle-Task then gets the prio 7 and all other Tasks and the Mutex gets higher priorities (0..6). If the timer-service should used too, it must be this timer task additionally involved.

Managed / Unmanaged Interrupt Service Routines (ISR)

The pC/OS kernel must be notified when an ISR is running and needs to consider when leaving this if a process change is "preemptive" required. There are, depending on the hardware and used implementation, two ways:

managed ISR	the IRQ entry / exit is central and informs the kernel (see eg. ARM7TDMI ports)
unmanaged ISR	each ISR is independent and is jumped out directly from the vector table -> the kernel must be informed. (see eg. Cortex-Mx ports)

In managed-ISRs the central ISR entry / exit code informs the kernel, so that the ISR itself must not be observed for the kernel. In unmanaged ISR however, at first `OS_IntEnter()` is to call and at end / at last `OS_IntExit()` is to call !

managed ISR	unmanaged ISR
<pre> PUBLIC OSirqISR CODE32 OSirqISR ; save registers ; register interrupt on kernel ; read Interrupt vector for ... ; ... this event (eg MyManaged_ISR) ; call handler (eg MyManaged_ISR) --> ; call OS_IntExit() ; restore registers END void MyManaged_ISR(void) { . . // my ISR code . } </pre>	<pre> void MyUnManaged_ISR(void) { OS_IntEnter(); . . // my ISR code . OS_IntExit(); } </pre>

Task-Control

OS_Init

```
void OS_Init(void)
```

Initialize the Kernel and installs the Idle-Task. This function must be called before all other kernelservices at the system initialization once.

Parameters

none

Return Value

none

Example

```
void main(void)
{
    .
    .
    OS_Init();
    .
    .
    OS_Start();
}
```

OS_Start

```
void OS_Start(void)
```

Starts the kernel. This function activates the sheduler and never returns back to caller.

Parameters

none

Return Value

none

Example

```
void main(void)
{
    .
    .
    OS_Init();
    .
    .
    OS_Start();
}
```

OS_TaskCreate

```
U08 OS_TaskCreate(void (OS_FAR *task)(void *dptr), void *data, void *pstk, U08 prio)
```

Installs a new Task. This function initializes the Task-Control-Block and writes down the new Task with his Stack and the call parameters. This can from main() take place out in term during the initialization as well as another Task. If the optional feature "OS_STK_CHECK_EN" (Stack-end check) is used, the kernel requires an additional pointer to the stack end.

Parameters

*dptr	pointer to task-code
*data	pointer to parameter of this task
*pstk	pointer to stack of this task
*pstkend	<i>pointer to end-of-stack of this task</i>
prio	priority of this task

Return Value

OS_NO_ERR	Task successfully positioned
OS_PRIO_EXIST	under this priority, already a Task exists
OS_PRIO_INVALID	this priority is reserved for the Idle-Task or the value of priority is bigger than OS_MIN_PRIO

Example

```
OS_STK_TYPE Task1Stack[STK_SIZE];
U08 Task1Data;

void OS_FAR Task1(void *data); // forward declaration
.
.

void main(void)
{
    U08 state;

    .
    .
    OS_Init();
    .
    state = OS_TaskCreate(Task1, (void *)&Task1Data, (void *)&Task1Stack[STK_SIZE], 18);
    .
    OS_Start();
}

.
.

void OS_FAR Task1(void *data)
{
    .
    .
    while(1)
    {
        .
        .
    }
}
```

OS_ChangePrio

U08 OS_ChangePrio(U08 newp)

Change the priority of the current Tasks. This function can be used in order to change the priority of the tasks on reason of an event for example.

Parameters

newp	new priority of this task
------	---------------------------

Return Value

OS_NO_ERR	Priority successfully changed
OS_PRIO_EXIST	under this priority, already a task exists
OS_PRIO_INVALID	this priority is reserved for the Idle-Task or the value of priority is bigger than OS_MIN_PRIO
OS_MUX_USED	to change Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_ChangePrio(38);
        .
    }
}
```

OS_TaskChangePrio

U08 OS_TaskChangePrio(U08 oldp, U08 newp)

Change the priority of a Tasks. This function can be used in order to change the priority of a running/ready tasks on reason of an event for example.

The priority of Tasks, waiting on a resource (Semaphore/Queue/Pipe/..) can not changed, because this state is visible for the kernel but not the exact resource itself.

Parameters

oldp	actual/old priority of the task
newp	new priority of this task

Return Value

OS_NO_ERR	Priority successfully changed
OS_PRIO_EXIST	under this priority, already a task exists
OS_PRIO_INVALID	this priority is reserved for the Idle-Task or the value of priority is bigger than OS_MIN_PRIO
OS_TASK_NOT_RDY	the Task is not in RUNNING/READY-state and so the priority can not changed
OS_MUX_USED	to change Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TaskChangePrio(38, 25);
        .
    }
}
```

OS_TaskDelete

U08 OS_TaskDelete(U08 prio)

Delete the given task. This function can be used, about for example on reason of an event the task too ending/clearing. This task is distant from the Task-Control-Table afterwards. Allocated resources of the tasks are not released automatically on that occasion.
In order to later be able to execute this task again, it must be positioned again by means of OS_TaskCreate regularly. Tasks, waiting on a resource (Semaphore/Queue/Pipe/..) can not be deleted, because this state is visible for the kernel but not the exact resource itself.

Parameters

prio	priority of the task to delete
------	--------------------------------

Return Value

OS_NO_ERR	Task deleted
OS_TASK_NOT_EXIST	under this priority, no task exists
OS_TASK_NOT_RDY	the Task is not in RUNNING/READY-state and so the task can not be deleted
OS_MUX_USED	to delete Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;
    .
    .
    while(1)
    {
        .
        state = OS_TaskDelete(OS_PRIO_SELF);
        .
    }
}
```

OS_TaskIdDelete

U08 OS_TaskIdDelete(U08 id)

Delete the given task by unique ID. This function can be used, about for example on reason of an event the task too ending/clearing. This task is distant from the Task-Control-Table afterwards. Allocated resources of the tasks are not released automatically on that occasion.

In order to later be able to execute this task again, it must be positioned again by means of OS_TaskCreate regularly. Tasks, waiting on a resource (Semaphore/Queue/Pipe/..) can not be deleted, because this state is visible for the kernel but not the exact resource itself.

Parameters

id	unique ID of the task to delete
----	---------------------------------

Return Value

OS_NO_ERR	Task deleted
OS_TASK_NOT_EXIST	>under this ID, no task exists
OS_TASK_NOT_RDY	the Task is not in RUNNING/READY-state and so the task can not be deleted
OS_MUX_USED	to delete Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;
    .
    .
    while(1)
    {
        .
        state = OS_TaskIdDelete(3);
        .
    }
}
```

OS_TaskGetStatus

U08 OS_TaskGetStatus(U08 prio)

Returns the current status of the given task.

Parameters

prio	priority of the task
------	----------------------

Return Value

status	see "TASK STATUS", Bitmask
--------	----------------------------

Example

```
void OS_FAR Task1(void *data)
{
    U08 status;
    .
    .
    while(1)
    {
        .
        status = OS_TaskGetStatus(6);
        .
    }
}
```

OS_TaskIdGetStatus

U08 OS_TaskIdGetStatus(U08 id)

Returns the current status of the given task by unique ID.

Parameters

id	unique ID of the task
----	-----------------------

Return Value

status	see "TASK STATUS", Bitmask
--------	----------------------------

Example

```
void OS_FAR Task1(void *data)
{
    U08 status;
    .
    .
    while(1)
    {
        .
        status = OS_TaskIdGetStatus(2);
        .
    }
}
```

OS_TaskGetID

U08 OS_TaskGetID(U08 prio)

Returns the unique-ID to the specified tasks. These can later be used to e.g. a task - even if his priority have changed or has just a mutex in use - a violent end (`OS_TaskDestroy()`).

Parameters

prio	current priority of the task
------	------------------------------

Return Value

id	the unique-ID of this task
----	----------------------------

Example

```
U08 idT1;

void OS_FAR Task1(void *data)
{
    .
    idT1 = OS_TaskGetID(OS_PRIO_SELF);
    .
    while(1)
    {
        .
        .
    }
}
```

OS_TaskGetPrio

U08 OS_TaskGetPrio(U08 id)

Returns the priority to the specified tasks by unique ID.

Parameters

id	unique ID of the task
----	-----------------------

Return Value

prio	the priority of this task
------	---------------------------

Example

```
U08 prioT1;

void OS_FAR Task1(void *data)
{
    .
    prioT1 = OS_TaskGetPrio(2);
    .
    while(1)
    {
        .
        .
    }
}
```

OS_TaskIdDestroy

U08 OS_TaskIdDestroy(U08 id)

Removes the specified task completely independently of his status. This feature can be used to e.g. on basis of an event the task is to cancel. This task is then from the Task-Control-Table, from possibly registered IPCs (Semaphore/MBox/Queue/Pipe/..) and the Memory Manager completely removed.

If the tasks at this stage, a mutex has occupied, it will be released and a user-callback function is called to make any necessary reinitialization of the affected hardware, etc. (see OSMutexReInitResource () in "pC_OS_userCB.c"). But this can be done only for one mutex (the last). If the task have two mutexes occupied, it is only the last released!

In order to later be able to execute this task again, it must be positioned again by means of OS_TaskCreate regularly.

ATTENTION:

During this task will be removed from the Task-Control-Table and from the IPCs all interrupts are blocked because a suitable event for this task could result in a access/update conflict. During the subsequent clean up the memory-manager the interrupts are allowed again but scheduling is suppressed to prevent a simultaneous re-booting this task using OS_TaskCreate() (priority of this task).

Parameters

id	unique-ID of the task to destroy
----	----------------------------------

Return Value

OS_NO_ERR	task completely removed
OS_TASK_NOT_EXIST	the specified task does not exist
OS_TASK_NOT_RDY	the task could not be completely removed from the IPCs or a mutex
OS_MEM_ERR	during deallocating the memory allocations of this task an error occurs

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;
    .
    .
    while(1)
    {
        .
        state = OS_TaskIdDestroy(2);
        .
    }
}
```

OS_TaskSuspend

U08 OS_TaskSuspend(U08 prio)

Suspends a task from the implementation through the kernel. This function can be used in order to deactivate a task for a time on reason of an event for example.

Parameters

prio	priority of task to suspending
------	--------------------------------

Return Value

OS_NO_ERR	Task successfully suspended
OS_SUSPEND_IDLE	the Idle-Task cannot be suspended
OS_PRIO_INVALID	the value of priority is bigger than OS_MIN_PRIO
OS_TASK_SUSP_PRIO	under this priority, no Task is registered
OS_MUX_USED	to suspend Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TaskSuspend(24);
        .
    }
}
```

OS_TaskIdSuspend

U08 OS_TaskIdSuspend(U08 id)

suspends a task given by unique ID from the implementation through the kernel. This function can be used in order to deactivate a task for a time on reason of an event for example.

Parameters

id	unique ID of task to suspending
----	---------------------------------

Return Value

OS_NO_ERR	Task successfully suspended
OS_SUSPEND_IDLE	the Idle-Task cannot be suspended
OS_TASK_SUSP_PRIO	under this ID, no Task is registered
OS_MUX_USED	to suspend Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TaskIdSuspend(4);
        .
    }
}
```

OS_TaskResume

U08 OS_TaskResume (U08 prio)

Reactivate a suspended Task. This function can be used in order to activate a suspended task again on reason of an event for example.

Parameters

prio	priority of suspended task
------	----------------------------

Return Value

OS_NO_ERR	Task successfully reactivated
OS_TASK_NOT_SUSP	the Task is not suspended
OS_PRIO_INVALID	the value of priority is bigger than OS_MIN_PRIO
OS_TASK_NOT_EXIST	under this priority, no Task is registered
OS_MUX_USED	to resume Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TaskResume(24);
        .
    }
}
```

OS_TaskIdResume

U08 OS_TaskIdResume (U08 id)

Reactivate a suspended Task by given unique ID. This function can be used in order to activate a suspended task again on reason of an event for example.

Parameters

id	unique ID of suspended task
----	-----------------------------

Return Value

OS_NO_ERR	Task successfully reactivated
OS_TASK_NOT_SUSP	the Task is not suspended
OS_TASK_NOT_EXIST	under this ID, no Task is registered
OS_MUX_USED	to resume Task have a Mutex occupied

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TaskIdResume(4);
        .
    }
}
```

OS_TimeDly

```
void OS_TimeDly(U16 ticks)
```

If puts the current task for kernel-ticks sleeps. This function can be used in order to let pass a defined time on reason of an event for example. ATTENTION! With the parameter OS_SUSPEND (0), the Task for always is deactivated and can never be activated again.

Parameters

ticks	kernel-ticks as sleeping-time (1...65535)
-------	---

Return Value

none

Example

```
void OS_FAR Task1(void *data)
{
    .
    .
    while(1)
    {
        .
        OS_TimeDly(200);
        .
    }
}
```

OS_TimeDlyResume

U08 OS_TimeDlyResume(U08 prio)

Breaks off the wait of a tasks prematurely. This function can be used in order to prematurely activate an asleep task again on reason of an event for example.

Parameters

prio	priority of sleeping task
------	---------------------------

Return Value

OS_NO_ERR	Task successfully wakened
OS_TIME_NOT_DLY	the Task doesn't sleep
OS_PRIO_INVALID	the value of priority is bigger than OS_MIN_PRIO
OS_TASK_NOT_EXIST	under this priority, no Task is registered

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TimeDlyResume(24);
        .
    }
}
```

OS_TimeDlyIdResume

U08 OS_TimeDlyIdResume(U08 id)

Breaks off the wait of a tasks prematurely by unique ID. This function can be used in order to prematurely activate an asleep task again on reason of an event for example.

Parameters

id	unique ID of sleeping task
----	----------------------------

Return Value

OS_NO_ERR	Task successfully wakened
OS_TIME_NOT_DLY	the Task doesn't sleep
OS_TASK_NOT_EXIST	under this ID, no Task is registered

Example

```
void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TimeDlyIdResume(4);
        .
    }
}
```

OS_Lock

```
void OS_Lock(void)
```

If turns off the sheduler. This function can be used, about for example atomic (not under-breakable) to be able to execute processes, without task-switches. Interrupts still are served.

Parameters

none

Return Value

none

Example

```
void OS_FAR Task1(void *data)
{
    .
    .
    while(1)
    {
        .
        OS_Lock();
        .
        .           // not under-breakable part
        .
        OS_Unlock();
        .
    }
}
```

OS_Unlock

```
void OS_Unlock(void)
```

If switches on the sheduler again. This function is used, about for example atomic (not under-breakable) to complete processes and to make a taskswitch again possible.

Parameters

none

Return Value

none

Example

```
void OS_FAR Task1(void *data)
{
    .
    .
    while(1)
    {
        .
        OS_Lock();
        .
        .           // not under-breakable part
        .
        OS_Unlock();
        .
    }
}
```

OS_GetRev

U08 OS_FAR *OS_GetRev(void)

Returns a pointer on the kernelrevision (NULL-terminated ASCII-array).

Parameters

none

Return Value

*pointer	pointer to the address of array
----------	---------------------------------

Example

```
void OS_FAR Task1(void *data)
{
    U08 OS_FAR *Revision;

    .
    .
    while(1)
    {
        .
        Revision = OS_GetRev();
        .
    }
}
```

Dynamic-Memory

OS_MemoryInit

```
U08 OS_MemoryInit(OS_MEM OS_HUGE *mp, U32 size)
```

Initialize the dynamic memory management. This function must be called for the dynamic memory management at the system initialization once. The functions of the vigorous memory management can be used also without current kernel. ATTENTION! It is executed no checkup of the storage area.

Parameters

*mp	startaddress of memory-pool
size	size of memory-pool in bytes

Return Value

OS_NO_ERR	Memory pool positioned
OS_MEM_ERR	one of the parameters is ZERO

Example for LARGE memory in NEAR-model

```
void main(void)
{
    U08 state;

    .
    .
    state = OS_MemoryInit((OS_MEM OS_HUGE *) (0x10000000), 458750);
    .
    .
}
```

Example for model-known memory

```
U08 memorypool[MEMSIZE];

void main(void)
{
    U08 state;

    .
    state = OS_MemoryInit((OS_MEM OS_HUGE *) (memorypool), MEMSIZE);
    .
    .
}
```

OS_MemAlloc

U08 OS_MemAlloc(U08 OS_HUGE **MemPtr, U32 size)

Allocation of a required memory area.

Parameters

*MemPtr	pointer of pointer to get address of memory-area
size	size of needed memory in bytes

Return Value

OS_NO_ERR	memory successfully allocated
OS_MEM_ERR	size is ZERO or bigger as storage area of the processor
OS_MEM_OVF	not sufficiently free memory

Example

```
void OS_FAR Task1(void *data)
{
    U08 OS_HUGE *Addr_p;
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_MemAlloc(&Addr_p, 3800);
        .
    }
}
```

OS_MemFree

U08 OS_MemFree(OS_MEM OS_HUGE *MemPtr)

Release of an allocated memory area.

Parameters

*MemPtr	pointer to address of memory-area
---------	-----------------------------------

Return Value

OS_NO_ERR	memory successfully released
OS_MEM_ERR	Pointer is ZERO or not a valid allocation found

Example

```
void OS_FAR Task1(void *data)
{
    U08 OS_HUGE *Addr_p;
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_MemAlloc(&Addr_p, 3800);
        .
        .
        state = OS_MemFree((OS_MEM OS_HUGE *)Addr_p);
        .
    }
}
```

OS_MemFreeSize

U32 OS_MemFreeSize(void)

It returns the amount of free memory.

Parameters

none

Return Value

size	free size in memory-pool in bytes
------	-----------------------------------

Example

```
void OS_FAR Task1(void *data)
{
    U08 OS_HUGE *Addr_p;
    U32      fsize;
    U08      state;

    .
    .
    while(1)
    {
        .
        state = OS_MemAlloc(&Addr_p, 3800);
        .
        .
        fsize = OS_MemFreeSize();
        .
    }
}
```

Mailboxes

OS_MboxInit

U08 OS_MboxInit(OS_MBOX *pmbbox)

Initialization of a Mailbox. Through a mailbox any kind of data can pass by a pointer. On this, the recipient receives a pointer in the data field of the sender!

Parameters

*pmbbox	pointer to Mailbox
---------	--------------------

Return Value

OS_NO_ERR	Mailbox initialized
-----------	---------------------

Example

```
OS_MBOX MailBox1;

void main(void)
{
    U08 state;

    .
    .
    OS_Init();
    .
    state = OS_MboxInit(&MailBox1);
    .
}
```

OS_MboxPend

U08 OS_MboxPend(OS_MBOX *pmbbox, void OS_FAR *msg, U16 timeout)

Waits for a message from a mailbox. With OS_NO_SUSP, it immediately is come back even if no news was available and becomes with OS_SUSPEND as long as waited until a message is available, if necessary unending.

Parameters

*pmbbox	pointer to Mailbox
*msg	pointer to receiving parameter (U32)
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Message from Mailbox gotten
OS_MBOX_NODATA	no message in Mailbox (with OS_NO_SUSP)
OS_TIMEOUT	no message in Mailbox (after waits)

Example

```
OS_MBOX MailBox1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U32 Message;

    .
    .
    while(1)
    {
        .
        state = OS_MboxPend(&MailBox1, &Message, 200);
        .
    }
}
```

OS_MboxPendAbort

U08 OS_MboxPendAbort (OS_MBOX *pmbbox)

Aborts waiting of a receiving Tasks (highest waiting prio) on a Mailbox. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pmbbox	pointer to Mailbox
---------	--------------------

Return Value

OS_NO_ERR	pending of a task aborted
OS_TASK_NOT_EXIST	no pending task on this Maibox

Example

```
OS_MBOX MailBox1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_MboxPendAbort(&MailBox1);
        .
    }
}
```

OS_MboxPost

U08 OS_MboxPost(OS_MBOX *pmbbox, void OS_FAR *msg, U16 timeout)

Sends a message into a Mailbox. With OS_NO_SUSP, it immediately is come back even if the Mailbox was full and becomes with OS_SUSPEND as long as waited until the message can be written down, if necessary unending.

Parameters

*pmbbox	pointer to Mailbox
*msg	pointer to message (U32)
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Message in Mailbox sent
OS_MBOX_FULL	Mailbox fully (with OS_NO_SUSP)
OS_TIMEOUT	Mailbox fully (after waits)

Example

```
OS_MBOX MailBox1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U32 Message;

    .
    .
    while(1)
    {
        .
        Message =0x3076;
        state = OS_MboxPost(&MailBox1, &Message, OS_SUSPEND);
        .
    }
}
```

OS_MboxPostAbort

U08 OS_MboxPostAbort (OS_MBOX *pmbox)

Aborts waiting of a sending Tasks (highest waiting prio) on a Mailbox. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pmbox	pointer to Mailbox
--------	--------------------

Return Value

OS_NO_ERR	posting of a task aborted
OS_TASK_NOT_EXIST	no posting task on this Maibox

Example

```
OS_MBOX MailBox1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_MboxPostAbort(&MailBox1);
        .
    }
}
```

Queues

OS_QueueInit

```
U08 OS_QueueInit(OS_Q *pq, void OS_HUGE *buffer, U16 size)
```

Initialize a Queue. A Queue serves the byte-expels transfer of data at another process of the FIFO-prinzip. Within this Queue can <size> byte through the kernel buffer <*buffer> at other processes is handed over. The buffer can be generated through direct declaration (UBYTE buffer[size]) or through dynamic allocation. For the dynamic allocation in systems with segment-based memory management, the type declaration is OS_HUGE necessary in order to be able to go down well away with an area over segment borders.

Parameters

*pq	pointer to Queue
*buffer	pointer to kernel-buffer
size	size of kernel-buffer in bytes

Return Value

OS_NO_ERR	Queue initialized
-----------	-------------------

Example

```
OS_Q Queue1;  
U08 Q_Data1[256];  
  
void main(void)  
{  
    U08 state;  
  
    .  
    .  
    OS_Init();  
    .  
    state = OS_QueueInit(&Queue1, &Q_Data1[0], 256);  
    .  
}
```

OS_QueueInfo

U08 OS_QueueInfo(OS_Q *pq, U16 *size, U16 *used, U08 *prio)

Retrieval of the status of a Queue. Through this retrieval, miscellaneous parameters their initialization as well as their filling stand can be determined. Furthermore, the priority of the waiting tasks can be determined.

Parameters

*pq	pointer to Queue
*size	pointer to variable will get the size
*used	pointer to variable will get the used-bytes at this time
*prio	pointer to variable will get the priority of waiting Task (if zero - no Task is waiting)

Return Value

OS_NO_ERR	no mistake (for expansions)
-----------	-----------------------------

Example

```
OS_Q Queue1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U16 size;
    U16 used;
    U08 prio;

    .
    .
    while(1)
    {
        .
        state = OS_QueueInfo(&Queue1, &size, &used, &prio);
        .
    }
}
```

OS_QueuePend

U08 OS_QueuePend(OS_Q *pq, U08 OS_FAR *msg, U16 timeout)

Wait on one byte from a Queue. With OS_NO_SUSP, it immediately is come back even if no bytes were available and become with OS_SUSPEND as long as waited until one byte is available, if necessary unending.

Parameters

*pq	pointer to Queue
*msg	pointer to receiving Byte
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Byte from Queue gotten
OS_Q_NODATA	no byte in Queue (with OS_NO_SUSP)
OS_TIMEOUT	no byte in Queue (after waits)

Example

```
OS_Q Queue1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U08 Receive;

    .
    .
    while(1)
    {
        .
        state = OS_QueuePend(&Queue1, &Receive, 100);
        .
    }
}
```

OS_QueuePendAbort

U08 OS_QueuePendAbort (OS_Q *pq)

Aborts waiting of a receiving Tasks (highest waiting prio) on a Queue. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pq	pointer to Queue
-----	------------------

Return Value

OS_NO_ERR	pending of a task aborted
OS_TASK_NOT_EXIST	no pending task on this Queue

Example

```
OS_Q Queue1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_QueuePendAbort (&Queue1);
        .
    }
}
```

OS_QueuePost

U08 OS_QueuePost(OS_Q *pq, U08 msg, U16 timeout)

Sends one byte into a Queue. With OS_NO_SUSP, it immediately is come back even if the Queue was full and becomes with OS_SUSPEND as long as waited until the byte can be written down, if necessary unending.

Parameters

*pq	pointer to Queue
msg	byte to send
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Byte in Queue sent
OS_Q_FULL	Queue fully (with OS_NO_SUSP)
OS_TIMEOUT	Queue fully (after waits)

Example

```
OS_Q Queue1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U08 Message;

    .
    .
    while(1)
    {
        .
        Message = 0x6A;
        state = OS_QueuePost(&Queue1, Message, 5000);
        .
    }
}
```

OS_QueueFrontPost

U08 OS_QueueFrontPost(OS_Q *pq, U08 msg, U16 timeout)

Sends one byte at the beginning of a Queue. Consequently, this byte first is finished reading again by the recipient (cuts in line). With OS_NO_SUSP, it immediately is come back even if the Queue was full and becomes with OS_SUSPEND as long as waited until the byte can be written down, if necessary unending.

Parameters

*pq	pointer to Queue
msg	byte to send
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Byte in Queue sent
OS_Q_FULL	Queue fully (with OS_NO_SUSP)
OS_TIMEOUT	Queue fully (after waits)

Example

```
OS_Q Queue1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U08 Message;

    .
    .
    while(1)
    {
        .
        Message = 0x2D;
        state = OS_QueueFrontPost(&Queue1, Message, OS_NO_SUSP);
        .
    }
}
```

OS_QueuePostAbort

U08 OS_QueuePostAbort(OS_Q *pq)

Aborts waiting of a sending Tasks (highest waiting prio) on a Queue.
It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pq	pointer to Queue
-----	------------------

Return Value

OS_NO_ERR	posting of a task aborted
OS_TASK_NOT_EXIST	no posting task on this Queue

Example

```
OS_Q Queue1;  
  
void OS_FAR Task1(void *data)  
{  
    U08 state;  
  
    .  
    .  
    while(1)  
    {  
        .  
        state = OS_QueuePostAbort(&Queue1);  
        .  
    }  
}
```

OS_QueueClear

U08 OS_QueueClear(OS_Q *pq)

Deletes the content of a Queue and reactivates a waiting posting-process. This function can be used to reactivate the datatransfer after a hang-on. The deleted data get lost on that occasion.

Parameters

*pq	pointer to Queue
-----	------------------

Return Value

OS_NO_ERR	content of Queue deleted
-----------	--------------------------

Example

```
OS_Q Queue1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        .
        state = OS_QueueClear(&Queue1);
        .
    }
}
```

Pipes

OS_PipeInit

```
U08 OS_PipeInit(OS_P *pp, void OS_HUGE *buffer, U16 size, U08 deep)
```

Initialize a Pipe. A Pipe serves transfer of data of the package manners at another process of the FIFO-prinzip. Within this Pipe can at max <deep> package with ever at max <size> byte one packet through the kenrnel-buffer <*buffer> at another process is handed over. The Buffer can be generated through direct declaration (UBYTE Buffer[(size+2)*deep]) or through dynamic memory allocation. For the dynamic allocation in systems with segment-based memory management, the type declaration is OS_HUGE necessary in order to be able to go down well away with an area over segment borders. The additional length of 2 bytes per package is required for the storage of the package length.

Parameters

*pp	pointer to Pipe
*buffer	pointer to kernel-buffer
size	max size of data-bytes per paket
deep	max pakets in pipe

Return Value

OS_NO_ERR	Pipe initialized
-----------	------------------

Example

```
OS_P Pipe1;

U08 P_Data1[(MAXPAKET+2)*8];

void main(void)
{
    U08 state;

    .
    .
    OS_Init();
    .
    state = OS_PipeInit(&Pipe1, P_Data1, MAXPAKET+2, 8);
    .
}
```

OS_PipeInfo

```
U08 OS_PipeInfo(OS_P *pp, U16 *size, U08 *deep, U08 *used, U08 *prio)
```

Retrieval of the status of a Pipe. Through this retrieval, miscellaneous parameters of their initialization as well as their filling stand can be determined. Furthermore, the priority of the waiting Tasks can be determined.

Parameters

*pp	pointer to Pipe
*size	pointer to variable will get the size per paket
*deep	pointer to variable will get the max pakets in pipe
*used	pointer to variable will get the used-pakets at this time
*prio	pointer to variable will get the priority of waiting Task (if zero - no Task is waiting)

Return Value

OS_NO_ERR	no mistake (for expansions)
-----------	-----------------------------

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U16 size;
    U08 deep;
    U08 used;
    U08 prio;

    .
    .
    while(1)
    {
        .
        state = OS_PipeInfo(&Pipe1, &size, &deep, &used, &prio);
        .
    }
}
```

OS_PipePend

```
U08 OS_PipePend(OS_P *pp, U08 OS_HUGE *msg, U16 *lng, U16 timeout)
```

Waits on a data package from a Pipe. The receiver-buffer must be included sufficiently big in order to be able to pick up the package. Since the receiver-buffer can also be dynamically allocated, the type declaration is OS_HUGE necessary on the other hand in order to be able to go down well away with an area over segment borders. With OS_NO_SUSP, it immediately is come back even if no package was available and becomes with OS_SUSPEND as long as waited until one package is available, if necessary unending.

Parameters

*pp	pointer to Pipe
*msg	pointer to receiving array
*lng	pointer to variable will get the lenght of paket
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Package from Pipe gotten
OS_P_NODATA	no package in Pipe (with OS_NO_SUSP)
OS_TIMEOUT	no package in Pipe (after waits)

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U16 rLenght;
    U08 Receive[1024];

    .
    .
    while(1)
    {
        .
        state = OS_PipePend(&Pipe1, Receive, &rLenght, OS_SUSPEND);
        .
    }
}
```

OS_PipePendAbort

U08 OS_PipePendAbort(OS_P *pp)

Aborts waiting of a receiving Tasks (highest waiting prio) on a Pipe. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pp	pointer to Pipe
-----	-----------------

Return Value

OS_NO_ERR	pending of a task aborted
OS_TASK_NOT_EXIST	no pending task on this Pipe

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_PipePendAbort(&Pipe1);
        .
    }
}
```

OS_PipePost

U08 OS_PipePost(OS_P *pp, U08 OS_HUGE *msg, U16 lenght, U16 timeout)

Sends one package into a Pipe. So the transmitter-buffer also dynamically allocated can be, the type declaration is OS_HUGE necessary on the other hand in order to be able to go down well away with an area over segment borders. With OS_NO_SUSP, it immediately is come back even if the Pipe was full and becomes with OS_SUSPEND as long as waited until the package can be written down, if necessary unending.

Parameters

*pp	pointer to Pipe
*msg	pointer to data-paket
lenght	lenght of data-paket
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Package in Pipe sent
OS_P_FULL	Pipe fully (with OS_NO_SUSP)
OS_P_LEN_ERR	Package too long
OS_TIMEOUT	Pipe fully (after waits)

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U08 Message[]={"Hello World!";

    .
    .
    while(1)
    {
        .
        .
        state = OS_PipePost(&Pipe1, Message, strlen(Message), 500);
        .
    }
}
```

OS_PipeFrontPost

U08 OS_PipeFrontPost(OS_P *pp, U08 OS_HUGE *msg, U16 lenght, U16 timeout)

Sends one package at the beginning of a Pipe. Consequently, this package first is finished reading again by the recipient (cuts in line). Since the transmitter-buffer can also be dynamically allocated, the type declaration is OS_HUGE necessary on the other hand in order to be able to go down well away with an area over segment borders. With OS_NO_SUSP, it immediately is come back even if the Pipe was full and becomes with OS_SUSPEND as long as waited until the package can be written down, if necessary unending.

Parameters

*pp	pointer to Pipe
*msg	pointer to data-paket
lenght	lenght of data-paket
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Package in Pipe sent
OS_P_FULL	Pipe fully (with OS_NO_SUSP)
OS_P_LEN_ERR	Package too long
OS_TIMEOUT	Pipe fully (after waits)

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;
    U08 Message[]={"Hallo Welt !"};

    .
    .
    while(1)
    {
        .
        .
        state = OS_PipeFrontPost(&Pipe1, Message, strlen(Message), OS_NO_SUSP);
        .
    }
}
```

OS_PipePostAbort

U08 OS_PipePostAbort(OS_P *pp)

Aborts waiting of a sending Tasks (highest waiting prio) on a Pipe. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pp	pointer to Pipe
-----	-----------------

Return Value

OS_NO_ERR	posting of a task aborted
OS_TASK_NOT_EXIST	no posting task on this Pipe

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_PipePostAbort(&Pipe1);
        .
    }
}
```

OS_PipeClear

U08 OS_PipeClear(OS_P *pp)

Deletes the content of a Pipe and reactivates a waiting transmitter-process. This function can be used to reactivate the datatransfer after a hang-on. The deleted packages get lost on that occasion.

Parameters

*pp	pointer to Pipe
-----	-----------------

Return Value

OS_NO_ERR	Pipe-content deleted
-----------	----------------------

Example

```
OS_P Pipe1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        .
        state = OS_PipeClear(&Pipe1);
        .
    }
}
```

Semaphores

OS_SemInit

U08 OS_SemInit(OS_SEM *psem, U16 cnt)

Initialize a Semaphore. One semaphore serves the process-synchronisation. Two variations of the utilization belong semaphores to it to one.

- binary: for example the synchronisation of accesses on common resources/variables
- counting: Attendants on entering of a signal, to the control of the sequence of processes.

With a binary semaphore, a state-machine can become protected before simultaneous accesses of different processes (Read/Write), for example. So, inconsistent conditions or data are avoided. Can appear however in some cases *Priority Inversion*, occupied i.e. this a low Task the resource, a higher Task therefore must wait and then for example through an INT a middle Task (and its heirs) whom lower Task interrupts for an uncertain time. In such a case, it is initialized the semaphores with 1 as cnt, the access asked by means of OS_SemPend and released again by means of OS_SemPost.

With a counting semaphore, arriving is signalled by events. So, a process can wait for a signal to pause about the sequence of processes. By means of OS_SemAccept, also the number of the meanwhile entered events can be determined on that occasion. In such a case, it is initialized the semaphores with 0 as cnt, waited on the event by means of OS_SemPend or OS_SemAccept and reported the event by means of OS_SemPost.

Parameters

*psem	pointer to Semaphore
-------	----------------------

Return Value

OS_NO_ERR	Semaphore initialized
-----------	-----------------------

Example

```
OS_SEM Statel;  
  
void main(void)  
{  
    U08 state;  
  
    .  
    .  
    OS_Init();  
    .  
    state = OS_SemInit(&Statel, 1);  
    .  
}
```

OS_SemPend

U08 OS_SemPend(OS_SEM *psem, U16 timeout)

Reserve one on the protected resource semaphore and consequently the access as well as wait for an event. With OS_NO_SUSP, it immediately is come back even if was not freely the semaphores as well as no event was available and becomes with OS_SUSPEND as long as waited until the semaphores the event could be reserved as well as could happen, if necessary unending.

Parameters

*psem	pointer to Semaphore
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Semaphore reserve / event was available
OS_SEM_NODATA	Semaphore occupy / no event (with OS_NO_SUSP)
OS_TIMEOUT	Semaphore occupy / no event (after waits)

Example

```
OS_SEM  Statel;  
  
void OS_FAR Task1(void *data)  
{  
    U08  state;  
  
    .  
    .  
    while(1)  
    {  
        .  
        state = OS_SemPend(&Statel, OS_SUSPEND);  
        .  
        .  
    }  
}
```

OS_SemPendAbort

U08 OS_SemPendAbort (OS_SEM *psem)

Aborts waiting of a Tasks (highest waiting prio) on a Semaphore. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*psem	pointer to Semaphore
-------	----------------------

Return Value

OS_NO_ERR	pending of a task aborted
OS_TASK_NOT_EXIST	no pending task on this Semaphore

Example

```
OS_SEM  State1;

void OS_FAR Task1(void *data)
{
    U08  state;

    .
    .
    while(1)
    {
        .
        state = OS_SemPendAbort(&State1);
        .
    }
}
```

OS_SemAccept

U08 OS_SemAccept(OS_SEM *psem, U16 *cnt, U16 timeout)

It is used as Event-Counter with utilization of the semaphores. The Semaphore-counter is not influenced on that occasion. If the counter bigger than 0 the current counter will return. With OS_NO_SUSP, it immediately is come back even if the semaphoren-counter 0 is and becomes with OS_SUSPEND as long as waited until the event once appeared, if necessary unending.

Parameters

*psem	pointer to Semaphore
*cnt	pointer to variable will get the counter-value
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Event min. 1 times happened
OS_SEM_NODATA	Counter immediately 0 (with OS_NO_SUSP)
OS_TIMEOUT	Counter immediately 0 (after waits)

Example

```
OS_SEM  Event1;

void OS_FAR Task1(void *data)
{
    U08  state;
    U16  EventCnt;

    .
    .
    while(1)
    {
        .
        state = OS_SemAccept(&Event1, &EventCnt, 500);
        .
    }
}
```

OS_SemPost

U08 OS_SemPost (OS_SEM *psem)

Gives a retiring semaphore and consequently the access to the protected resource again freely as well as signals an event.

Parameters

*psem	pointer to Semaphore
-------	----------------------

Return Value

OS_NO_ERR	Semaphores released / event reported
OS_SEM_OVF	Error in the Semaphore-handling (Counter too big)

Example

```
OS_SEM  State1;

void OS_FAR Task1(void *data)
{
    U08  state;

    .
    .
    while(1)
    {
        .
        .
        state = OS_SemPost(&State1);
        .
    }
}
```

OS_SemClear

U08 OS_SemClear(OS_SEM *psem)

Deletes the Counter of the semaphore. This function can be used to reset a counting-semaphore or for error-handling to restart the semaphore-handling. With application of binary semaphore to the control of accesses on a protected resource must be released the semaphore in the connection with application to the mistake-handling by OS_SemPost so much times, how simultaneously processes can access the resource.

Parameters

*psem	pointer to Semaphore
-------	----------------------

Return Value

OS_NO_ERR	count of semaphore reset to 0
-----------	-------------------------------

Example

```
OS_SEM State1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_SemClear(&State1);
        .
    }
}
```

Mutexes

OS_MutexCreate

U08 OS_MutexCreate(OS_MUX *pmux, U08 prio)

Aims as well as initializing of a Mutex (Mutual-Exclusion). A Mutex serves the synchronisation of accesses to common resources/variables. With a Mutex, state-machines are protected from simultaneous accesses of different processes (Read/Write), for example. The second process must wait, until the first process finished his access (Read/Write). So, inconsistent conditions or data are avoided. In contrast to the utilization of semaphores, the effect of the *Priority Inversion* cannot kick open on that occasion here. The priority of the Mutex must be included higher, as the highest priority of the Tasks accessing it. The Mutex is written down as not current Task, so under the same priority no other Task can run.

Parameters

*pmux	pointer to Mutex
-------	------------------

Return Value

OS_NO_ERR	Mutex written down and initialized
-----------	------------------------------------

Example

```
OS_MUX  Mutex1;

void main(void)
{
    U08  state;

    .
    .
    OS_Init();
    .
    state = OS_MutexCreate(&Mutex1, 10);
    .
}
```

OS_MutexPend

U08 OS_MutexPend(OS_MUX *pmux, U16 timeout)

Reserve a Mutex and consequently the access on the protected resource. With OS_NO_SUSP, it immediately is come back even if the Mutex was not free and becomes with OS_SUSPEND as long as waited until the Mutex could be reserved, if necessary unending.

Parameters

*pmux	pointer to Mutex
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Mutex reserved
OS_MUX_NOACC	Mutex is occupied (with OS_NO_SUSP)
OS_TIMEOUT	Mutex is occupied (after waits)
OS_MUX_ERR	Error in Mutex-handling

Example

```
OS_MUX  Mutex1;

void OS_FAR Task1(void *data)
{
    U08  state;

    .
    .
    while(1)
    {
        .
        state = OS_MutexPend(&Mutex1, OS_SUSPEND);
        .
        .
    }
}
```

OS_MutexPendAbort

U08 OS_MutexPendAbort(OS_MUX *pmux)

Aborts waiting of a Tasks (highest waiting prio) on a Mutex.
It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pmux	pointer to Mutex
-------	------------------

Return Value

OS_NO_ERR	pending of a task aborted
OS_TASK_NOT_EXIST	no pending task on this Mutex

Example

```
OS_MUX  Mutex1;

void OS_FAR Task1(void *data)
{
    U08  state;

    .
    .
    while(1)
    {
        .
        state = OS_MutexPendAbort(&Mutex1);
        .
    }
}
```

OS_MutexPost

U08 OS_MutexPost (OS_MUX *pmux)

Gives a reserved Mutex free and again the access on the protected resource.

Parameters

*pmux	pointer to Mutex
-------	------------------

Return Value

OS_NO_ERR	Mutex released
OS_MUX_ERR	Error in Mutex-handling

Example

```
OS_MUX  Mutex1;

void OS_FAR Task1(void *data)
{
    U08  state;

    .
    .
    while(1)
    {
        .
        .
        state = OS_MutexPost (&Mutex1);
        .
    }
}
```

Event-Groups

OS_EvgInit

U08 OS_EvgInit(OS_EVG *pevg)

Initialize an Eventgroup. An Eventgroup consists individually can be processed of 32 single-events, that summarized in an ULONG, as also grouped. Each Event within the group can report the appearance of an event, however any statement about it doesn't meet, how often the event appeared in the meantime. In order to also be able to count events, you must be used semaphores as Counting-Semaphore for every individual event. (semaphore with 0 initialize, at appearance of the event "OS_SemPost" and when wait "OS_SemAccept")

Parameters

*pevg	pointer to Eventgroup
-------	-----------------------

Return Value

OS_NO_ERR	Event-group initialized
-----------	-------------------------

Example

```
OS_EVG Events1;

void main(void)
{
    U08 state;

    .
    .
    OS_Init();
    .
    state = OS_EvgInit(&Events1);
    .
}
```

OS_EvgPost

U08 OS_EvgPost(OS_EVG *pevg, U32 events, U08 mode)

Report the appearance an as well as several Events of an Eventgroup. The bit mask is interpreted as OR of the Events on that occasion. I.e. all Events, that are set in the bit mask, are reported. Mode is used the utilization of this function for the erasure of Events.

Parameters

*pevg	pointer to Eventgroup
events	bit-mask of events
mode	mode of usement "OS_EVG_OR / OS_EVG_CLR"

Return Value

OS_NO_ERR	Event(s) reported
-----------	-------------------

Example

```
OS_EVG Events1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_EvgPost(&Events1, ~0x00101000, OS_EVG_CLR); // clear this events
        state = OS_EvgPost(&Events1, 0x01000100, OS_EVG_OR); // set this events
        .
    }
}
```

OS_EvgPend

U08 OS_EvgPend(OS_EVG *pevg, U32 *events, U08 mode, U16 timeout)

Waits on one as well as several Events of an Eventgroup. The bit mask is interpreted modes as connection of the Events on that occasion together with him. I.e., already an Event, that is set in the bit mask, is enough with OS_EVG_OR for the function and with OS_EVG_AND, all Events, that are set in the bit mask, had to arrive. For a special case events of an Eventgroup can wake up multiple tasks at once. For this the Eventgroup differs on EvgPend and EvgPost between "OS_EVG_OR_C / OS_EVG_AND_C" for normal use (consuming event) or just "OS_EVG_OR / OS_EVG_AND" to wake up multiple tasks. But the events are then manually to delete again by a task. After returning the bit mask contains the occurred events that triggered the return. With OS_NO_SUSP, it immediately is come back even if no Event appeared and becomes with OS_SUSPEND as long as waited until the Event(s) appeared, if necessary indefinitely.

Parameters

*pevg	pointer to Eventgroup
*events	pointer to bit-mask of events waiting for, returns the events on return
mode	mode of usement "OS_EVG_OR_C / OS_EVG_AND_C"
timeout	kernel-ticks as waiting-time (1...65534)

Return Value

OS_NO_ERR	Event(s) appeared
OS_EVG_NOE	Event(s) not appeared (with OS_NO_SUSP)
OS_TIMEOUT	Event(s) not appeared (after waits)

Example

```
OS_EVG  Events1;

void OS_FAR Task1(void *data)
{
    U32  event;
    U08  state;

    .
    .
    while(1)
    {
        .
        event = 0x00100100;
        state = OS_EvgPend(&Events1, &event, OS_EVG_OR_C, OS_SUSPEND);
        .
    }
}
```

OS_EvgPendAbort

U08 OS_EvgPendAbort (OS_EVG *pevg)

Aborts waiting of a task (highest waiting prio) onto a Eventgroup. It is only the waiting task with the highest priority quasi "premature" to TimeOut forwarded.

Parameters

*pevg	pointer to Eventgroup
-------	-----------------------

Return Value

OS_NO_ERR	pending of a task aborted
OS_TASK_NOT_EXIST	no pending task on this eventgroup

Example

```
OS_EVG Events1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_EvgPendAbort (&Events1);
        .
    }
}
```

Timer-Service

OS_TimerCreate

```
U08 OS_TimerCreate(OS_TMR *ptmr, U32 time, void(*tFct)(void *), void *tArg, U08 mode)
```

Creating / initialize a timer.

A timer can e.g. for subsequent purposes:

- timeouts within protocol layers and applications such as TCP / IP, X25, HTTP, FTP, ...
- prevent the "starvation" of tasks by defining a timeout and corresponding measures such as priority raising or other
- Periodic management of services
- soft-deadline / watchdog of services

As *mode* subsequent details can be made:

- OS_TMR_ENABLE - starts the Timer immediately
- OS_TMR_RONCE - Timer is of type "run-once", this means single timeout and after it is automatically disabled, but remains registered
- OS_TMR_CYCL - Timer is of type "cyclic / periodic" this means the timer will automatically restarted after each timeout
- OS_TMR_CLR - Timer is of type "run-once auto-erase," this means the timer is single timeout and is automatically deleted and must be created new for further use

It is OS_TMR_CLR the scheme goes before OS_TMR_CYCL and this before OS_TMR_RONCE.

The registered callback function should be as short as possible. For information-sharing an argument can be used.

Parameters

*ptmr	pointer to Timer
time	timeout of this timer (in timer-ticks)
tFct	address of timeout-callback function
tArg	argument of timeout-callback function
mode	mode of this timer (run-once / cyclic / auto-clear)

Return Value

OS_NO_ERR	Timer registered and initialized
OS_TMR_NO_TIME	no valid time a parameter given (time == 0)
OS_TMR_EXIST	Timer was still registered and initialized

Example

```
OS_TMR Timer1;

void TCP_To_CB(void *session)
{
    OS_QueuePost(&TCPIP_To_Q, (U08)session, OS_NO_SUSP);
}

U08 TCP_send(void)
{
    U08 state;
    U08 session;

    .
    .
    state = OS_TimerCreate(&Timer1, 30, TCP_To_CB, &session, OS_TMR_ENABLE | OS_TMR_CLR);
    .
}
```


OS_TimerDelete

U08 OS_TimerDelete(OS_TMR *ptmr)

Deactivate and delete a Timer.

Parameters

*ptmr	pointer to Timer
-------	------------------

Return Value

OS_NO_ERR	Timer deleted
OS_TMR_NOT_EXIST	the Timer was not registered

Example

```
OS_TMR Timer1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TimerDelete(&Timer1);
        .
        .
    }
}
```

OS_TimerStart

U08 OS_TimerStart(OS_TMR *ptmr, U32 time)

Starts a deactivated, restart a run-once or restart a running Timer.

Parameters

*ptmr	pointer to Timer
time	new timeout (if not zero) of this timer (in timer-ticks)

Return Value

OS_NO_ERR	Timer (re-)started
OS_TMR_NOT_EXIST	the Timer is not registered

Example

```
OS_TMR Timer1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        state = OS_TimerStart(&Timer1, 0);
        .
        .
    }
}
```

OS_TimerStop

U08 OS_TimerStop(OS_TMR *ptmr)

Stops / deactivat a running Timer.

Parameters

*ptmr	pointer to Timer
-------	------------------

Return Value

OS_NO_ERR	Timer stopped
OS_TMR_NOT_EXIST	the Timer is not registered

Example

```
OS_TMR Timer1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        .
        state = OS_TimerStop(&Timer1);
        .
    }
}
```

OS_TimerGetState

U08 OS_TimerGetState(OS_TMR *ptmr)

Returns the status of a created timer.

The following information is provided:

- OS_TMR_ENABLE - the Timer is actually running
- OS_TMR_RONCE - Timer is of type "run-once", this means single timeout and after it is automatically disabled, but remains registered
- OS_TMR_CYCL - Timer is of type "cyclic / periodic" this means the timer will automatically restarted after each timeout
- OS_TMR_CLR - Timer is of type "run-once auto-erase," this means the timer is single timeout and is automatically deleted and must be created new for further use

If in the returns status not OS_TMR_ENABLE but OS_TMR_CLR, the timer was never created or the timer was "run-once auto-erase" and the time had expired.

Parameters

*ptmr	pointer to Timer
-------	------------------

Return Value

status	status of the timers (see "modi" on OS_TimerCreate)
--------	---

Example

```
OS_TMR Timer1;

void OS_FAR Task1(void *data)
{
    U08 state;

    .
    .
    while(1)
    {
        .
        .
        state = OS_TimerGetState(&Timer1);
        if(state & OS_TMR_ENABLE)
        {
            .
            .
        }
        .
    }
}
```

OS_TimerGetRemain

U32 OS_TimerGetRemain(OS_TMR *ptmr)

Returns the remaining time (in timer-ticks) of a running timer.
Is the returned time equal to 0, the timer was expired or was never activated by OS_TimerCreate.

Parameters

*ptmr	pointer to Timer
-------	------------------

Return Value

time	remaining time in timer-ticks
------	-------------------------------

Example

```
OS_TMR Timer1;

void OS_FAR Task1(void *data)
{
    U32 rtime;

    .
    .
    while(1)
    {
        .
        .
        rtime = OS_TimerGetRemain(&Timer1);
        .
    }
}
```

System-Ticks

OS_TimeSet

```
void OS_TimeSet(U32 ticks)
```

Places the kernel-internal Tick-Counter on handed over value.

Parameters

ticks	new value of tick-counter
-------	---------------------------

Return Value

none

Example

```
void OS_FAR Task1(void *data)
{
    .
    .
    while(1)
    {
        .
        OS_TimeSet(24837);
        .
    }
}
```

OS_TimeGet

U32 OS_TimeGet(void)

It returns the current value of the kernel-internal Tick-Counter.

Parameters

none

Return Value

ticks	actual value of tick-counter
-------	------------------------------

Example

```
void OS_FAR Task1(void *data)
{
    U32 time;

    .
    .
    while(1)
    {
        .
        time = OS_TimeGet();
        .
    }
}
```

Interrupts

OS_IntEnter

```
void OS_IntEnter(void)
```

Register an Interrupt-Level. No contextswitch are generated by it. This function is necessary for C-Code ISRs.

Parameters

none

Return Value

none

Example

```
void OS_FAR ISR1(void)
{
    OS_IntEnter();
    .
    .
    .
    OS_IntExit();
}
```

OS_IntExit

```
void OS_IntExit(void)
```

Unregister an Interrupt-Level. Contextswitches are generated again by it. This function is necessary for C-Code ISRs.

Parameters

none

Return Value

none

Example

```
void OS_FAR ISR1(void)
{
    OS_IntEnter();
    .
    .
    .
    OS_IntExit();
}
```

History

OS_HistoryPost

U08 OS_HistoryPost(U32 param1, U32 param2)

Writes down an entry into the History-Table of the kernel. Additional to the two parameters still becomes the priority of the Tasks and the Tick-Counter, as time stamps, written down.

Parameters

param1	first 32-bit parameter for table
param2	second 32-bit parameter for table

Return Value

OS_NO_ERR	Entry written
-----------	---------------

Example

```
OS_Q Queue5;

void OS_FAR Task2(void *data)
{
    U08 state;
    U08 Message;

    .
    .
    while(1)
    {
        .
        Message = 0x2D;
        state = OS_QueueFrontPost(&Queue5, Message, 200);
        if(state != OS_NO_ERR)
            OS_HistoryPost((U32)state, 0x0205);
        .
    }
}
```

OS_HistoryRead

U08 OS_HistoryRead(U32 *param1, U32 *param2, U08 *prio, U32 *time)

Reads next entry from the History-Table of the kernel and deletes this on that occasion.

Parameters

*param1	pointer to variable will get the first 32-bit parameter
*param2	pointer to variable will get the second 32-bit parameter
*prio	pointer to variable will get priority of task who has this written
*time	pointer to variable will get time-stamp of this entry

Return Value

OS_NO_ERR	Entry read
OS_HIS_END	no entry existing

Example

```
void OS_FAR Task3(void *data)
{
    U08 state;
    U32 Hpara1;
    U32 Hpara2;
    U08 Tprio;
    U32 stamp;

    .
    .
    while(1)
    {
        .
        state = OS_HistoryRead(&Hpara1, &Hpara2, &Tprio, &stamp);
        .
    }
}
```

Comments

Comments

Comments
