
Freescale MQX™ RTOS – Reference Manual

MQXRM
Rev. 16
02/2014



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Revision History

To provide the most up-to-date information, the revision of our documents on the World Wide Web will be the most current. Your printed copy may be an earlier revision. To verify you have the latest information available, refer to freescale.com and navigate to Design Resources>Software and Tools>All Software and Tools>Freescale MQX Software Solutions.

The following revision history table summarizes changes contained in this document.

Revision Number	Revision Date	Description of Changes
Rev. 0	01/2009	Initial Release coming with MQX 3.0
Rev. 1	05/2009	Minor formatting updates.
Rev. 2	09/2009	Formatting significantly updated for MQX 3.4 Release. Autoclear feature of <code>_lwevent_set_auto_clear</code> .
Rev. 3	01/2010	Update coming with MQX 3.5. <code>_lwevent_wait</code> description updated.
Rev. 4	08/2010	Update of <code>_lwevent_xxx</code> & <code>_time_diff_xxx</code> sections.
Rev. 5	11/2010	Update of the following sections: <code>_time_diff_ticks</code> <code>_task_create_xxx</code> <code>_task_get_template_ptr</code> <code>_mem_alloc</code> <code>_lwmem_alloc</code> <code>_lwevent_get_signalled</code> (chapter added)
Rev. 6	04/2011	Update of <code>_time_get_ticks_per_sec</code> , <code>_lwmsgq_init</code> and <code>_sem_open</code> and <code>_time_delay</code> sections.
Rev. 7	12/2011	<code>_ipc_task</code> function and <code>IPC_PROTOCOL_INIT_STRUCT</code> description updated. <code>IPC_INIT_STRUCT</code> description added. <code>_lwevent_wait...</code> and <code>_mqx_exit</code> chapters updated. "Function Listing Format" section updated by the User Mode specific function parameter categories. <code>_mem_set_pool_access</code> , <code>_usr_lwevent_*</code> , <code>_usr_lwmem_*</code> , <code>_usr_lwsem_*</code> , <code>_usr_task_*</code> , <code>_usr_time_*</code> sections added.
Rev. 8	06/2012	<code>_lwtimer_add_timer_to_queue()</code> , <code>_msgq_send_queue</code> and <code>_task_stop_preemption()</code> function descriptions updated.
Rev. 9	12/2012	Update reflecting changes in the MQX code and the source tree structure (paths, prototypes, file names, etc.)

Revision Number	Revision Date	Description of Changes
Rev. 10	04/2013	<p>_lwmsgq_send and _lwmsgq_receive function descriptions updated.</p> <p>Cautions added to all _DCACHE_xxx sections.</p> <p>Task Error Codes of _msgq_send_broadcast, _lwmem_alloc, _lwmem_alloc_*_from and _mem_alloc sections updated.</p> <p>Error codes of _mutex_destroy, _lwmem_free and _mem_test functions updated.</p> <p>Return values of the _mutatr_init, _mem_extend_pool and _mem_extend functions updated.</p> <p>_lwmem_alloc and _lwmem_alloc_*_from sections updated.</p>
Rev. 11	05/2013	<p>Added description of following functions:</p> <p>_mem_alloc_system_align</p> <p>_mem_alloc_system_align_from</p> <p>_lwmem_alloc_system_align</p> <p>_lwmem_alloc_system_align_from</p>
Rev. 12	06/2013	Made corrections to various _mmu_ functions.
Rev. 13	08/2013	Added _psp_push_fp_context and _psp_pop_fp_context.
Rev. 14	10/2013	Updated _lwmem_alloc_*_from, _mem_alloc ..., and _time_get_resolution, _time_set_resolution
Rev. 15	01/2014	Added C99 types.

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Chapter 1

Before You Begin

1.1	About MQX	15
1.2	About This Book	15
1.3	Function Listing Format	15
1.4	Conventions	17
1.4.1	Tips	17
1.4.2	Notes	17
1.4.3	Cautions	17

Chapter 2

MQX Functions and Macros

2.1	MQX Function Overview	19
2.1.1	_DCACHE_DISABLE	21
2.1.2	_DCACHE_ENABLE	22
2.1.3	_DCACHE_FLUSH	23
2.1.4	_DCACHE_FLUSH_LINE	24
2.1.5	_DCACHE_FLUSH_MLINES	25
2.1.6	_DCACHE_INVALIDATE	26
2.1.7	_DCACHE_INVALIDATE_LINE	27
2.1.8	_DCACHE_INVALIDATE_MLINES	28
2.1.9	_event_clear	29
2.1.10	_event_close	31
2.1.11	_event_create, _event_create_auto_clear	32
2.1.12	_event_create_component	34
2.1.13	_event_create_fast, _event_create_fast_auto_clear	36
2.1.14	_event_destroy	38
2.1.15	_event_destroy_fast	40
2.1.16	_event_get_value	41
2.1.17	_event_get_wait_count	43
2.1.18	_event_open	44
2.1.19	_event_open_fast	46
2.1.20	_event_set	47
2.1.21	_event_test	49
2.1.22	_event_wait_all	50
2.1.23	_event_wait_any	52
2.1.24	_ICACHE_DISABLE	54
2.1.25	_ICACHE_ENABLE	55
2.1.26	_ICACHE_INVALIDATE	56
2.1.27	_ICACHE_INVALIDATE_LINE	57
2.1.28	_ICACHE_INVALIDATE_MLINES	58
2.1.29	_int_default_isr	59
2.1.30	_int_disable, _int_enable	60
2.1.31	_int_exception_isr	61

2.1.32 _int_get_default_isr	62
2.1.33 _int_get_exception_handler	63
2.1.34 _int_get_isr	64
2.1.35 _int_get_isr_data	65
2.1.36 _int_get_isr_depth	66
2.1.37 _int_get_kernel_isr	67
2.1.38 _int_get_previous_vector_table	68
2.1.39 _int_get_vector_table	69
2.1.40 _int_install_default_isr	70
2.1.41 _int_install_exception_isr	71
2.1.42 _int_install_isr	72
2.1.43 _int_install_kernel_isr	74
2.1.44 _int_install_unexpected_isr	75
2.1.45 _int_kernel_isr	76
2.1.46 _int_set_exception_handler	77
2.1.47 _int_set_isr_data	78
2.1.48 _int_set_vector_table	79
2.1.49 _int_unexpected_isr	80
2.1.50 _psp_push_fp_context	81
2.1.51 _psp_pop_fp_context	82
2.1.52 _ipc_add_io_ipc_handler	83
2.1.53 _ipc_add_ipc_handler	84
2.1.54 _ipc_msg_processor_route_exists	85
2.1.55 _ipc_msg_route_add	86
2.1.56 _ipc_msg_route_remove	87
2.1.57 _ipc_pcb_init	88
2.1.58 _ipc_task	90
2.1.59 _klog_control	91
2.1.60 _klog_create, _klog_create_at	93
2.1.61 _klog_disable_logging_task, _klog_enable_logging_task	95
2.1.62 _klog_display	96
2.1.63 _klog_get_interrupt_stack_usage	97
2.1.64 _klog_get_task_stack_usage	99
2.1.65 _klog_show_stack_usage	100
2.1.66 _log_create	101
2.1.67 _log_create_component	103
2.1.68 _log_destroy	104
2.1.69 _log_disable, _log_enable	105
2.1.70 _log_read	106
2.1.71 _log_reset	108
2.1.72 _log_test	109
2.1.73 _log_write	110
2.1.74 _lwevent_clear	111
2.1.75 _lwevent_create	112
2.1.76 _lwevent_destroy	113

2.1.77 _lwevent_get_signalled	114
2.1.78 _lwevent_set	116
2.1.79 _lwevent_set_auto_clear	117
2.1.80 _lwevent_test	118
2.1.81 _lwevent_wait ...	119
2.1.82 _lwlog_calculate_size	121
2.1.83 _lwlog_create, _lwlog_create_at	122
2.1.84 _lwlog_create_component	124
2.1.85 _lwlog_destroy	125
2.1.86 _lwlog_disable, _lwlog_enable	126
2.1.87 _lwlog_read	127
2.1.88 _lwlog_reset	128
2.1.89 _lwlog_test	129
2.1.90 _lwlog_write	130
2.1.91 _lwmem_alloc ...	131
2.1.92 _lwmem_alloc_*_from	134
2.1.93 _lwmem_create_pool	136
2.1.94 _lwmem_free	137
2.1.95 _lwmem_get_size	139
2.1.96 _lwmem_set_default_pool	140
2.1.97 _lwmem_test	141
2.1.98 _lwmem_transfer	142
2.1.99 _lwmsgq_deinit	143
2.1.100 _lwmsgq_init	144
2.1.101 _lwmsgq_receive	145
2.1.102 _lwmsgq_send	147
2.1.103 _lwsem_create	148
2.1.104 _lwsem_destroy	150
2.1.105 _lwsem_poll	151
2.1.106 _lwsem_post	152
2.1.107 _lwsem_test	153
2.1.108 _lwsem_wait ...	154
2.1.109 _lwtimer_add_timer_to_queue	156
2.1.110 _lwtimer_cancel_period	158
2.1.111 _lwtimer_cancel_timer	159
2.1.112 _lwtimer_create_periodic_queue	160
2.1.113 _lwtimer_test	161
2.1.114 _mem_alloc ...	162
2.1.115 _mem_copy	166
2.1.116 _mem_create_pool	167
2.1.117 _mem_extend	168
2.1.118 _mem_extend_pool	169
2.1.119 _mem_free	170
2.1.120 _mem_free_part	172
2.1.121 _mem_get_error	173

2.1.122_mem_get_error_pool	175
2.1.123_mem_get_highwater	176
2.1.124_mem_get_highwater_pool	177
2.1.125_mem_get_size	178
2.1.126_mem_set_pool_access	180
2.1.127_mem_sum_ip	181
2.1.128_mem_swap_endian	182
2.1.129_mem_test	183
2.1.130_mem_test_all	184
2.1.131_mem_test_and_set	185
2.1.132_mem_test_pool	186
2.1.133_mem_transfer	187
2.1.134_mem_zero	188
2.1.135_mmu_add_vregion	189
2.1.136_mmu_vdisable	190
2.1.137_mmu_venable	191
2.1.138_mmu_vinit	192
2.1.139_mmu_vtop	193
2.1.140_mqx	194
2.1.141_mqx_bsp_revision	196
2.1.142_mqx_copyright	197
2.1.143_mqx_date	198
2.1.144_mqx_exit	199
2.1.145_mqx_fatal_error	200
2.1.146_mqx_generic_revision	201
2.1.147_mqx_get_counter	202
2.1.148_mqx_get_cpu_type	203
2.1.149_mqx_get_exit_handler	204
2.1.150_mqx_get_initialization	205
2.1.151_mqx_get_kernel_data	206
2.1.152_mqx_get_system_task_id	207
2.1.153_mqx_get_tad_data, _mqx_set_tad_data	208
2.1.154_mqx_idle_task	209
2.1.155_mqx_io_revision	210
2.1.156_mqx_monitor_type	211
2.1.157_mqx_psp_revision	212
2.1.158_mqx_set_cpu_type	213
2.1.159_mqx_set_exit_handler	214
2.1.160_mqx_version	215
2.1.161_mqx_zero_tick_struct	216
2.1.162_msg_alloc	217
2.1.163_msg_alloc_system	219
2.1.164_msg_available	220
2.1.165_msg_create_component	221
2.1.165.1Example	222

2.1.166_msg_free	223
2.1.167_msg_swap_endian_data	224
2.1.168_msg_swap_endian_header	226
2.1.169_msgpool_create	227
2.1.170_msgpool_create_system	229
2.1.171_msgpool_destroy	230
2.1.172_msgpool_test	231
2.1.173_msgq_close	232
2.1.174_msgq_get_count	234
2.1.175_msgq_get_id	235
2.1.176_msgq_get_notification_function	236
2.1.177_msgq_get_owner	237
2.1.178_msgq_open	238
2.1.179_msgq_open_system	240
2.1.180_msgq_peek	242
2.1.181_msgq_poll	243
2.1.182_msgq_receive	245
2.1.183_msgq_send	248
2.1.184_msgq_send_broadcast	251
2.1.185_msgq_send_priority	253
2.1.186_msgq_send_queue	255
2.1.187_msgq_send_urgent	257
2.1.188_msgq_set_notification_function	258
2.1.189_msgq_test	260
2.1.190_mutatr_destroy	261
2.1.191_mutatr_get_priority_ceiling, _mutatr_set_priority_ceiling	262
2.1.192_mutatr_get_sched_protocol, _mutatr_set_sched_protocol	264
2.1.193_mutatr_get_spin_limit, _mutatr_set_spin_limit	266
2.1.194_mutatr_get_wait_protocol, _mutatr_set_wait_protocol	268
2.1.194.1Waiting protocols	269
2.1.195_mutatr_init	270
2.1.196_mutex_create_component	271
2.1.197_mutex_destroy	272
2.1.198_mutex_get_priority_ceiling, _mutex_set_priority_ceiling	273
2.1.199_mutex_get_wait_count	275
2.1.200_mutex_init	276
2.1.201_mutex_lock	277
2.1.202_mutex_test	279
2.1.203_mutex_try_lock	281
2.1.204_mutex_unlock	282
2.1.205_name_add	283
2.1.206_name_create_component	284
2.1.207_name_delete	286
2.1.208_name_find	287
2.1.209_name_find_by_number	288

2.1.210_name_test	289
2.1.211_partition_alloc, _partition_alloc_zero	291
2.1.212_partition_alloc_system, _partition_alloc_system_zero	293
2.1.213_partition_calculate_blocks	294
2.1.214_partition_calculate_size	295
2.1.215_partition_create	296
2.1.216_partition_create_at	298
2.1.217_partition_create_component	300
2.1.218_partition_destroy	301
2.1.219_partition_extend	302
2.1.220_partition_free	303
2.1.221_partition_get_block_size	304
2.1.222_partition_get_free_blocks	306
2.1.223_partition_get_max_used_blocks	307
2.1.224_partition_get_total_blocks	308
2.1.225_partition_get_total_size	309
2.1.226_partition_test	310
2.1.227_partition_transfer	311
2.1.228_queue_dequeue	312
2.1.229_queue_enqueue	314
2.1.230_queue_get_size	315
2.1.231_queue_head	316
2.1.232_queue_init	317
2.1.233_queue_insert	318
2.1.234_queue_is_empty	320
2.1.235_queue_next	321
2.1.236_queue_test	322
2.1.237_queue_unlink	323
2.1.238_sched_get_max_priority	324
2.1.239_sched_get_min_priority	325
2.1.240_sched_get_policy	326
2.1.241_sched_get_rr_interval, _sched_get_rr_interval_ticks	327
2.1.242_sched_set_policy	328
2.1.243_sched_set_rr_interval, _sched_set_rr_interval_ticks	329
2.1.244_sched_yield	330
2.1.245_sem_close	331
2.1.246_sem_create	332
2.1.247_sem_create_component	334
2.1.248_sem_create_fast	336
2.1.249_sem_destroy, _sem_destroy_fast	337
2.1.250_sem_get_value	339
2.1.251_sem_get_wait_count	340
2.1.252_sem_open, _sem_open_fast	341
2.1.253_sem_post	343
2.1.254_sem_test	345

2.1.255_sem_wait ...	346
2.1.256_str_mqx_uint_to_hex_string ...	348
2.1.257_strnlen ...	349
2.1.258_task_abort ...	350
2.1.259_task_block ...	351
2.1.260_task_check_stack ...	352
2.1.261_task_create, _task_create_blocked, _task_create_at ...	353
2.1.262_task_destroy ...	355
2.1.263_task_disable_fp, _task_enable_fp ...	357
2.1.264_task_errno ...	358
2.1.265_task_get_creator ...	359
2.1.266_task_get_environment, _task_set_environment ...	360
2.1.267_task_get_error, _task_get_error_ptr ...	361
2.1.268_task_get_exception_handler, _task_set_exception_handler ...	362
2.1.269_task_get_exit_handler, _task_set_exit_handler ...	363
2.1.270_task_get_id ...	364
2.1.271_task_get_id_from_name ...	365
2.1.272_task_get_index_from_id ...	366
2.1.273_task_get_parameter ..., _task_set_parameter ...	367
2.1.274_task_get_priority, _task_set_priority ...	368
2.1.275_task_get_processor ...	370
2.1.276_task_get_td ...	371
2.1.277_task_get_template_index ...	372
2.1.278_task_get_template_ptr ...	373
2.1.279_task_ready ...	374
2.1.280_task_restart ...	376
2.1.281_task_set_error ...	377
2.1.282_task_start_preemption, _task_stop_preemption ...	378
2.1.283_taskq_create ...	379
2.1.284_taskq_destroy ...	381
2.1.285_taskq_get_value ...	382
2.1.286_taskq_resume ...	383
2.1.287_taskq_suspend ...	385
2.1.288_taskq_suspend_task ...	386
2.1.289_taskq_test ...	388
2.1.290_ticks_to_time ...	389
2.1.291_time_add ...	390
2.1.292_time_delay ...	392
2.1.293_time_dequeue ...	393
2.1.294_time_dequeue_td ...	395
2.1.295_time_diff, _time_diff_ticks ...	396
2.1.296_time_diff_ ...	398
2.1.297_time_from_date ...	401
2.1.298_time_get, _time_get_ticks ...	403
2.1.299_time_get_elapsed, _time_get_elapsed_ticks ...	404

2.1.300_time_get_hwticks	405
2.1.301_time_get_hwticks_per_tick, _time_set_hwticks_per_tick	406
2.1.302_time_get_microseconds	407
2.1.303_time_get_nanoseconds	408
2.1.304_time_get_resolution, _time_set_resolution	409
2.1.305_time_get_ticks_per_sec, _time_set_ticks_per_sec	410
2.1.306_time_init_ticks	411
2.1.307_time_notify_kernel	412
2.1.308_time_set, _time_set_ticks	413
2.1.309_time_set_timer_vector	414
2.1.310_time_to_date	415
2.1.311_time_to_ticks	416
2.1.312mktime	417
2.1.313gmtime_r	418
2.1.314timegm	419
2.1.315localtime_r	420
2.1.316_timer_cancel	421
2.1.317_timer_create_component	422
2.1.318_timer_start_oneshot_after	425
2.1.319_timer_start_oneshot_at	427
2.1.320_timer_start_periodic_at	429
2.1.321_timer_start_periodic_every	431
2.1.322_timer_test	433
2.1.323_usr_lwevent_clear	434
2.1.324_usr_lwevent_create	435
2.1.325_usr_lwevent_destroy	436
2.1.326_usr_lwevent_get_signalled	437
2.1.327_usr_lwevent_set	438
2.1.328_usr_lwevent_set_auto_clear	439
2.1.329_usr_lwevent_wait	440
2.1.330_usr_lwmem_alloc	442
2.1.331_usr_lwmem_alloc_from	443
2.1.332_usr_lwmem_create_pool	444
2.1.333_usr_lwmem_free	445
2.1.334_usr_lwmsgq_init	446
2.1.335_usr_lwmsgq_receive	447
2.1.336_usr_lwmsgq_send	448
2.1.337_usr_lwsem_create	449
2.1.338_usr_lwsem_destroy	450
2.1.339_usr_lwsem_poll	451
2.1.340_usr_lwsem_post	452
2.1.341_usr_lwsem_wait	453
2.1.342_usr_task_abort	455
2.1.343_usr_task_create	456
2.1.344_usr_task_destroy	457

2.1.345_usr_task_get_td	458
2.1.346_usr_task_ready	459
2.1.347_usr_task_set_error	460
2.1.348_usr_time_delay	461
2.1.349_usr_time_get_elapsed_ticks	462
2.1.350_watchdog_create_component	463
2.1.351_watchdog_start, _watchdog_start_ticks	465
2.1.352_watchdog_stop	466
2.1.353_watchdog_test	467
2.1.354MSG_MUST_CONVERT_DATA_ENDIAN	468
2.1.355MSG_MUST_CONVERT_HDR_ENDIAN	469

Chapter 3

MQX Data Types

3.1 Data Types Overview	471
3.2 MQX Complex Data Types in Alphabetical Order	473
3.2.1 DATE_STRUCT	473
3.2.2 IPC_PCB_INIT_STRUCT	475
3.2.3 IPC_PROTOCOL_INIT_STRUCT	476
3.2.4 IPC_ROUTING_STRUCT	477
3.2.5 IPC_INIT_STRUCT	478
3.2.6 LOG_ENTRY_STRUCT	479
3.2.7 LWEVENT_STRUCT	480
3.2.8 LWLOG_ENTRY_STRUCT	481
3.2.9 LWSEM_STRUCT	482
3.2.10 LWTIMER_PERIOD_STRUCT	483
3.2.11 LWTIMER_STRUCT	484
3.2.12 MESSAGE_HEADER_STRUCT	485
3.2.13 MQX_INITIALIZATION_STRUCT	487
3.2.14 MQX_TICK_STRUCT	489
3.2.15 MUTEX_ATTR_STRUCT	490
3.2.16 MUTEX_STRUCT	491
3.2.17 QUEUE_ELEMENT_STRUCT	493
3.2.18 QUEUE_STRUCT	494
3.2.19 TASK_TEMPLATE_STRUCT	495
3.2.20 TIME_STRUCT	498
3.2.21 time_t	499
3.2.22 TM_STRUCT	500



Chapter 1 Before You Begin

1.1 About MQX

The MQX™ Real-Time Operating System has been designed for uni-processor, multi-processor, and distributed-processor embedded real-time systems.

MQX is a runtime library of functions that programs use to become real-time multi-tasking applications. The main features are its scalable size, component-oriented architecture, and ease of use.

MQX supports multi-processor applications and can be used with flexible embedded input/output products for networking, data communications, and file management.

1.2 About This Book

This book contains alphabetical listings of MQX function prototypes and alphabetical listings of data type definitions.

Use this book in conjunction with *Freescale MQX™ RTOS User Guide*, which covers the following general topics:

- MQX at a glance
- Using MQX
- Rebuilding MQX
- Developing a new BSP
- Frequently asked questions

1.3 Function Listing Format

This is the general format for listing a function or a data type.

function_name()

A short description of what function **function_name()** does.

Prototype

Provides a prototype for the function **function_name()**.

```
<return_type> function_name(  
    <type_1>  parameter_1,  
    <type_2>  parameter_2,  
    ...  
    <type_n>  parameter_n)
```

Parameters

parameter_1 [in] — Pointer to x
parameter_2 [out] — Handle for y
parameter_n [in/out] — Pointer to z

Parameter passing is categorized as follows:

- *In* — It means the function uses one or more values in the parameter you give it, without storing any changes.
- *Out* — It means the function saves one or more values in the parameter you give it. You can examine the saved values to find out useful information about your application.
- *In/out* — It means the function changes one or more values in the parameter you give it, and saves the result. You can examine the saved values to find out useful information about your application.

When User-mode and Memory Protection (new in MQX 3.8) is enabled in the MQX PSP, there are some additional restrictions on the parameters being passed by a pointer reference to MQX API functions. See the functions prefixed with the **_usr** prefix. The following parameter categories should be taken into a consideration:

- *RO* — means the function parameter must be located in the "Read Only" memory for a User task or other code executed in the User mode.
- *RW* — means the function parameter must be located in the "Read Write" memory for a User task or other code executed in the User mode.

Returns

Specifies any value or values returned by the function.

Traits

Specifies any of the following that might apply for the function:

- it blocks, or conditions under which it might block
- it must be started as a task
- it creates a task
- it disables and enables interrupts
- pre-conditions that might not be obvious
- any other restrictions or special behavior

See Also

Lists other functions or data types related to the function **function_name()**.

Example

Provides an example (or a reference to an example) that illustrates the use of function **function_name()**.

Description

Describes the function **function_name()**. This section also describes any special characteristics or restrictions that might apply:

- Function blocks, or might block under certain conditions.
- Function must be started as a task.
- Function creates a task.
- Function has pre-conditions that might not be obvious.
- Function has restrictions or special behavior.

1.4 Conventions

1.4.1 Tips

Tips point out useful information.

TIP

The most efficient way to allocate a message from an ISR is to use `_msg_alloc()`.

1.4.2 Notes

Notes point out important information.

NOTE

Non-strict semaphores do not have priority inheritance.

1.4.3 Cautions

Cautions tell you about commands or procedures that could have unexpected or undesirable side effects or could be dangerous to your files or your hardware.

CAUTION

If you modify MQX data types, some MQX™ Host Tools from MQX Embedded might not operate properly.

Chapter 2 MQX Functions and Macros

2.1 MQX Function Overview

Table 2-1. MQX Functions

Component	Prefix
Cache-control macros for data cache	_DCACHE_
Cache-control macros for instruction cache	_ICACHE_
Endian conversion macros	MSG_
Events	_event_
Inter-processor communication	_ipc_
Interrupt handling	_int_
Kernel log	_klog_
Lightweight events	_lwevent_
Lightweight logs	_lwlog_
Lightweight memory with variable-size blocks	_lwmem_
Lightweight semaphores	_lwsem_
Logs (user logs)	_log_
Memory with fixed-size blocks (partitions)	_partition_
Memory with variable-size blocks	_mem_
Messages	_msg_ _msgpool_ _msgq_
Miscellaneous	_mqx_
MMU and virtual memory control	_mmu_
Mutexes	_mutatr_ _mutex_
Names	_name_
Partitions	_partition_
Queues	_queue_
Scheduling	_sched_
Semaphores	_sem_
String functions	_str
Task management	_task_
Task queues	_taskq_
Timers	_timer_
Timing	_time_

Table 2-1. MQX Functions

Virtual memory control	_mmu_
Watchdogs	_watchdog

2.1.1 **`_DCACHE_DISABLE`**

If the PSP supports disabling the data cache, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_DCACHE_DISABLE(void)
```

Parameters

None

Returns

None

See Also

[**`_DCACHE_ENABLE`**](#)

2.1.2 **`_DCACHE_ENABLE`**

If the PSP supports enabling the data cache, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_DCACHE_ENABLE(  
    uint32_t flags)
```

Parameters

flags [IN] — CPU-type-specific flags that the processor needs to enable its data cache

Returns

None

See Also

[**`_DCACHE_DISABLE`**](#)

2.1.3 `_DCACHE_FLUSH`

If the PSP supports flushing the data cache, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_DCACHE_FLUSH(void)
```

Parameters

None

Returns

None

See Also

[_DCACHE_FLUSH_LINE](#)

[_DCACHE_FLUSH_MLINES](#)

Description

The macro flushes the entire data cache. Unwritten data that is in the cache is written to physical memory.

CAUTION

The flushing and invalidating functions always operate with whole cache lines. In case the data entity is not aligned to the cache line size these operations will affect data that precedes and follows data area currently being flushed/invalidated.

The MQX memory allocators align data entity to the cache line size by default. Once an entity is declared statically the alignment to the cache line size is not guaranteed (unless align pragma is used).

On some CPUs, flushing the data cache also invalidates the data cache entries.

2.1.4 `_DCACHE_FLUSH_LINE`

If the PSP supports flushing one data cache line, the macro calls a PSP-specific function to flush the line.

Prototype

```
source\psp\cpu_family\cpu.h
#include <psp.h>
_DCACHE_FLUSH_LINE(
    void *addr)
```

Parameters

addr [IN] — Address to be flushed

Returns

None

See Also

[_DCACHE_FLUSH](#)

[_DCACHE_FLUSH_MLINES](#)

Description

The line that is flushed is the one that contains *addr*.

The macro is used when a device (such as a DMA) needs to access memory and the CPU does not provide bus snooping.

CAUTION

The flushing and invalidating functions always operate with whole cache lines. In case the data entity is not aligned to the cache line size these operations will affect data that precedes and follows data area currently being flushed/invalidated.

The MQX memory allocators align data entity to the cache line size by default. Once an entity is declared statically the alignment to the cache line size is not guaranteed (unless align pragma is used).

On some CPUs, flushing the data cache also invalidates the data cache entries.

Example

Flush a data cache line on the MPC860 processor.

```
...
uint32_t data;
...
data = 55;
_DCACHE_FLUSH_LINE(&data);
```


2.1.5 `_DCACHE_FLUSH_MLINES`

If the PSP supports flushing a memory region from the data cache, the macro calls a PSP-support function to flush the region.

Prototype

```
source\psp\cpu_family\cpu.h
#include <psp.h>
_DCACHE_FLUSH_MLINES(
    void      *addr,
    _mem_size  length)
```

Parameters

addr [IN] — Address from which to start flushing the data cache

length [IN] — Number of single-addressable units to flush

Returns

None

See Also

[`_DCACHE_FLUSH`](#)

[`_DCACHE_FLUSH_LINE`](#)

Description

The macro is used when a device (such as a DMA) needs to access memory and the CPU does not provide bus snooping.

CAUTION

The flushing and invalidating functions always operate with whole cache lines. In case the data entity is not aligned to the cache line size these operations will affect data that precedes and follows data area currently being flushed/invalidated.

The MQX memory allocators align data entity to the cache line size by default. Once an entity is declared statically the alignment to the cache line size is not guaranteed (unless align pragma is used).

On some CPUs, flushing the data cache also invalidates the data cache entries.

Example

Flush an array of data from the data cache on the MPC860 processor.

```
...
uint32_t data[10];
...
data[5] = 55;
_DCACHE_FLUSH_MLINES(data, sizeof(data));
```

2.1.6 `_DCACHE_INVALIDATE`

If the PSP supports invalidating all the data cache entries, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_DCACHE_INVALIDATE(void)
```

Parameters

None

Returns

None

See Also

[_DCACHE_INVALIDATE_LINE](#)

[_DCACHE_INVALIDATE_MLINES](#)

Description

Data that is in the data cache and has not been written to memory is lost. A subsequent data access reloads the cache with data from physical memory.

CAUTION

The flushing and invalidating functions always operate with whole cache lines. In case the data entity is not aligned to the cache line size these operations will affect data that precedes and follows data area currently being flushed/invalidated.

The MQX memory allocators align data entity to the cache line size by default. Once an entity is declared statically the alignment to the cache line size is not guaranteed (unless align pragma is used).

2.1.7 `_DCACHE_INVALIDATE_LINE`

If the PSP supports invalidating one data cache line, the macro calls a PSP-specific function to invalidate the line.

Prototype

```
source\psp\cpu_family\cpu.h
#include <psp.h>
_DCACHE_INVALIDATE_LINE(
    void *addr)
```

Parameters

addr [IN] — Address to be invalidated

Returns

None

See Also

[_DCACHE_INVALIDATE](#)

[_DCACHE_INVALIDATE_MLINES](#)

Description

The line that is invalidated is the one that contains *addr*.

The macro is used when a device (such as a DMA) needs to access memory and the CPU does not provide bus snooping.

CAUTION

The flushing and invalidating functions always operate with whole cache lines. In case the data entity is not aligned to the cache line size these operations will affect data that precedes and follows data area currently being flushed/invalidated.

The MQX memory allocators align data entity to the cache line size by default. Once an entity is declared statically the alignment to the cache line size is not guaranteed (unless align pragma is used).

Example

Invalidate a data cache line on the MPC860 processor.

```
...
uint32_t data;
...
_DCACHE_INVALIDATE_LINE(&data);
if (data == 55) {
    ...
}
```

2.1.8 `_DCACHE_INVALIDATE_MLINES`

If the PSP supports invalidating a memory region in the data cache, the macro calls a PSP-specific function to invalidate the region.

Prototype

```
source\psp\cpu_family\cpu.h
#include <psp.h>
_DCACHE_INVALIDATE_MLINES(
    void      *addr,
    _mem_size  length)
```

Parameters

addr [IN] — Address from which to start invalidating the data cache

length [IN] — Number of single-addressable units to invalidate

Returns

None

See Also

[`_DCACHE_INVALIDATE`](#)

[`_DCACHE_INVALIDATE_LINE`](#)

Description

The macro is used when a device (such as a DMA) needs to access memory and the CPU does not provide bus snooping.

CAUTION

The flushing and invalidating functions always operate with whole cache lines. In case the data entity is not aligned to the cache line size these operations will affect data that precedes and follows data area currently being flushed/invalidated.

The MQX memory allocators align data entity to the cache line size by default. Once an entity is declared statically the alignment to the cache line size is not guaranteed (unless align pragma is used).

Example

Invalidate an array of data in the data cache on the MPC860 processor.

```
...
uint32_t data[10];
...
_DCACHE_INVALIDATE_MLINES(data, sizeof(data));
if (data[5] == 55) {
}
```

2.1.9 `_event_clear`

Clears the specified event bits in the event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_clear(
    void      *event_group_ptr,
    _mx_uint  bit_mask)
```

Parameters

event_group_ptr [IN] — Event group handle returned by `_event_open()` or `_event_open_fast()`

bit_mask [IN] — Each set bit represents an event bit to clear

Returns

- MQX_OK
- Errors

Error	Description
EVENT_INVALID_EVENT	Event group is not valid.
EVENT_INVALID_EVENT_HANDLE	One of the following: <ul style="list-style-type: none"> • <code>_event_open()</code> or <code>_event_open_fast()</code> did not get the event group handle • <code>_event_create()</code> did not create the event group

Traits

See Also

[_event_create](#), [_event_create_auto_clear](#)

[_event_open](#)

[_event_open_fast](#)

[_event_set](#)

[_event_get_value](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Example

Task 1 waits for an event condition so that it can do some processing. When Task 2 sets the event bit, Task 1 does the processing. When Task 1 finishes the processing, it clears the event bit so that another task can set the bit the next time the event condition occurs.

```
void *event_ptr;
```

```
result = _event_open("global", &event_ptr);
if (result == MQX_OK) {
    while (TRUE) {
        result = _event_wait_all(event_ptr, 0x01, 0);
        /* Do some processing. */
        . . . .
        result = _event_clear(event_ptr, 0x01);
    }
    result = _event_close(event_ptr);
}
```

2.1.10 `_event_close`

Closes the connection to the event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint  _event_close(
    void  *event_group_ptr)
```

Parameters

event_group_ptr [IN] — Event group handle returned by `_event_open()` or `_event_open_fast()`

Returns

- `MQX_OK`
- Errors

Errors

Task error code from `_mem_free()`

MQX could not free the event group handle.

Error	Description
<code>EVENT_INVALID_EVENT_HANDLE</code>	Event group connection is not valid.
<code>MQX_CANNOT_CALL_FUNCTION_FROM_ISR</code>	Function cannot be called from an ISR.

Traits

Cannot be called from an ISR

See Also

[_event_destroy](#)

[_event_open](#)

[_event_open_fast](#)

Description

The function closes the connection to the event group and frees the event group handle.

A task that opened an event group on a remote processor can also close the event group.

Example

See [_event_clear\(\)](#).

2.1.11 `_event_create`, `_event_create_auto_clear`

<code>_event_create()</code>	Creates the named event group.
<code>_event_create_auto_clear()</code>	Creates the named event group with autoclearing event bits.

Prototype

`_event_create()`

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_create(
    char *name)
```

`_event_create_auto_clear()`

```
source\event\ev_creaa.c
#include <event.h>
_mqx_uint _event_create_auto_clear(
    char *name)
```

Parameters

name [IN] — Name of the event group

Returns

- `MQX_OK`
- Errors

Error	Description
<code>EVENT_EXISTS</code>	Event group was already created.
<code>EVENT_TABLE_FULL</code>	Name table is full and cannot be expanded.
<code>MQX_CANNOT_CALL_FUNCTION_FROM_ISR</code>	Function cannot be called from an ISR.
<code>MQX_INVALID_COMPONENT_BASE</code>	Event component data is not valid.
<code>MQX_OUT_OF_MEMORY</code>	MQX could not allocate memory for the event group.

Traits

- Creates the event component with default values if it was not previously created
- Cannot be called from an ISR

See Also

[_event_close](#)

[_event_create_component](#)

[_event_destroy](#)

[_event_open](#)

Description

After a task creates a named event group, any task that wants to use it must open a connection to it with [_event_open\(\)](#). When a task no longer needs a named event group, it can destroy the event group with [_event_destroy\(\)](#).

If a task creates an event group with autoclearing event bits, MQX clears the event bits as soon as they are set. Task that are waiting for the event bits are made ready, but need not clear the bits.

Example

See [_event_create_component\(\)](#).

2.1.12 `_event_create_component`

Creates the event component.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_create_component(
    _mx_uint initial_number,
    _mx_uint grow_number,
    _mx_uint maximum_number)
```

Parameters

initial_number [IN] — Initial number of event groups that the application can create
grow_number [IN] — Number of event groups to add if the application creates all the event groups
maximum_number [IN] — If *grow_number* is non-zero, maximum number of event groups (0 means an unlimited number)

Returns

- MQX_OK (success)
- MQX_OUT_OF_MEMORY (MQX could not allocate memory for the event group)
- MQX_CANNOT_CALL_FUNCTION_FROM_ISR (Function cannot be called from an ISR.)

See Also

[_event_create](#), [_event_create_auto_clear](#)

[_event_create_fast](#), [_event_create_fast_auto_clear](#)

[_event_open](#)

[_event_open_fast](#)

Description

If an application previously called the function and *maximum_number* is now greater than what was previously specified, MQX changes the maximum number of event groups to *maximum_number*.

If an application does not explicitly create the event component, MQX does so with the following default values the first time that a task calls a function in the **`_event_create`** family of functions.

Parameter	Default
<i>initial_number</i>	8
<i>grow_number</i>	8
<i>maximum_number</i>	0 (unlimited)

Example

Create the event component with two event groups, the ability to grow by one, and up to a maximum of four. Create an event group, do some processing, and then destroy the event group.

```
result = _event_create_component(2, 1, 4);
if (result != MQX_OK)
{
    printf("\nCould not create the event component");
    _mqx_exit();
}
result = _event_create("global");
...
result = _event_destroy("global");
```

2.1.13 `_event_create_fast`, `_event_create_fast_auto_clear`

<code>_event_create_fast()</code>	Creates the fast event group.
<code>_event_create_fast_auto_clear()</code>	Creates the fast event group with autoclearing event bits.

Prototype

`_event_create_fast()`

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_create_fast(
    _mx_uint index)
```

`_event_create_fast_auto_clear()`

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_create_fast_auto_clear(
    _mx_uint index)
```

Parameters

index [IN] — Number of the event group

Returns

- MQX_OK (success)
- Error: See [_event_create](#), [_event_create_auto_clear](#)

Traits

- Creates the event component with default values if they were not previously created
- Cannot be called from an ISR

See Also

[_event_close](#)

[_event_create](#), [_event_create_auto_clear](#)

[_event_create_component](#)

[_event_destroy_fast](#)

[_event_open_fast](#)

Description

See [_event_create](#), [_event_create_auto_clear](#).

Example

```
#define MY_EVENT_GROUP 123
```

```
void *event_ptr;
...
result = _event_create_fast(MY_EVENT_GROUP);
if (result != MQX_OK) {
    _mqx_exit();
}
result = _event_open_fast(MY_EVENT_GROUP, &event_ptr);
if (result != MQX_OK) {
    _mqx_exit();
}
...
result = _event_close(event_ptr);
result = _event_destroy_fast(MY_EVENT_GROUP);
...
```

2.1.14 `_event_destroy`

Destroys the named event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_destroy(
    char *name)
```

Parameters

name [IN] — Name of the event group

Returns

- MQX_OK
- Errors

Error	Description
EVENT_INVALID_EVENT	Event group is no longer valid.
EVENT_NOT_FOUND	Event group is not in the table.
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_COMPONENT_DOES_NOT_EXIST	Event component was not created.
MQX_INVALID_COMPONENT_BASE	Event component data is not valid.

Traits

Cannot be called from an ISR

See Also

[_event_create](#), [_event_create_auto_clear](#)

[_event_create_component](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Description

The event group must have been created with `_event_create()` or `_event_create_auto_clear()`.

If tasks are blocked waiting for an event bit in the event group, MQX does the following:

- moves them to their ready queues
- sets their task error code to **EVENT_DELETED**

- returns **EVENT_DELETED** for `_event_wait_all()` and `_event_wait_any()`

Example

See [_event_create_component\(\)](#).

2.1.15 `_event_destroy_fast`

Destroys the fast event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_destroy_fast(
    _mx_uint index)
```

Parameters

index [IN] — Number of the event group

Returns

- MQX_OK
- Error: See [_event_destroy](#)

Traits

Cannot be called from an ISR

See Also

[_event_create_component](#)

[_event_create_fast](#), [_event_create_fast_auto_clear](#)

Description

The event group must have been created with `_event_create_fast()` or `_event_create_fast_auto_clear()`.

See [_event_destroy](#).

Example

See [_event_create_fast](#), [_event_create_fast_auto_clear](#).

2.1.16 `_event_get_value`

Gets the event bits for the event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_get_value(
    void      *event_group_ptr,
    _mx_uint  *event_group_value_ptr)
```

Parameters

event_group_ptr [IN] — Event group handle returned by `_event_open()` or `_event_open_fast()`
event_group_value_ptr [OUT] — Where to write the value of the event bits (on error, 0 is written)

Returns

- MQX_OK
- Errors

Error	Description
EVENT_INVALID_EVENT	Event group is no longer valid.
EVENT_INVALID_EVENT_HANDLE	Event group handle is not valid.

See Also

[_event_clear](#)

[_event_set](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Example

If another task has set event bit 0, this task sets event bit 1.

```
void *event_ptr;
_mqx_uint event_bits;
...
if (_event_open("global", &event_ptr) == MQX_OK) {
    for (;;) {
        if (_event_get_value(event_ptr, &event_bits) == MQX_OK) {
            if (event_bits & 0x01) {
                _event_set(event_ptr, 0x02);
            }
        }
    }
}
```

```
    ...  
}  
}
```

2.1.17 `_event_get_wait_count`

Gets the number of tasks that are waiting for event bits in the event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_get_wait_count(
    void *event_group_ptr)
```

Parameters

event_group_ptr [IN] — Event group handle returned by `_event_open()` or `_event_open_fast()`

Returns

- Number of waiting tasks (success)
- MAX_MQX_UINT (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code to `EVENT_INVALID_EVENT_HANDLE`.

See also

[_event_open](#)

[_event_open_fast](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

[_task_set_error](#)

Description

Tasks can be waiting for different combinations of event bits.

Example

```
void *event_ptr;
_mqx_uint task_wait_count;
...
if (_event_open("global", &event_ptr) == MQX_OK) {
    ...
    task_wait_count = _event_get_wait_count(event_ptr);
    ...
}
```

2.1.18 `_event_open`

Opens a connection to the named event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_open(
    char *name_ptr,
    void **event_ptr)
```

Parameters

name_ptr [IN] — Pointer to the name of the event group (see description)

event_ptr [OUT] — Where to write the event group handle (*NULL* is written if an error occurred)

Returns

- MQX_OK
- Errors

Error	Description
EVENT_INVALID_EVENT	Event group data is no longer valid.
EVENT_NOT_FOUND	Named event group is not in the name table.
MQX_COMPONENT_DOES_NOT_EXIST	Event component is not created.
MQX_INVALID_COMPONENT_BASE	Event component data is not valid.
MQX_OUT_OF_MEMORY	MQX could not allocate memory for the event connection data.

See Also

[_event_close](#)

[_event_create, _event_create_auto_clear,](#)

[_event_set](#)

[_event_get_wait_count](#)

[_event_get_value](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Description

The named event group must have been created with `_event_create()` or `_event_create_auto_clear()`. Each task that needs access to the named event group must first open a connection to it.

To open an event group on a remote processor, prepend the event-group name with the remote processor number as follows.

This string:	Opens this named event group:	On this processor:
"2:Fred"	"Fred"	2
"0:Sue"	"Sue"	Local processor

The other allowed event operations on remote processors are:

- `_event_set()`
- `_event_close()`

The task closes the connection with `_event_close()`.

Example

See [_event_clear\(\)](#).

2.1.19 `_event_open_fast`

Opens a connection to the fast event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_open_fast(
    _mx_uint      index,
    void **event_group_ptr)
```

Parameters

index [IN] — Index of the event group

event_group_ptr [OUT] — Where to write the event group handle (*NULL* is written if an error occurred)

Returns

- **MQX_OK**
- Error: See [_event_open](#)

See Also

[_event_close](#)

[_event_create_fast](#), [_event_create_fast_auto_clear](#)

[_event_set](#)

[_event_get_wait_count](#)

[_event_get_value](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Description

See [_event_open](#).

Example

See [_event_create_fast](#), [_event_create_fast_auto_clear](#).

2.1.20 `_event_set`

Sets the specified event bits in the event group.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_set(
    void      *event_group_ptr,
    _mx_uint  bit_mask)
```

Parameters

event_group_ptr [IN] — Event group handle returned by `_event_open()` or `_event_open_fast()`
bit_mask [IN] — Each set bit represents an event bit to be set

Returns

- MQX_OK
- Errors

Error	Description
EVENT_INVALID_EVENT	Event group is no longer valid.
EVENT_INVALID_EVENT_HANDLE	Event group handle is not a valid event connection.
MQX_COMPONENT_DOES_NOT_EXIST	Event component is not created.
MQX_INVALID_COMPONENT_BASE	Event component data is no longer valid.

Traits

Tasks waiting for the event bits might be dispatched.

See Also

[_event_get_wait_count](#)

[_event_get_value](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Description

Before a task can set an event bit in an event group, the event group must be created and the task must open an connection to the event group.

A task can set or clear one event bit or any combination of event bits in the event group.

A task that opened an event group on a remote processor can set bits in the event group.

Example

The task is responsible for setting event bits 0 and 1 in the named event.

```
void    *event_ptr;
_mqx_uint result;
...
if (_event_create("global") == MQX_OK) {
    if (_event_open("global", &event_ptr) == MQX_OK) {
        for (;;) {
            /*If some condition is true, */
            _event_set(event_ptr, 0x03);
            ...
        }
    }
}
```


2.1.21 `_event_test`

Tests the event component.

Prototype

```
source\kernel\event.c
#include <event.h>
_mqx_uint _event_test(
    void **event_error_ptr)
```

Parameters

event_error_ptr [OUT] — Handle for the event group that has an error if MQX found an error in the event component (*NULL* if no error is found)

Returns

- MQX_OK
- Errors

Error	Description
EVENT_INVALID_EVENT	Data for an event group is not valid.
MQX_INVALID_COMPONENT_BASE	Event component data is not valid.
Return code from <code>_queue_test()</code>	Waiting queue for an event group has an error.

See Also

[_event_close](#)

[_event_open](#)

[_event_set](#)

[_event_get_wait_count](#)

[_event_get_value](#)

[_event_wait_all ...](#)

[_event_wait_any ...](#)

Example

```
void *event_ptr;
...
if (_event_test(&event_ptr) != MQX_OK) {
    printf("Event component test failed - Event group in error: 0x%lx",
        event_ptr);
    ...
}
```

2.1.22 `_event_wait_all ...`

	Wait for all the specified event bits to be set in the event group:
<code>_event_wait_all()</code>	For the number of milliseconds
<code>_event_wait_all_for()</code>	For the number of ticks (in tick time)
<code>_event_wait_all_ticks()</code>	For the number of ticks
<code>_event_wait_all_until()</code>	Until the specified time (in tick time)

Prototype

```

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_all(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    uint32_t   ms_timeout)

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_all_for(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    MQX_TICK_STRUCT_PTR tick_time_timeout_ptr)

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_all_ticks(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    uint32_t   tick_timeout)

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_all_until(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    MQX_TICK_STRUCT_PTR tick_time_ptr)

```

Parameters

event_group_ptr [IN] — Event group handle returned by [_event_open](#) or [_event_open_fast](#)

bit_mask [IN] — Each set bit represents an event bit to wait for

ms_timeout [IN] — One of the following:

maximum number of milliseconds to wait for the events to be set. After the timeout elapses without the event signalled, the function returns.

0 (unlimited wait)

tick_time_timeout_ptr [IN] — One of the following:

pointer to the maximum number of ticks to wait

NULL (unlimited wait)

tick_timeout [IN] — One of the following:

maximum number of ticks to wait

0 (unlimited wait)

tick_time_ptr [IN] — One of the following:

pointer to the time (in tick time) until which to wait

NULL (unlimited wait)

Returns

- MQX_OK
- Errors

Error	Description
EVENT_DELETED	Event group was destroyed while the task waited.
EVENT_INVALID_EVENT	Event group is no longer valid.
EVENT_INVALID_EVENT_HANDLE	Handle is not a valid event group handle.
EVENT_WAIT_TIMEOUT	Timeout expired before the event bits were set.
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.

Traits

- Blocks until the event combination is set or until the timeout expires
- Cannot be called from an ISR

See Also

[_event_clear](#)

[_event_open](#)

[_event_open_fast](#)

[_event_set](#)

[_event_get_wait_count](#)

[_event_get_value](#)

[_event_wait_any ...](#)

Example

See [_event_clear](#).

2.1.23 `_event_wait_any ...`

	Wait for any of the specified event bits to be set in the event group:
<code>_event_wait_any()</code>	For the number of milliseconds
<code>_event_wait_any_for()</code>	For the number of ticks (in tick time)
<code>_event_wait_any_ticks()</code>	For the number of ticks
<code>_event_wait_any_until()</code>	Until the specified time (in tick time)

Prototype

```

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_any(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    uint32_t   ms_timeout)

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_any_for(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    MQX_TICK_STRUCT_PTR tick_time_timeout_ptr)

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_any_ticks(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    _mx_uint  tick_timeout)

source\kernel\event.c
#include <event.h>
_mqx_uint _event_wait_any_until(
    void      *event_group_ptr,
    _mx_uint  bit_mask,
    MQX_TICK_STRUCT_PTR tick_time_ptr)

```

Parameters

event_group_ptr [IN] — Event group handle returned by `_event_open()` or `_event_open_fast()`

bit_mask [IN] — Each set bit represents an event bit to wait for

ms_timeout [IN] — One of the following:

- maximum number of milliseconds to wait
- 0 (unlimited wait)

tick_time_timeout_ptr [IN] — One of the following:

pointer to the maximum number of ticks to wait

NULL (unlimited wait)

tick_timeout [IN] — One of the following:

maximum number of ticks to wait

0 (unlimited wait)

tick_time_ptr [IN] — One of the following:

pointer to the time (in tick time) until which to wait

NULL (unlimited wait)

Returns

- MQX_OK
- See `_event_wait_all` family

Traits

- Blocks until the event combination is set or until the timeout expires
- Cannot be called from an ISR

See also

[_event_clear](#)

[_event_open](#)

[_event_open_fast](#)

[_event_set](#)

[_event_get_wait_count](#)

[_event_get_value](#)

[_event_wait_all ...](#)

Example

See [_event_clear](#).

2.1.24 **_ICACHE_DISABLE**

If the PSP supports disabling the instruction cache, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_ICACHE_DISABLE(void)
```

Parameters

None

Returns

None

See Also

[_ICACHE_ENABLE](#)

2.1.25 `_ICACHE_ENABLE`

If the PSP supports enabling the instruction cache, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_ICACHE_ENABLE(  
    uint32_t flags)
```

Parameters

flags [IN] — CPU-type-specific flags that the processor needs to enable its instruction cache

Returns

None

See Also

[_ICACHE_DISABLE](#)

2.1.26 `_ICACHE_INVALIDATE`

If the PSP supports invalidating all the entries in the instruction cache, the macro calls a PSP-specific function to do so.

Prototype

```
source\psp\cpu_family\cpu.h  
#include <psp.h>  
_ICACHE_INVALIDATE(void)
```

Parameters

None

Returns

None

See Also

- [_ICACHE_INVALIDATE_LINE](#)
- [_ICACHE_INVALIDATE_MLINES](#)

Description

Instructions that are in the cache and have not been written to memory are lost. A subsequent instruction access reloads the cache with instructions from physical memory.

2.1.27 `_ICACHE_INVALIDATE_LINE`

If the PSP supports invalidating one instruction cache line, the macro calls a PSP-specific function to invalidate the line.

Prototype

```
source\psp\cpu_family\cpu.h
#include <psp.h>
_ICACHE_INVALIDATE_LINE(
    void *addr)
```

Parameters

addr [IN] — Address to be invalidated

Returns

None

See Also

- [_ICACHE_INVALIDATE](#)
- [_ICACHE_INVALIDATE_MLINES](#)

Description

The line that is invalidated is the one that contains *addr*.

If an application writes to code space (such as when it patches or loads code), the instruction cache for write operations will be incorrect. In this case, the application calls `_ICACHE_INVALIDATE_LINE` to invalidate the appropriate line in the cache.

NOTE

The amount of memory that is invalidated depends on the size of the CPU's instruction cache line.

Example

Invalidate an instruction cache line on the MPC860 processor.

```
...
extern int some_function();
...
_ICACHE_INVALIDATE_LINE(&some_function);
```

2.1.28 `_ICACHE_INVALIDATE_MLINES`

If the PSP supports invalidating a memory region in the instruction cache, the macro calls a PSP-specific function to invalidate the region.

Prototype

```
source\psp\cpu_family\cpu.h
#include <psp.h>
_ICACHE_INVALIDATE_MLINES(
    void      *addr,
    _mem_size  length)
```

Parameters

addr [IN] — Address from which to start invalidating the instruction cache

length [IN] — Number of single-addressable units to invalidate

Returns

None

See Also

- [_ICACHE_INVALIDATE](#)
- [_ICACHE_INVALIDATE_LINE](#)

Description

If an application writes to code space (such as when it patches or loads code), the instruction cache for write operations will be incorrect. In this case, the application calls `_ICACHE_INVALIDATE_MLINES` to invalidate the appropriate lines in the cache.

Example

Invalidate an entire function in the instruction cache on the MPC860 processor.

```
...
extern int some_function();
extern int end_some_function();
...
_ICACHE_INVALIDATE_MLINES(some_function, end_some_function -
    some_function);
```

2.1.29 `_int_default_isr`

Default ISR that MQX calls if an unhandled interrupt or exception occurs.

Prototype

```
source\kernel\int.c  
void _int_default_isr(  
    void *vector_number)
```

Parameters

vector_number [IN] — Parameter that MQX passes to the ISR

Returns

None

Traits

Blocks the active task

See Also

[`_int_install_default_isr`](#)

[`_int_install_unexpected_isr`](#)

[`_int_install_exception_isr`](#)

Description

An application can replace the function with `_int_install_unexpected_isr()` or `_int_install_exception_isr()`, both of which install MQX-provided default ISRs.

An application can install an application-provided default ISR with `_int_install_default_isr()`.

MQX changes the state of the active task to **UNHANDLED_INT_BLOCKED** and blocks it.

2.1.30 `_int_disable`, `_int_enable`

<code>_int_disable()</code>	Disable hardware interrupts.
<code>_int_enable()</code>	Enable hardware interrupts.

Prototype

```
source\kernel\int.c
void _int_disable(void)

void _int_enable(void)
```

Parameters

None

Returns

None

Description

The function `_int_enable()` resets the processor priority to the hardware priority that corresponds to the active task's software priority.

The function `_int_disable()` disables all hardware interrupts at priorities up to and including the MQX disable-interrupt level. As a result, no task can interrupt the active task while the active task is running until interrupts are re-enabled with `_int_enable()`. If the active task blocks while interrupts are disabled, the state of the interrupts (disabled or enabled) depends on the interrupt-disabled state of the next task that MQX makes ready.

Keep to a minimum code between calls to `_int_disable()` and its matching `_int_enable()`.

If `_int_disable()` or `_int_enable()` are nested, MQX re-enables interrupts only after the number of calls to `_int_enable()` equals the number of calls to `_int_disable()`.

Example

See `_task_ready()`.

2.1.31 `_int_exception_isr`

To provide support for exception handlers, applications can use this ISR to replace the default ISR. The ISR is specific to the PSP.

Prototype

```
source\psp\cpu_family\int_xcpt.c
void _int_exception_isr(
    void    *parameter)
```

Parameters

parameter [IN] — Parameter passed to the default ISR (the vector number)

Returns

None

Traits

See description

See Also

[`_int_install_exception_isr`](#)

[`_mqx_fatal_error`](#)

[`_task_abort`](#)

Description

An application calls `_int_install_exception_isr()` to install `_int_exception_isr()`.

The function `_int_exception_isr()` does the following:

- If an exception occurs when a task is running and a task exception ISR exists, MQX runs the ISR; if a task exception ISR does not exist, MQX aborts the task by calling `_task_abort()`.
- If an exception occurs when an ISR is running and an ISR exception ISR exists, MQX aborts the running ISR and runs the ISR's exception ISR.
- The function walks the interrupt stack looking for information about the ISR or task that was running before the exception occurred. If the function determines that the interrupt stack contains incorrect information, it calls `_mqx_fatal_error()` with error code **MQX_CORRUPT_INTERRUPT_STACK**.

2.1.32 `_int_get_default_isr`

Gets a pointer to the default ISR that MQX calls when an unexpected interrupt occurs.

Prototype

```
source\kernel\int.c  
INT_ISR_FPTR _int_get_default_isr(void)
```

Parameters

None

Returns

- Pointer to the default ISR for unhandled interrupts (success)
- *NULL* (failure)

See Also

[`_int_install_default_isr`](#)

2.1.33 `_int_get_exception_handler`

Gets a pointer to the current ISR exception handler for the vector number.

Prototype

```
source\kernel\int.c  
INT_EXCEPTION_FPTR _int_get_exception_handler(  
    _mqx_uint vector)
```

Parameters

vector [IN] — Vector number whose exception handler is to be returned

Returns

- Pointer to the current exception handler (success)
- *NULL* (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code

See Also

[`_int_set_exception_handler`](#)

[`_int_exception_isr`](#)

[`_task_set_error`](#)

Description

The returned exception handler is either a default ISR or an ISR that the application installed with `_int_set_exception_handler()`.

2.1.34 `_int_get_isr`

Gets the current ISR for the vector number.

Prototype

```
source\kernel\int.c  
INT_ISR_FPTR _int_get_isr(  
    _mqx_uint vector)
```

Parameters

vector [IN] — Vector number whose ISR is to be returned

Returns

- Pointer to the ISR (success)
- *NULL* (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code

See Also

[_int_get_isr_data](#)

[_int_set_isr_data](#)

[_task_set_error](#)

Description

The returned ISR is either a default ISR or an ISR that the application installed with `_int_install_isr()`.

Example

See `_int_get_kernel_isr()`.

2.1.35 `_int_get_isr_data`

Gets the data that is associated with the vector number.

Prototype

```
source\kernel\int.c  
void *_int_get_isr_data(  
    _mqx_uint  vector)
```

Parameters

vector [IN] — Vector number whose ISR data is to be returned

Returns

- Pointer to ISR data (success)
- *NULL* (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code

See Also

[`_int_get_isr`](#)

[`_int_install_isr`](#)

[`_int_set_isr_data`](#)

Description

An application installs ISR data with `_int_set_isr_data()`.

When MQX calls `_int_kernel_isr()` or an application ISR, it passes the data as the first parameter to the ISR.

Example

See `_int_get_kernel_isr()`.

2.1.36 `_int_get_isr_depth`

Gets the depth of nesting of the current interrupt stack.

Prototype

```
source\kernel\int.c  
_mqx_uint _int_get_isr_depth(void)
```

Parameters

None

Returns

- 0 (an interrupt is not being serviced)
- 1 (a non-nested interrupt is being serviced)
- ≥ 2 (a nested interrupt is being serviced)

See Also

[_int_install_isr](#)

Example

See [_int_get_kernel_isr](#).

2.1.37 `_int_get_kernel_isr`

Gets a pointer to the kernel ISR for the vector number. The kernel ISR depends on the PSP.

Prototype

```
source\psp\cpu_family\int_gkis.c
INT_KERNEL_ISR_FPTR _int_get_kernel_isr(
    uint32 vector)
```

Parameters

vector [IN] — Vector number whose kernel ISR is being requested

Returns

- Pointer to the kernel ISR (success)
- *NULL* (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code

See Also

[_int_kernel_isr](#)

[_int_install_kernel_isr](#)

Description

The returned kernel ISR is either the default kernel ISR or an ISR that the application installed with `_int_install_kernel_isr()`.

Example

Get various ISR info for a specific interrupt.

```
#define      SPECIFIC_INTERRUPT  3
_mqx_uint   depth;
void        *vector_tbl;
INT_KERNEL_ISR_FPTR kernel_isr;
INT_ISR_FPTR my_isr;
void        *my_isr_data;

kernel_isr  = _int_get_kernel_isr(SPECIFIC_INTERRUPT);
my_isr      = _int_get_isr(SPECIFIC_INTERRUPT);
my_isr_dat  = _int_get_isr_data(SPECIFIC_INTERRUPT);
depth       = _int_get_isr_depth();
vector_tbl  = _int_get_vector_table();
```

2.1.38 `_int_get_previous_vector_table`

Gets the address of the interrupt vector table that MQX might have created when it started.

Prototype

```
source\psp\cpu_family\int_pvta.c  
_psp_code_addr  
_int_get_previous_vector_table(void)
```

Parameters

None

Returns

Address of the interrupt vector table that MQX creates when it starts

See Also

[_int_get_vector_table](#)

[_int_set_vector_table](#)

Description

The function is useful if you are installing third-party debuggers or monitors.

2.1.39 `_int_get_vector_table`

Gets the address of the current interrupt vector table. The function depends on the PSP.

Prototype

```
source\psp\cpu_family\int_vtab.c  
_psp_code_addr _int_get_vector_table(void)
```

Parameters

None

Returns

Address of the current interrupt vector table

See also

[_int_set_vector_table](#)

[_int_get_previous_vector_table](#)

Example

See `_int_get_kernel_isr()`.

2.1.40 `_int_install_default_isr`

Installs an application-provided default ISR.

Prototype

```
source\kernel\int.c  
INT_ISR_FPTR _int_install_default_isr(  
    INT_ISR_FPTR default_isr)
```

Parameters

default_isr [IN] — New default ISR

Returns

Pointer to the default ISR before the function was called

See Also

[_int_get_default_isr](#)

[_int_install_isr](#)

Description

MQX uses the application-provided default ISR for all interrupts for which the application has not installed an application ISR. The ISR handles all unhandled and unexpected interrupts.

2.1.41 `_int_install_exception_isr`

Installs the MQX-provided `_int_exception_isr()` as the default ISR for unhandled interrupts and exceptions.

Prototype

```
source\kernel\int.c  
INT_ISR_FPTR _int_install_exception_isr(void)
```

Parameters

None

Returns

Pointer to the default exception handler before the function was called

See Also

[_int_get_default_isr](#)

2.1.42 `_int_install_isr`

Installs the ISR.

Prototype

```
source\kernel\int.c
INT_ISR_FPTR _int_install_isr(
    _mqx_uint      vector,
    INT_ISR_FPTR   isr_ptr,
    void           *isr_data)
```

Parameters

vector [IN] — Vector number (not the offset) of the interrupt

isr_ptr [IN] — Pointer to the ISR

isr_data [IN] — Pointer to the data to be passed as the first parameter to the ISR when an interrupt occurs and the ISR runs

Returns

- Pointer to the ISR for the vector before calling the function (success)
- *NULL* (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

Task Error Codes

Error Code	Description
MQX_COMPONENT_DOES_NOT_EXIST	Interrupt component is not created.
MQX_INVALID_VECTORED_INTERRUPT	Vector is outside the valid range of interrupt numbers.

See Also

[_int_get_default_isr](#)

[_int_install_default_isr](#)

[_int_get_isr_data](#)

[_int_set_isr_data](#)

[_int_get_isr](#)

[_task_set_error](#)

Description

The application defines the ISR data, which can be a constant or a pointer to a memory block from `_mem_alloc()`.

MQX catches all hardware interrupts in the range that the BSP defined and saves the context of the active task. For most interrupts, MQX calls the ISR that is stored in the interrupt vector table at the location identified by its interrupt vector number.

Example

In the initialization of a serial I/O handler, install the same ISR for the four channels, assigning a logical interrupt to each one through the third parameter of **_int_install_isr()**.

```
_int_install_isr(SIO_INTERRUPT_A, SIO_isr, LOG_INTA);  
_int_install_isr(SIO_INTERRUPT_B, SIO_isr, LOG_INTB);  
_int_install_isr(SIO_INTERRUPT_C, SIO_isr, LOG_INTC);  
_int_install_isr(SIO_INTERRUPT_D, SIO_isr, LOG_INTD);
```

2.1.43 `_int_install_kernel_isr`

Installs the kernel ISR. The kernel ISR depends on the PSP.

Prototype

```
source\psp\cpu_family\int_kisr.c
INT_KERNEL_ISR_FPTR _int_install_kernel_isr(
    _mqx_uint          vector,
    INT_KERNEL_ISR_FPTR isr_ptr)
```

Parameters

vector [IN] — Vector where the kernel ISR is to be installed

isr_ptr [IN] — Pointer to the ISR to install in the vector table

Returns

- Pointer to the kernel ISR for the vector before the function was called (success)
- *NULL* (failure)

See Also

[_int_kernel_isr](#)

[_int_get_kernel_isr](#)

Description

Some real-time applications need special event handling to occur outside the scope of MQX. The need might arise that the latency in servicing an interrupt be less than the MQX interrupt latency. If this is the case, an application can use `_int_install_kernel_isr()` to bypass MQX and let the interrupt be serviced immediately.

Because the function returns the previous kernel ISR, applications can temporarily install an ISR or chain ISRs so that each new one calls the one installed before it.

A kernel ISR must save the registers that it needs and must service the hardware interrupt. When the kernel ISR is finished, it must restore the registers and perform a return-from-interrupt instruction.

A kernel ISR cannot call MQX functions. However, it can put data in global data, which a task can access.

NOTE

The function is not available for all PSPs.

2.1.44 `_int_install_unexpected_isr`

Installs the MQX-provided unexpected ISR, `_int_unexpected_isr()`, for all interrupts that do not have an application-installed ISR.

Prototype

```
source\kernel\int.c  
INT_ISR_FPTR _int_install_unexpected_isr(void)
```

Parameters

None

Returns

Pointer to the unexpected interrupt ISR before the function was called

See Also

[_int_install_exception_isr](#)

[_int_unexpected_isr](#)

Description

The installed ISR writes the cause of the unexpected interrupt to the standard I/O stream.

2.1.45 `_int_kernel_isr`

Default kernel ISR that MQX calls to intercept all interrupts.

Prototype

```
source\psp\cpu_family\dispatch.comp  
void _int_kernel_isr(void)
```

Parameters

None

Returns

None

See Also

[`_int_install_kernel_isr`](#)

[`_int_install_isr`](#)

Description

The ISR is usually written in assembly language.

It does the following:

- Saves enough registers so that an ISR written in C can be called.
- If the current stack is not the interrupt stack, switches to the interrupt stack.
- Creates an interrupt context on the stack. This lets functions written in C properly access the task error code, `_int_enable()`, and `_int_disable()`.
- Checks for ISRs. If they have not been installed or if the ISR number is outside the range of installed ISRs, calls `DEFAULT_ISR`.
- If ISRs have been installed and if an application C-language ISR has not been installed for the vector, calls `DEFAULT_ISR`.
- After returning from the C-language ISR, does the following:
 - if this is a nested ISR, performs an interrupt return instruction.
 - if the current task is still the highest-priority ready task, performs an interrupt return instruction.
 - otherwise, saves the full context for the current task and enters the scheduler

2.1.46 `_int_set_exception_handler`

Sets the ISR exception handler for the interrupt vector.

Prototype

```
source\kernel\int.c
INT_EXCEPTION_FPTR _int_set_exception_handler
    (_mqx_uint      vector,
     INT_EXCEPTION_FPTR error_handler_address)
```

Parameters

vector [IN] — Interrupt vector that this exception handler is for

error_handler_address [IN] — Pointer to the exception handler

Returns

- Pointer to the exception handler before the function was called (success)
- `NULL` (failure)

Traits

On failure, does not install the exception handler and calls `_task_set_error()` to set the task error code

See Also

[_int_get_exception_handler](#)

[_int_exception_isr](#)

[_task_set_error](#)

Description

The function sets the exception handler for an ISR. When an exception (unhandled interrupt) occurs while the ISR is running, MQX calls the exception handler and terminates the ISR.

An application should install `_int_exception_isr()` as the MQX default ISR.

The returned exception handler is either the default handler or one that the application previously installed with `_int_set_exception_handler()`.

2.1.47 `_int_set_isr_data`

Sets the data associated with the interrupt.

Prototype

```
source\kernel\int.c  
void *_int_set_isr_data(  
    _mqx_uint vector,  
    void      *data)
```

Parameters

vector [IN] — Interrupt vector that the data is for

data [IN] — Data that MQX passes to the ISR as its first parameter

Returns

- ISR data before the function was called (success)
- *NULL* (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code

See also

[_int_get_isr](#)

[_int_get_isr_data](#)

2.1.48 `_int_set_vector_table`

Changes the location of the interrupt vector table.

Prototype

```
source\psp\cpu_family\int_vtab.c  
_psp_code_addr _int_set_vector_table(  
    _psp_code_addr new)
```

Parameters

new [IN] — Address of the new interrupt vector table

Returns

Address of the previous vector table

Traits

Behavior depends on the BSP and the PSP

See Also

[`_int_get_vector_table`](#)

[`_int_get_previous_vector_table`](#)

2.1.49 `_int_unexpected_isr`

An MQX-provided default ISR for unhandled interrupts. The function depends on the PSP.

Prototype

```
source\psp\cpu_family\int_unx.c  
void _int_unexpected_isr(  
    void *parameter)
```

Parameters

parameter [IN] — Parameter passed to the default ISR

Returns

None

Traits

Blocks the active task

See also

[_int_install_unexpected_isr](#)

Description

The function changes the state of the active task to **UNHANDLED_INT_BLOCKED** and blocks the task.

The function uses the default I/O channel to display at least:

- vector number that caused the unhandled exception
- task ID and task descriptor of the active task

Depending on the PSP, more information might be displayed.

CAUTION

Since the ISR uses `printf()` to display information to the default I/O channel, default I/O must not be on a channel that uses interrupt-driven I/O or the debugger.

2.1.50 `_psp_push_fp_context`

Store floating point context (registers).

Prototype

```
void void _psp_push_fp_context(void)
```

Parameters

None

Returns

None

See Also

[_psp_pop_fp_context](#)

Description

This function must be use in each interrupt handler which use FPU extension. Call it at the beginning, before any other operations to protect system against to corruption of context.

2.1.51 `_psp_pop_fp_context`

Restore floating point context (registers) in interrupt handler.

Prototype

```
void void _psp_pop_fp_context(void)
```

Parameters

None

Returns

None

See Also

[_psp_push_fp_context](#)

Description

This function must be use in each interrupt handler which use FPU extension. Call it at the end, when every operations with the floatpoints finished.

2.1.52 `_ipc_add_io_ipc_handler`

Add an IPC handler for the I/O component.

Prototype

```
source\kernel\ipc.c
#include <ipc.h>
_mqx_uint _ipc_add_io_ipc_handler(
    IPC_HANDLER_FPTR handler,
    _mx_uint component)
```

Parameters

handler [IN] — Pointer to the function that MQX calls when it receives an IPC request for the component

component [IN] — I/O component that the handler is for (see description)

Returns

- MQX_OK
- Errors

Error	Description
MQX_IPC_SERVICE_NOT_AVAILABLE	IPC server has not been started.

See Also

[_ipc_add_ipc_handler](#)

Description

The IPC task calls the function when an IPC message for the specified I/O component is received. The IPC task calls the function once for each component.

The parameter *component* can be one of:

- **IO_CAN_COMPONENT**
- **IO_HDLC_COMPONENT**
- **IO_LAPB_COMPONENT**
- **IO_LAPD_COMPONENT**
- **IO_MFS_COMPONENT**
- **IO_PPP_COMPONENT**
- **IO_RTCS_COMPONENT**
- **IO_SDL_COMPONENT**
- **IO_SNMP_COMPONENT**
- **IO_SUBSYSTEM_COMPONENT**

2.1.53 `_ipc_add_ipc_handler`

Adds an IPC handler for the MQX component.

Prototype

```
source\kernel\ipc.c
#include <ipc.h>
_mqx_uint _ipc_add_ipc_handler(
    IPC_HANDLER_FPTR handler,
    _mx_uint component)
```

Parameters

handler [IN] — Pointer to the function that MQX calls when it receives an IPC request for the component

component [IN] — MQX component that the handler is for (see description)

Returns

- MQX_OK
- Errors

Error	Description
MQX_IPC_SERVICE_NOT_AVAILABLE	IPC server has not been started.

See Also

[_ipc_add_io_ipc_handler](#)

Description

The IPC task calls the function when an IPC message for the specified MQX component is received. The IPC task calls the function once for each component.

The parameter *component* can be one of:

- **KERNEL_EVENTS**
- **KERNEL_IPC**
- **KERNEL_IPC_MSG_ROUTING**
- **KERNEL_LOG**
- **KERNEL_LWLOG**
- **KERNEL_MESSAGES**
- **KERNEL_MUTEXES**
- **KERNEL_NAME_MANAGEMENT**
- **KERNEL_PARTITIONS**
- **KERNEL_SEMAPHORES**
- **KERNEL_TIMER**
- **KERNEL_WATCHDOG**

2.1.54 `_ipc_msg_processor_route_exists`

Gets a pointer to the route for the processor.

Prototype

```
source\kernel\ipc.c
#include <ipc.h>
void *_ipc_msg_processor_route_exists(
    _processor_number proc_number)
```

Parameters

proc_number [IN] — Processor number to check for a route

Returns

- Pointer to the route (a route exists)
- *NULL* (a route does not exist)

See Also

[`_ipc_msg_route_add`](#)

[`_ipc_msg_route_remove`](#)

2.1.55 `_ipc_msg_route_add`

Adds a route to the message routing table.

Prototype

```
source\kernel\ipc.c
#include <ipc.h>
_mqx_uint _ipc_msg_route_add(
    _processor_number min_proc_number,
    _processor_number max_proc_number,
    _queue_number     queue)
```

Parameters

min_proc_number [IN] — Minimum processor number in the range

max_proc_number [IN] — Maximum processor number in the range

queue [IN] — Queue number of the IPC to use for processor numbers in the range

Returns

- MQX_OK
- Errors
 - MQX_COMPONENT_DOES_NOT_EXIST
 - MQX_INVALID_PROCESSOR_NUMBER
 - MSGQ_INVALID_QUEUE_ID
 - IPC_ROUTE_EXISTS

See Also

[_ipc_msg_route_remove](#)

[_ipc_msg_processor_route_exists](#)

[IPC_ROUTING_STRUCT](#)

Description

The IPC component must first be created.

2.1.56 `_ipc_msg_route_remove`

Removes a route from the message routing table.

Prototype

```
source\kernel\ipc.c
#include <ipc.h>
_mqx_uint _ipc_msg_route_remove(
    _processor_number  min_proc_number,
    _processor_number  max_proc_number,
    _queue_number      queue)
```

Parameters

- *min_proc_number [IN]* — Minimum processor number in the range
- *max_proc_number [IN]* — Maximum processor number in the range
- *queue [IN]* — Queue number of the IPC to remove

Returns

- MQX_OK
- Errors
 - MQX_COMPONENT_DOES_NOT_EXIST
 - MQX_INVALID_PROCESSOR_NUMBER

See Also

[_ipc_msg_route_add](#)

[_ipc_msg_processor_route_exists](#)

IPC_ROUTING_STRUCT

Description

The IPC component must first be installed.

2.1.57 `_ipc_pcb_init`

Initializes an IPC for a PCB driver.

Prototype

```
source\kernel\ipc.c
_mqx_uint _ipc_pcb_init(
    IPC_PROTOCOL_INIT_STRUCT_PTR init_ptr,
    void *info_ptr)
```

Parameters

init_ptr [IN] — Pointer to an IPC protocol initialization structure (**IPC_PROTOCOL_INIT_STRUCT**)

info_ptr [IN] — Pointer to an IPC protocol information structure

Returns

- **MQX_OK** (success)
- **IPC_LOOPBACK_INVALID_QUEUE** (failure)

See Also

[IPC_PCB_INIT_STRUCT](#)

[IPC_PROTOCOL_INIT_STRUCT](#)

Description

The function is used in structure of type **IPC_PROTOCOL_STRUCT** to initialize an IPC that uses the PCB device drivers.

The **IPC_PROTOCOL_INIT_DATA** field in **IPC_PROTOCOL_INIT_STRUCT** must point to a structure of type **IPC_PCB_INIT_STRUCT**.

Example

Initialize an IPC for the PCB.

```
IPC_PCB_INIT_STRUCT pcb_init =
{
    /* IO_PORT_NAME */           "pcb_mqxa_ittyb:",
    /* DEVICE_INSTALL? */        _io_pcb_mqxa_install,
    /* DEVICE_INSTALL_PARAMETER*/ (void*)&pcb_mqxa_init,
    /* IN_MESSAGES_MAX_SIZE */   sizeof( THE_MESSAGE ),
    /* IN_MESSAGES_TO_ALLOCATE */ 8,
    /* IN_MESSAGES_TO_GROW */     8,
    /* IN_MESSAGES_MAX_ALLOCATE */ 16,
    /* OUT_PCBS_INITIAL */        8,
    /* OUT_PCBS_TO_GROW */        8,
```



```
/* OUT_PCBS_MAX */          16
};

IPC_PROTOCOL_INIT_STRUCT _ipc_init_table[] =
{
    { _ipc_pcb_init, &pcb_init, "Pcb_to_test2", QUEUE_TO_TEST2 },
    { NULL, NULL, NULL, 0}
};
```

2.1.58 `_ipc_task`

Task that initializes IPCs and processes remote service requests.

Prototype

```
source\kernel\ipc.c
#include <ipc.h>
void _ipc_task(
    uint32_t parameter)
```

Parameters

parameter [IN] — pointer to the IPC_INIT_STRUCT (task creation parameter)

Returns

None

See Also

[IPC_INIT_STRUCT](#)

Description

For applications to use the IPC component, the task must be either specified in the task template list as an autostart task or explicitly created.

The task installs the IPCs that are listed in the IPC initialization structure. Pointer to this initialization structure (IPC_INIT_STRUCT_PTR) is provided as the creation parameter, otherwise default IPC_INIT_STRUCT is used (*_default_ipc_init*). When the initialization is finished it waits for service requests from remote processors.

Example

The task template causes MQX to create IPC Task.

```
static const IPC_INIT_STRUCT ipc_init = {
    ipc_routing_table,
    ipc_init_table
};

TASK_TEMPLATE_STRUCT  MQX_template_list[] =
{
    { IPC_TTN,    _ipc_task,    IPC_DEFAULT_STACK_SIZE, 6L,
      "_ipc_task", MQX_AUTO_START_TASK, (uint32_t)&ipc_init, 0L },
    ...

    { 0L, 0L, 0L, 0L, 0L, 0L, 0L, 0L }
};
```

2.1.59 `_klog_control`

Controls logging in kernel log.

Prototype

```
source\kernel\klog.c
#include <klog.h>
void _klog_control(
    uint32_t bit_mask,
    bool      set_bits)
```

Parameters

bit_mask [IN] — Which bits of the kernel log control variable to modify

set_bits [IN] – TRUE (bits that are set in *bit_mask* are set in the control variable)

FALSE (bits that are set in *bit_mask* are cleared in the control variable)

Returns

None

See Also

[_klog_create, _klog_create_at](#)

[_klog_disable_logging_task, _klog_enable_logging_task](#)

[_lwlog_create_component](#)

Description

The application must first create kernel log with `_klog_create()`.

The function `_klog_control()` sets or clears bits in the kernel log control variable, which MQX uses to control logging. To select which functions to log, set combinations of bits in the **KLOG_FUNCTIONS_ENABLED** flag for the *bit_mask* parameter.

MQX logs to kernel log only if **KLOG_ENABLED** is set in *bit_mask*.

NOTE

To use kernel logging, MQX must be configured at compile time with `MQX_KERNEL_LOGGING` set to 1. For information on configuring MQX, see MQX User's Guide.

If this bit is set:	MQX:
KLOG_ENABLED (log MQX services)	Logs to kernel log

If combinations of these bits are set:	Select combinations from:
KLOG_FUNCTIONS_ENABLED (log calls to MQX component APIs)	KLOG_TASKING_FUNCTIONS KLOG_ERROR_FUNCTIONS KLOG_MESSAGE_FUNCTIONS KLOG_INTERRUPT_FUNCTIONS KLOG_MEMORY_FUNCTIONS KLOG_TIME_FUNCTIONS KLOG_EVENT_FUNCTIONS KLOG_NAME_FUNCTIONS KLOG_MUTEX_FUNCTIONS KLOG_SEMAPHORE_FUNCTIONS KLOG_WATCHDOG_FUNCTIONS KLOG_PARTITION_FUNCTIONS KLOG_IO_FUNCTIONS
KLOG_TASK_QUALIFIED (log specific tasks only)	For each task to log, call one of: _klog_disable_logging_task() _klog_enable_logging_task()
KLOG_INTERRUPTS_ENABLED (log interrupts) KLOG_SYSTEM_CLOCK_INT_ENABLED (log periodic timer interrupts) KLOG_CONTEXT_ENABLED (log context switches)	—

Example

Enable logging to kernel log for all calls that this task and its creator make to the semaphore component API.

```
_log_create_component();
_klog_create(4096, LOG_OVERWRITE);

/* Clear all the control bits and then set particular ones: */
_klog_control(0xffffffff, FALSE);
_klog_control(
    KLOG_ENABLED |
    KLOG_TASK_QUALIFIED |
    KLOG_FUNCTIONS_ENABLED | KLOG_SEMAPHORE_FUNCTIONS,
    TRUE);

/* Enable task logging for this task and its creator: */
_klog_enable_logging_task(_task_get_id());
_klog_enable_logging_task(_task_get_creator());
...
/* Disable task logging for this task: */
_klog_disable_logging_task(_task_get_id());

/* Display and delete all entries in kernel log: */
while (_klog_display()) {
}
```

2.1.60 `_klog_create`, `_klog_create_at`

<code>_klog_create()</code>	Creates kernel log.
<code>_klog_create_at()</code>	Creates kernel log at the specific location

Prototype

```
source\kernel\klog.c
#include <log.h>
#include <klog.h>
_mqx_uint _klog_create(
    _mx_uint max_size,
    _mx_uint flags)

source\kernel\klog.c
#include <log.h>
#include <klog.h>
_mqx_uint _klog_create_at(
    _mx_uint max_size,
    _mx_uint flags,
    void *where)
```

Parameters

max_size [IN] — Maximum size (in **mqx_max_types**) of the data to be stored

flags [IN] — One of the following:

LOG_OVERWRITE (when the log is full, write new entries over oldest entries)

0 (when the log is full, write no more entries; the default)

where [IN] — Where to create the log

Returns

- **MQX_OK**
- Errors

Errors from <code>_lwlog_create()</code>	Description
LOG_EXISTS	Kernel log already exists.
MQX_INVALID_COMPONENT_BASE	Log component data is not valid.
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for kernel log.

See Also

[_klog_control](#)

[_klog_disable_logging_task](#), [_klog_enable_logging_task](#)

[_lwlog_create_component](#)

[_lwlog_create, _lwlog_create_at](#)

Description

If the log component is not created, MQX creates it. MQX uses lightweight log number 0 as kernel log.

Each entry in kernel log contains MQX-specific data, a timestamp (in absolute time), a sequence number, and information specified by **_klog_control()**.

The MQX Embedded PerformanceTool uses kernel log to analyze how the application operates and uses resources.

Example

See [_klog_control\(\)](#).

2.1.61 `_klog_disable_logging_task`, `_klog_enable_logging_task`

<code>_klog_disable_logging_task()</code>	Disables kernel logging for the task.
<code>_klog_enable_logging_task()</code>	Enables kernel logging for the task.

Prototype

```
source\kernel\klog.c
#include <klog.h>
void _klog_disable_logging_task(
    _task_id task_id)
```

Parameters

task_id [IN] — Task ID of the task for which kernel logging is to be disabled or enabled

Returns

None

Traits

Disables and enables interrupts

See Also

[_klog_control](#)

Description

If the application calls `_klog_control()` with **KLOG_TASK_QUALIFIED**, it must call `_klog_enable_logging_task()` for each task for which it wants to log information.

The application disables logging by calling `_klog_disable_logging_task()` for each task for which it wants to stop logging. If the application did not first enable logging for the task, MQX ignores the request.

NOTE

To use kernel logging, MQX must be configured at compile time with `MQX_KERNEL_LOGGING` set to 1. For information on configuring MQX, see MQX User's Guide.

Example

See `_klog_control()`.

2.1.62 `_klog_display`

Displays the oldest entry in kernel log and delete the entry.

Prototype

```
source\kernel\klog.c  
bool _klog_display(void)
```

Parameters

None

Returns

- *TRUE* (entry is found and displayed)
- *FALSE* (entry is not found)

Traits

Depending on the low-level I/O used, the calling task might block and MQX might perform a dispatch operation.

See Also

[`_klog_control`](#)

[`_klog_create`](#), [`_klog_create_at`](#)

Description

The function prints the oldest entry in kernel log to the default output stream of the current task and deletes the entry.

Example

See `_klog_control()`.

2.1.63 `_klog_get_interrupt_stack_usage`

Gets the size of the interrupt stack and the total amount of it used.

Prototype

```
source\kernel\klog.c
_mqx_uint _klog_get_interrupt_stack_usage(
    _mem_size_ptr  stack_size_ptr,
    _mem_size_ptr  stack_used_ptr)
```

Parameters

stack_size_ptr [OUT] — Where to write the size (in single-addressable units) of the stack
stack_used_ptr [OUT] — Where to write the amount (in single-addressable units) of stack used

Returns

- MQX_OK (success)
- MQX_INVALID_CONFIGURATION (failure: compile-time configuration option MQX_MONITOR_STACK is not set)

See Also

[_klog_get_task_stack_usage](#)

[_klog_show_stack_usage](#)

Description

The amount used is a highwater mark—the highest amount of interrupt stack that the application has used so far. It shows only how much of the stack has been written to at this point. If the amount is 0, the interrupt stack is not large enough.

NOTE

To use kernel logging, MQX must be configured at compile time with MQX_MONITOR_STACK set to 1. For information on configuring MQX, see MQX User's Guide.

Example

Determine the state of all stacks.

```
_mem_size  stack_size;
_mem_size  stack_used;
_mqx_uint  return_value;
...
_klog_get_interrupt_stack_usage(&stack_size, &stack_used);
printf("Interrupt stack size: 0x%x, Stack used: 0x%x",
    stack_size, stack_used);

/* Get stack usage for this task: */
_klog_get_task_stack_usage(_task_get_id(), &stack_size, &stack_used);
printf("Task ID: 0x%lx, Stack size: 0x%x, Stack used: 0x%x",
    _task_get_id(), stack_size, stack_used);
```

```
...  
/* Display all stack usage: */  
_klog_show_stack_usage();
```

2.1.64 `_klog_get_task_stack_usage`

Gets the stack size for the task and the total amount of it that the task has used.

Prototype

```
source\kernel\klog.c
_mqx_uint _klog_get_task_stack_usage(
    _task_id      task_id,
    _mem_size_ptr stack_size_ptr,
    _mem_size_ptr stack_used_ptr)
```

Parameters

task_id [IN] — Task ID of the task to display

stack_size_ptr [OUT] — Where to write the size (in single-addressable units) of the stack

stack_used_ptr [OUT] — Where to write the amount (in single-addressable units) of stack used

Returns

- **MQX_OK** (success)
- Errors (failure)

Error	Description
MQX_INVALID_CONFIGURATION	Compile-time configuration option MQX_MONITOR_STACK is not set.
MQX_INVALID_TASK_ID	<i>task_id</i> is not valid.

See Also

[_klog_get_interrupt_stack_usage](#)

[_klog_show_stack_usage](#)

NOTE

To use kernel logging, MQX must be configured at compile time with MQX_MONITOR_STACK set to 1. For information on configuring MQX, see MQX User's Guide.

Description

The amount used is a highwater mark—the highest amount of stack that the task has used so far. It might not include the amount that the task is currently using. If the amount is 0, the stack is not large enough.

Example

See `_klog_get_interrupt_stack_usage()`.

2.1.65 `_klog_show_stack_usage`

Displays the amount of interrupt stack used and the amount of stack used by each task.

Prototype

```
source\kernel\klog.c  
void _klog_show_stack_usage(void)
```

Parameters

None

Returns

None

Traits

Depending on the low-level I/O used, the calling task might block and MQX might perform a dispatch operation.

See Also

[`_klog_get_interrupt_stack_usage`](#)

[`_klog_get_task_stack_usage`](#)

Description

The function displays the information on the standard output stream for the calling task.

NOTE

To use kernel logging, MQX must be configured at compile time with `MQX_MONITOR_STACK` set to 1. For information on configuring MQX, see MQX User's Guide.

Example

See `_klog_get_interrupt_stack_usage()`.

2.1.66 `_log_create`

Creates the log.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_create(
    _mx_uint    log_number,
    _mx_uint    max_size,
    uint32_t    flags)
```

Parameters

log_number [IN] — Log number to create (0 through 15)

max_size [IN] — Maximum number of **_mx_uint**s to store in the log (includes **LOG_ENTRY_STRUCT** headers)

flags [IN] — One of the following:

LOG_OVERWRITE (when the log is full, write new entries over oldest ones)

0 (when the log is full, do not write entries)

Returns

- **MQX_OK**
- Errors

Error	Description
LOG_EXISTS	Log <i>log_number</i> has already been created.
MQX_OUT_OF_MEMORY	MQX is out of memory.

Traits

Creates the log component if it was not created

See Also

[_log_create_component](#)

[_log_destroy](#)

[_log_read](#)

[_log_write](#)

[LOG_ENTRY_STRUCT](#)

Description

Each entry in the log contains application-specified data, a timestamp (in absolute time), and a sequence number.

Example

```
#define LOG_SIZE 2048 /* Number of long words in the log */
_mqx_uint my_log = 2;
unsigned char log_entry[sizeof(LOG_ENTRY_STRUCT) + DATA_SIZE];
...
if (_log_create(my_log, LOG_SIZE, LOG_OVERWRITE) != MQX_OK) {
    /* The function failed.*/
}
while (quit == FALSE) {
    result = _log_write(my_log, 3, EVENT_B, i, j);
    ...
    result = _log_read(my_log, LOG_READ_OLDEST_AND_DELETE,
        DATA_SIZE, &log_entry);
}
...
log_destroy(my_log);
```

2.1.67 `_log_create_component`

Creates the log component.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_create_component(void)
```

Parameters

None

Returns

- MQX_OK (success)
- MQX_OUT_OF_MEMORY (failure)

Traits

Disables and enables interrupts

See Also

[_log_create](#)

Description

The log component provides a maximum of 16 separately configurable user logs (log numbers 0 through 15).

An application subsequently creates user logs with `_log_create()`.

2.1.68 `_log_destroy`

Destroys the log.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_destroy(
    _mx_uint log_number)
```

Parameters

log_number [IN] — Log number of a previously created log

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not previously created.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.

See Also

[_log_create](#)

[_log_create_component](#)

Example

See `_log_create()`.

2.1.69 `_log_disable`, `_log_enable`

<code>_log_disable()</code>	Stops logging to the log.
<code>_log_enable()</code>	Starts logging to the log.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_disable(
    _mx_uint log_number)

_mqx_uint _log_enable(
    _mx_uint log_number)
```

Parameters

log_number [IN] — Log number of a previously created log

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.

See Also

[_log_read](#)

[_log_reset](#)

[_log_write](#)

Description

A task can enable a log that has been disabled.

Example

See `_log_reset()`.

2.1.70 `_log_read`

Reads the information in the log.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_read(
    _mx_uint      log_num,
    _mx_uint      read_type,
    _mx_uint      size,
    LOG_ENTRY_STRUCT_PTR entry_ptr)
```

Parameters

log_num [IN] — Log number of a previously created log

read_type [IN] — Type of read operation (see description)

size [IN] — Maximum number of **_mqx_uints** (not including the entry header) to be read from an entry

entry_ptr [IN] — Where to write the log entry (any structure that starts with **LOG_STRUCT** or **LOG_ENTRY_STRUCT**)

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_ENTRY_NOT_AVAILABLE	Log entry is not available.
LOG_INVALID	<i>log_number</i> is out of range.
LOG_INVALID_READ_TYPE	<i>read_type</i> is not valid.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.
MQX_INVALID_POINTER	<i>entry_ptr</i> is <i>NULL</i> .

See Also

[_log_create](#)

[_log_write](#)

LOG_STRUCT

LOG_ENTRY_STRUCT

Description

read_type	Returns this entry in the log:
LOG_READ_NEWEST	Newest
LOG_READ_NEXT	Next one after the previous one read (must be used with LOG_READ_OLDEST)
LOG_READ_OLDEST	Oldest
LOG_READ_OLDEST_AND_DELETE	Oldest and deletes it

Example

See `_log_create()`.

2.1.71 `_log_reset`

Resets the log to its initial state (remove all entries).

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_reset(
    _mx_uint log_number)
```

Parameters

log_number [IN] — Log number of a previously created log

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.

See Also

[_log_disable](#), [_log_enable](#)

Example

```
_mx_uint my_log = 2;
...
result = _log_disable(my_log);
result = _log_reset(my_log);
if (result != MQX_OK) {
    /* The function failed. */
    return result;
}
result = _log_enable(my_log);
...
```

2.1.72 `_log_test`

Tests the log component.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_test(
    _mx_uint *log_error_ptr)
```

Parameters

log_error_ptr [OUT] — Pointer to the log in error (*NULL* if no error is found)

Returns

See description

Traits

Disables and enables interrupts

See Also

[_log_create_component](#)

[_log_create](#)

Description

Return value	<i>*log_error_ptr</i>	Condition
LOG_INVALID	Log number of the first invalid log	Information for a specific log is not valid
MQX_INVALID_COMPONENT_BASE	0	Log component data is not valid
MQX_OK	0	Log component data is valid

Example

```
_mx_uint bad_log;
...
result = _log_test(&bad_log);
switch (result) {
    case MQX_OK:
        printf("Log component is valid.");
        break;
    case MQX_INVALID_COMPONENT_BASE:
        printf("Log component data is not valid.");
        break;
    case LOG_INVALID:
        printf("Log %ld is not valid.", bad_log);
        break;
}
...
```

2.1.73 `_log_write`

Writes to the log.

Prototype

```
source\kernel\log.c
#include <log.h>
_mqx_uint _log_write(
    _mx_uint log_number,
    _mx_uint num_of_parameters,
    _mx_uint param1, ...)
```

Parameters

log_number [IN] — Log number of a previously created log

num_of_parameters [IN] — Number of parameters to write

param1 [IN] — Value to write (number of parameters depends on *num_of_parameters*)

Returns

- MQX_OK
- Errors

See Also

[_log_create](#)

[_log_read](#)

[_log_disable](#), [_log_enable](#)

Description

The function writes the log entry only if it returns **MQX_OK**.

Error	Description
LOG_DISABLED	Log is disabled.
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_FULL	Log is full and LOG_OVERWRITE is not set.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.

Example

See `_log_create()`.

2.1.74 `_lwevent_clear`

Clears the specified event bits in the lightweight event group.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_clear(
    LWEVENT_STRUCT_PTR event_group_ptr,
    _mqx_uint           bit_mask)
```

Parameters

event_group_ptr [IN] — Pointer to the event group
bit_mask [IN] — Each set bit represents an event bit to clear

Returns

- MQX_OK (success)
- LWEVENT_INVALID_EVENT (failure: lightweight event group is not valid)

Traits

Disables and enables interrupts.

See Also

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set, _lwevent_set_auto_clear](#)

[_lwevent_test](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

2.1.75 `_lwevent_create`

Initializes the lightweight event group.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_create(
    LWEVENT_STRUCT_PTR lwevent_group_ptr,
    _mqx_uint flags)
```

Parameters

lwevent_group_ptr [IN] — Pointer to the lightweight event group to initialize

flags [IN] — Creation flag; one of the following:

LWEVENT_AUTO_CLEAR - all bits in the lightweight event group are made autoclearing
0 - lightweight event bits are not set as autoclearing by default

note: the autoclearing bits can be changed any time later by calling [_lwevent_set_auto_clear](#).

Returns

- MQX_OK
- MQX_EINVAL (lwevent is already initialized)
- MQX_LWEVENT_INVALID (If, when in user mode, MQX tries to access a lwevent with inappropriate access rights.)

Traits

Disables and enables interrupts.

See Also

[_lwevent_destroy](#)

[_lwevent_set](#), [_lwevent_set_auto_clear](#)

[_lwevent_clear](#)

[_lwevent_test](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

2.1.76 `_lwevent_destroy`

Deinitializes the lightweight event group.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_destroy(
    LWEVENT_STRUCT_PTR lwevent_group_ptr)
```

Parameters

lwevent_group_ptr [IN] — Pointer to the event group to deinitialize

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_LWEVENT_INVALID	Lightweight event group was not valid.

Traits

Cannot be called from an ISR.

See Also

[_lwevent_create](#)

[_lwevent_set](#), [_lwevent_set_auto_clear](#)

[_lwevent_clear](#)

[_lwevent_test](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

Description

To reuse the lightweight event group, a task must reinitialize it.

2.1.77 `_lwevent_get_signalled`

Gets which particular bit(s) in the lwevent unblocked recent wait command.

Prototype

```
source\kernel\lwevent.c  
#include <lwevent.h>  
_mqx_uint _lwevent_get_signalled(void)
```

Parameters

None

Returns

- lwevent mask from last task's lwevent_wait_xxx call that unblocked the task

See Also

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set, _lwevent_set_auto_clear](#)

[_lwevent_clear](#)

[_lwevent_test](#)

[_lwevent_wait_ ...](#)

[LWEVENT_STRUCT](#)

Description

If `_lwevent_wait_xxx(...)` was recently called in a task, following call of `_lwevent_get_signalled` returns the mask of bit(s) that unblocked the command. User can expect valid data only when the recent `_lwevent_wait_xxx(...)` operation did not return `LWEVENT_WAIT_TIMEOUT` or an error value. This is useful primarily for events that are cleared automatically and thus corresponding `LWEVENT_STRUCT` was automatically reset and holds new value.

Example

```

result = _lwevent_wait_ticks(&my_event, MY_EVENT_A | MY_EVENT_B, FALSE, 5);
switch (result)
{
    case MQX_OK:
        /* Don't get value using legacy my_event.VALUE, obsolete */
        mask = _lwevent_get_signalled();
        if (mask & MY_EVENT_A)
        {
            printf("MY_EVENT_A unblocked this task.\n");
        }
        if (mask & MY_EVENT_B)
        {
            printf("MY_EVENT_B unblocked this task.\n");
        }
        break;
    case LWEVENT_WAIT_TIMEOUT:
        printf("The task was unblocked after 5 ticks timeout.\n");
        break;
    default:
        printf("An error %d on lwevent.\n", result);
        break;
}

```

2.1.78 `_lwevent_set`

Sets the specified event bits in the lightweight event group.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_set(
    LWEVENT_STRUCT_PTR lwevent_group_ptr,
    _mqx_uint flags)
```

Parameters

lwevent_group_ptr [IN] — Pointer to the lightweight event group to set bits in
flags [IN] — Each bit represents an event bit to be set

Returns

- MQX_OK (success)
- MQX_LWEVENT_INVALID (failure: lightweight event group was invalid)

Traits

Disables and enables interrupts

See Also

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set_auto_clear](#)

[_lwevent_clear](#)

[_lwevent_test](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

2.1.79 `_lwevent_set_auto_clear`

Sets autoclearing behavior of event bits in the lightweight event group.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_set_auto_clear(
    LWEVENT_STRUCT_PTR  lwevent_group_ptr,
    _mx_uint             auto_mask)
```

Parameters

lwevent_group_ptr [IN] — Pointer to the lightweight event group to set bits in
auto_mask [IN] — Mask of events, which become auto-clear (if corresponding bit of mask is set) or manual-clear (if corresponding bit of mask is clear)

Returns

- MQX_OK (success)
- MQX_LWEVENT_INVALID (failure: lightweight event group was invalid)

Traits

Disables and enables interrupts.

See Also

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set](#)

[_lwevent_clear](#)

[_lwevent_test](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

2.1.80 `_lwevent_test`

Tests the lightweight event component.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_test(
    void *lwevent_error_ptr,
    void *td_error_ptr)
```

Parameters

lwevent_error_ptr [OUT] — Pointer to the lightweight event group that has an error if MQX found an error in the lightweight event component (*NULL* if no error is found)

td_error_ptr [OUT] — TD on the lightweight event in error (*NULL* if no error is found)

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_LWEVENT_INVALID	A lightweight event group was invalid.
Return code from <code>_queue_test()</code>	Waiting queue for a lightweight event group has an error.

Traits

Cannot be called from an ISR.

See Also

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set, _lwevent_set_auto_clear](#)

[_lwevent_clear](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

2.1.81 `_lwevent_wait` ...

	Wait for the specified lightweight event bits to be set in the lightweight event group:
<code>_lwevent_wait_for()</code>	For the number of ticks (in tick time)
<code>_lwevent_wait_ticks()</code>	For the number of ticks
<code>_lwevent_wait_until()</code>	Until the specified time (in tick time)

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_wait_for(
    LWEVENT_STRUCT_PTR    event_ptr,
    _mx_uint               bit_mask,
    bool                   all,
    MQX_TICK_STRUCT_PTR    tick_ptr)

source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_wait_ticks(
    LWEVENT_STRUCT_PTR    event_ptr,
    _mx_uint               bit_mask,
    bool                   all,
    _mx_uint               timeout_in_ticks)

source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _lwevent_wait_until(
    LWEVENT_STRUCT_PTR    event_ptr,
    _mx_uint               bit_mask,
    bool                   all,
    MQX_TICK_STRUCT_PTR    tick_ptr)
```

Parameters

event_ptr [IN] — Pointer to the lightweight event

bit_mask [IN] — Each set bit represents an event bit to wait for

all — One of the following:

- TRUE (wait for all bits in *bit_mask* to be set)
- FALSE (wait for any bit in *bit_mask* to be set)

tick_ptr [IN] — One of the following:

- pointer to the maximum number of ticks to wait
- NULL (unlimited wait)

timeout_in_ticks [IN] — One of the following:

- maximum number of ticks to wait

0 (unlimited wait)

Returns

- MQX_OK
- LWEVENT_WAIT_TIMEOUT (the time elapsed before an event signalled)
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_LWEVENT_INVALID	Lightweight event group is no longer valid or was never valid.

Traits

Blocks until the event combination is set or until the timeout expires.

Cannot be called from an ISR.

See Also

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set, _lwevent_set_auto_clear](#)

[_lwevent_clear](#)

[_lwevent_wait_ ...](#)

[_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

[MQX_TICK_STRUCT](#)

2.1.82 `_lwlog_calculate_size`

Calculates the number of single-addressable units required for the lightweight log.

Prototype

```
source\kernel\lwlog.c  
_mem_size _lwlog_calculate_size(  
    _mqx_uint  entries)
```

Parameters

entries [IN] — Maximum number of entries in the log

Returns

Number of single-addressable units required

See Also

[_lwlog_create](#), [_lwlog_create_at](#)

[_lwlog_create_component](#)

[_klog_create](#), [_klog_create_at](#)

Description

The calculation takes into account all headers.

2.1.83 `_lwlog_create`, `_lwlog_create_at`

<code>_lwlog_create()</code>	Creates the lightweight log.
<code>_lwlog_create_at()</code>	Creates the lightweight log at the specific location.

Prototype

```
source\kernel\lwlog.c
_mqx_uint _lwlog_create(
    _mx_uint log_number,
    _mx_uint max_size,
    _mx_uint flags)

source\kernel\lwlog.c
_mqx_uint _lwlog_create_at(
    _mx_uint log_number,
    _mx_uint max_size,
    _mx_uint flags,
    void *where)
```

Parameters

log_number [IN] — Log number to create (1 through 15; 0 is reserved for kernel log)

max_size [IN] — Maximum number of entries in the log

flags [IN] — One of the following:

LOG_OVERWRITE (when the log is full, write new entries over oldest ones)

NULL (when the log is full, do not write entries; the default behavior)

where [IN] — Where to create the lightweight log

Returns

- **MQX_OK**
- Errors

Errors from <code>_lwlog_create_component(</code> <code>)</code>	Description
LOG_EXISTS	Lightweight log with log number <i>log_number</i> exists.
LOG_INVALID	<i>log_number</i> is out of range.
LOG_INVALID_SIZE	<i>max_size</i> is 0.
MQX_INVALID_COMPONENT_BASE	Data for the lightweight log component is not valid.
MQX_INVALID_POINTER	<i>where</i> is NULL .

Traits

Creates the lightweight log component if it was not created

See Also

[_lwlog_create_component](#)

[_klog_create](#), [_klog_create_at](#)

[LWLOG_ENTRY_STRUCT](#)

Description

Each entry in the log is the same size and contains a sequence number, a timestamp, and a seven-element array of application-defined data.

2.1.84 `_lwlog_create_component`

Creates the lightweight log component.

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_create_component(void)
```

Parameters

None

Returns

- `MQX_OK`
- Errors

Error	Description
<code>MQX_CANNOT_CALL_FUNCTION_FROM_ISR</code>	Function cannot be called from an ISR.
<code>MQX_OUT_OF_MEMORY</code>	MQX is out of memory.

Traits

Cannot be called from an ISR

See Also

[_lwlog_create](#), [_lwlog_create_at](#)

[_klog_create](#), [_klog_create_at](#)

Description

The lightweight log component provides a maximum of 16 logs, all with the same size of entries. Log number 0 is reserved for kernel log.

An application subsequently creates lightweight logs with `_lwlog_create()` or `_lwlog_create_at()`.

2.1.85 `_lwlog_destroy`

Destroys the lightweight log.

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_destroy(
    _mx_uint log_number)
```

Parameters

log_number [IN] — Log number of a previously created lightweight log (if *log_number* is 0, kernel log is destroyed)

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not previously created.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Lightweight log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Lightweight log component data is not valid.

Traits

Disables and enables interrupts

See Also

[_lwlog_create](#), [_lwlog_create_at](#)
[_lwlog_create_component](#)

2.1.86 `_lwlog_disable`, `_lwlog_enable`

<code>_lwlog_disable()</code>	Stops logging to the lightweight log.
<code>_lwlog_enable()</code>	Starts logging to the lightweight log.

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_disable(
    _mx_uint log_number)

_mqx_uint _lwlog_enable(
    _mx_uint log_number)
```

Parameters

log_number [IN] — Log number of a previously created lightweight log (if *log_number* is 0, kernel log is disabled or enabled)

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Lightweight log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Lightweight log component data is not valid.

See Also

[_lwlog_read](#)

[_lwlog_reset](#)

[_lwlog_write](#)

2.1.87 `_lwlog_read`

Reads the information in the lightweight log.

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_read(
    _mx_uint          log_number,
    _mx_uint          read_type,

    LWLOG_ENTRY_STRUCT_PTR entry_ptr)
```

Parameters

log_number [IN] — Log number of a previously created lightweight log (if *log_number* is 0, kernel log is read)

read_type [IN] — Type of read operation (see `_log_read()`)

entry_ptr [IN] — Where to write the log entry

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_ENTRY_NOT_AVAILABLE	Log entry is not available.
LOG_INVALID	<i>log_number</i> is out of range.
LOG_INVALID_READ_TYPE	<i>read_type</i> is not valid.
MQX_COMPONENT_DOES_NOT_EXIST	Lightweight log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Lightweight log component data is not valid.
MQX_INVALID_POINTER	<i>entry_ptr</i> is <i>NULL</i> .

See Also

[_lwlog_create](#), [_lwlog_create_at](#)

[_lwlog_write](#)

[_klog_display](#)

2.1.88 `_lwlog_reset`

Resets the lightweight log to its initial state (remove all entries).

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_reset(
    _mx_uint log_number)
```

Parameters

log_number [IN] — Log number of a previously created lightweight log (if *log_number* is 0, kernel log is reset)

Returns

- MQX_OK
- Errors

Error	Description
LOG_DOES_NOT_EXIST	<i>log_number</i> was not created.
LOG_INVALID	<i>log_number</i> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.

Traits

Disables and enables interrupts

See Also

[_lwlog_disable](#), [_lwlog_enable](#)

2.1.89 _lwlog_test

Tests the lightweight log component.

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_test(
    _mx_uint *log_error_ptr)
```

Parameters

log_error_ptr [OUT] — Pointer to the lightweight log in error (*NULL* if no error is found)

Returns

See description

Traits

Disables and enables interrupts

See Also

[_lwlog_create_component](#)

[_lwlog_create, _lwlog_create_at](#)

Description

Return value	<i>*log_error_ptr</i>	Condition
LOG_INVALID	Log number of the first invalid lightweight log	Information for a specific lightweight log is not valid
MQX_INVALID_COMPONENT_BASE	0	Lightweight log component data is not valid
MQX_OK	0	Lightweight log component data is valid

2.1.90 `_lwlog_write`

Writes to the lightweight log.

Prototype

```
source\kernel\lwlog.c
#include <lwlog.h>
_mqx_uint _lwlog_write(
    _mx_uint      log_number,
    _mx_max_type  p1,
    _mx_max_type  p2,
    _mx_max_type  p3,
    _mx_max_type  p4,
    _mx_max_type  p5,
    _mx_max_type  p6,
    _mx_max_type  p7)
```

Parameters

`log_number` [IN] — Log number of a previously created lightweight log

`p1 .. p7` [IN] — Data to be written to the log entry. If `log_number` is 0 and `p1` is ≥ 10 (0 through 9 are reserved for MQX), data specified by `p2` through `p7` is written to kernel log.

Returns

- `MQX_OK`
- Errors

Error	Description
LOG_DISABLED	Log is disabled.
LOG_DOES_NOT_EXIST	<code>log_number</code> was not created.
LOG_FULL	Log is full and LOG_OVERWRITE is not set.
LOG_INVALID	<code>log_number</code> is out of range.
MQX_COMPONENT_DOES_NOT_EXIST	Log component is not created.
MQX_INVALID_COMPONENT_HANDLE	Log component data is not valid.

See Also

[_lwlog_create](#), [_lwlog_create_at](#)

[_lwlog_read](#)

[_lwlog_disable](#), [_lwlog_enable](#)

Description

The function writes the log entry only if it returns **MQX_OK**.

2.1.91 `_lwmem_alloc ...`

	Allocate this type of lightweight-memory block from the default memory pool
<code>_lwmem_alloc()</code>	Private
<code>_lwmem_alloc_system()</code>	System
<code>_lwmem_alloc_system_zero()</code>	System (zero-filled)
<code>_lwmem_alloc_zero()</code>	Private (zero-filled)
<code>_lwmem_alloc_at()</code>	Private (start address defined)
<code>_lwmem_alloc_align()</code>	Private (aligned)
<code>_lwmem_alloc_system_align()</code>	System (aligned)

Prototype

```

source\kernel\lwmem.c
void *_lwmem_alloc(
    _mem_size  size)

void *_lwmem_alloc_zero(
    _mem_size  size)

void *_lwmem_alloc_system(
    _mem_size  size)

void *_lwmem_alloc_system_zero(
    _mem_size  size)

void *_lwmem_alloc_at(
    _mem_size  size
    void      *addr)

void *_lwmem_alloc_align(
    _mem_size  requested_size
    void      *req_align)

void *_lwmem_alloc_system_align(
    _mem_size  requested_size
    mem_size  req_align)

```

Parameter

size [IN] — Number of single-addressable units to allocate

addr [IN] — Start address of the memory block

requested_size [IN] — Number of single-addressable units to allocate

req_align [IN] — Align requested value

Returns

- Pointer to the lightweight-memory block (success)
- *NULL* (failure: see task error codes)

Task error codes

- MQX_OUT_OF_MEMORY — MQX cannot find a block of the requested size
- MQX_LWMEM_POOL_INVALID — Memory pool to allocate from is invalid

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_lwmem_create_pool](#)

[_lwmem_free](#)

[_lwmem_get_size](#)

[_lwmem_set_default_pool](#)

[_lwmem_transfer](#)

[_lwmem_alloc_*_from](#)

[_msg_alloc](#)

[_msg_alloc_system](#)

[_task_set_error](#)

Description

The application must first set a value for the default lightweight-memory pool by calling `_lwmem_set_default_pool()`.

The `_lwmem_alloc` functions allocate at least *size* single-addressable units; the actual number might be greater. The start address of the block is aligned so that tasks can use the returned pointer as a pointer to any data type without causing an error.

Tasks cannot use lightweight-memory blocks as messages. Tasks must use `_msg_alloc()` or `_msg_alloc_system()` to allocate messages.

Only the task that owns a lightweight-memory block that was allocated with one of the following functions can free the block:

- `_lwmem_alloc()`
- `_lwmem_alloc_zero()`
- `_lwmem_alloc_at()`
- `_lwmem_alloc_align()`

Any task can free a lightweight-memory block that is allocated with one of the following functions:

- `_lwmem_alloc_system()`

- `_lwmem_alloc_system_zero()`
- `_lwmem_alloc_system_align()`

2.1.92 `_lwmem_alloc_*_from`

	Allocate this type of lightweight-memory block from the specified lightweight-memory pool:
<code>_lwmem_alloc_from()</code>	Private
<code>_lwmem_alloc_system_from()</code>	System
<code>_lwmem_alloc_system_zero_from()</code>	System (zero-filled)
<code>_lwmem_alloc_zero_from()</code>	Private (zero-filled)
<code>_lwmem_alloc_align_from()</code>	Private (aligned)
<code>_lwmem_alloc_system_align_from()</code>	System (aligned)

Prototype

```

source\kernel\lwmem.c
void *_lwmem_alloc_from(
    _lwmem_pool_id pool_id
    _mem_size      size)

void *_lwmem_alloc_zero_from(
    _lwmem_pool_id pool_id,
    _mem_size      size)

void *_lwmem_alloc_system(
    _mem_size size)

void *_lwmem_alloc_system_zero(
    _mem_size size)

void *_lwmem_alloc_align_from(
    _lwmem_pool_id pool_id,
    _mem_size      requested_size,
    _mem_size      req_align)

void *_lwmem_alloc_system_align_from(
    _lwmem_pool_id pool_id,
    _mem_size      requested_size,
    _mem_size      req_align)

```

Parameters

pool_id [IN] — Lightweight-memory pool from which to allocate the lightweight-memory block (from `_lwmem_create_pool()`)

size [IN] — Number of single-addressable units to allocate

requested_size [IN] — Number of single-addressable units to allocate

req_align [IN] — Align requested value

Returns

- Pointer to the lightweight-memory block (success)
- *NULL* (failure: see task error codes)

Task error codes

- MQX_OUT_OF_MEMORY — MQX cannot find a block of the requested size
- MQX_LWMEM_POOL_INVALID — Memory pool to allocate from is invalid
- MQX_INVALID_PARAMETER - Requested alignment is not power of 2

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_lwmem_alloc ...](#)

[_lwmem_create_pool](#)

[_lwmem_free](#)

[_lwmem_transfer](#)

[_msg_alloc](#)

[_msg_alloc_system](#)

[_task_set_error](#)

Description

The functions are similar to `_lwmem_alloc()`, `_lwmem_alloc_system()`, `_lwmem_alloc_system_zero()`, `_lwmem_alloc_zero()`, `_lwmem_alloc_system_align`, and `_lwmem_alloc_align()`, except that the application does not call `_lwmem_set_default_pool()` first.

Only the task that owns a lightweight-memory block that was allocated with one of the following functions can free the block:

- `_lwmem_alloc_from()`
- `_lwmem_alloc_zero_from()`
- `_lwmem_alloc_align()`

Any task can free a lightweight-memory block that is allocated with one of the following functions:

- `_lwmem_alloc_system_from()`
- `_lwmem_alloc_system_zero_from()`
- `_lwmem_alloc_system_align_from()`

2.1.93 `_lwmem_create_pool`

Creates the lightweight-memory pool from memory that is outside the default memory pool.

Prototype

```
source\kernel\lwmem.c
_lwmem_pool_id _lwmem_create_pool(
    LWMEM_POOL_STRUCT_PTR  mem_pool_ptr,
    void                   *start,
    _mem_size              size)
```

Parameters

mem_pool_ptr [IN] — Pointer to the definition of the pool
start [IN] — Start of the memory for the pool
size [IN] — Number of single-addressable units in the pool

Returns

- Pool ID

See Also

[_lwmem_alloc_*_from](#)

[_lwmem_alloc ...](#)

Description

Tasks use the pool ID to allocate (variable-size) lightweight-memory blocks from the pool.

2.1.94 `_lwmem_free`

Free the lightweight-memory block.

Prototype

```
source\kernel\lwmem.c
_mqx_uint _lwmem_free(
    void *mem_ptr)
```

Parameters

mem_ptr [IN] — Pointer to the block to free

Returns

- MQX_OK (success)
- Errors (failure)

Error/Task Error Codes	Description
MQX_INVALID_POINTER	<i>mem_ptr</i> is <i>NULL</i> .
MQX_LWMEM_POOL_INVALID	Pool that contains the block is not valid.
MQX_NOT_RESOURCE_OWNER	If the block was allocated with <code>_lwmem_alloc()</code> or <code>_lwmem_alloc_zero()</code> , only the task that allocated it can free part of it.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_lwmem_alloc ...](#)

[_lwmem_free](#)

[_task_set_error](#)

Description

If the block was allocated with one of the following functions, only the task that owns the block can free it:

- `_lwmem_alloc()`
- `_lwmem_alloc_from()`
- `_lwmem_alloc_zero()`
- `_lwmem_alloc_zero_from()`

Any task can free a block that was allocated with one of the following functions:

- `_lwmem_alloc_system()`
- `_lwmem_alloc_system_from()`
- `_lwmem_alloc_system_zero()`

- `_lwmem_alloc_system_zero_from()`
- `_lwmem_alloc_system_align()`
- `_lwmem_alloc_system_align_from()`

2.1.95 `_lwmem_get_size`

Gets the size of the lightweight-memory block.

Prototype

```
source\kernel\lwmem.c
_mem_size _lwmem_get_size(
    void    *mem_ptr)
```

Parameters

mem_ptr [IN] — Pointer to the lightweight-memory block

Returns

- Number of single-addressable units in the block (success)
- 0 (failure)

Task Error Codes

- MQX_INVALID_POINTER — *mem_ptr* is *NULL*.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_lwmem_free](#)

[_lwmem_alloc ...](#)

[_task_set_error](#)

Description

The size is the actual size of the block and might be larger than the size that a task requested.

2.1.96 `_lwmem_set_default_pool`

Sets the value of the default lightweight-memory pool.

Prototype

```
source\kernel\lwmem.c  
_lwmem_pool_id _lwmem_set_default_pool(  
    _lwmem_pool_id pool_id)
```

Parameters

pool_id [IN] — New pool ID

Returns

Former pool ID

See Also

[_lwmem_alloc ...](#)

[_lwsem_destroy](#)

[_lwsem_post](#)

[_lwsem_test](#)

[_lwsem_wait ...](#)

Description

Because MQX allocates lightweight memory blocks from the default lightweight-memory pool when an application calls `_lwmem_alloc()`, `_lwmem_alloc_system()`, `_lwmem_alloc_system_zero()`, or `_lwmem_alloc_zero()`, the application must first call `_lwmem_set_default_pool()`.

2.1.97 `_lwmem_test`

Tests all lightweight memory.

Prototype

```
source\kernel\lwmem.c
_mqx_uint _lwmem_test(
    _lwmem_pool_id *pool_error_ptr,
    void *block_error_ptr)
```

Parameters

pool_error_ptr [OUT] — Pointer to the pool in error (points to *NULL* if no error was found)
block_error_ptr [OUT] — Pointer to the block in error (points to *NULL* if no error was found)

Returns

- MQX_OK (no blocks had errors)
- Errors

Error	Description
MQX_CORRUPT_STORAGE_POOL	A memory pool pointer is not correct.
MQX_CORRUPT_STORAGE_POOL_FREE_LIST	Memory pool freelist is corrupted.
MQX_LWMEM_POOL_INVALID	Lightweight-memory pool is corrupted.

Traits

- Can be called by only one task at a time (see description)
- Disables and enables interrupts

See Also

[_lwmem_alloc ...](#) family of functions

Description

The function checks the checksums in the headers of all lightweight-memory blocks.

The function can be called by only one task at a time because it keeps state-in-progress variables that MQX controls. This mechanism lets other tasks allocate and free lightweight memory while `_lwmem_test()` runs.

2.1.98 `_lwmem_transfer`

Transfers the ownership of the lightweight-memory block from one task to another.

Prototype

```
source\kernel\lwmem.c
_mqx_uint _lwmem_transfer(
    void      *block_ptr,
    _task_id  source,
    _task_id  target)
```

Parameters

block_ptr [IN] — Block whose ownership is to be transferred

source [IN] — Task ID of the current owner

target [IN] — Task ID of the new owner

Returns

- **MQX_OK** (success)
- Errors (failure)

Errors/Task Error Codes	Description
MQX_INVALID_POINTER	<i>block_ptr</i> is <i>NULL</i> .
MQX_INVALID_TASK_ID	<i>source</i> or <i>target</i> does not represent a valid task.
MQX_NOT_RESOURCE_OWNER	Block is not a resource of the task represented by <i>source</i>

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_lwmem_alloc ...](#) family of functions

[_task_set_error](#)

2.1.99 `_lwmsgq_deinit`

Deinitializes a lightweight message queue.

Synopsis

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _lwmsgq_deinit(
    void      *location)
```

Parameters

location [IN] — Pointer to memory to create a message queue.

Returns

- MQX_OK
- MQX_EINVAL (The location already points to a valid lightweight message queue.)

See also

[_lwmsgq_receive](#)

[_lwmsgq_send](#)

Description

This function deinitializes a message queue at location. All the tasks waiting for a message or are blocked upon full message queue are released.

2.1.100 `_lwmsgq_init`

Create a lightweight message queue.

Synopsis

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _lwmsgq_init(
    void      *location,
    _mx_uint  num_messages,
    _mx_uint  msg_size)
```

Parameters

- location* [IN] — Pointer to memory to create a message queue.
- num_message* [IN] — Number of messages in the queue.
- msg_size* [IN] — Specifies message size as a multiplier factor of *_mx_max_type* items.

Returns

- MQX_OK
- See error codes.

Traits

Disables and enables interrupts.

See also

[_lwmsgq_receive](#)

[_lwmsgq_send](#)

The function creates a message queue at *location*. There must be sufficient memory allocated to hold *num_messages* of *msg_size * sizeof(_mx_max_type)* plus the size of LWMMSGQ_STRUCT.

Task error codes

MQX_EINVAL — The *location* already points to a valid lightweight message queue.

2.1.101 `_lwmsgq_receive`

Get a message from a lightweight message queue.

Synopsis

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _lwmsgq_receive(
    void                *handle,
    _mqx_max_type_ptr    message,
    _mqx_uint            flags,
    _mqx_uint            ticks,
    MQX_TICK_STRUCT_PTR  tick_ptr)
```

Parameters

handle [IN] — Pointer to the message queue created by `_lwmsgq_init`

message [OUT] — Received message

flags [IN] — LWMSGQ_RECEIVE_BLOCK_ON_EMPTY (block the reading task if msgq is empty), LWMSGQ_TIMEOUT_UNTIL (perform a timeout using the tick structure as the absolute time), LWMSGQ_TIMEOUT_FOR (perform a timeout using the tick structure as the relative time)

ticks [IN] — The maximum number of ticks to wait. If set to zero waiting time is controlled by the *tick_ptr* input parameter value. When just LWMSGQ_RECEIVE_BLOCK_ON_EMPTY flag is set and ticks input parameters is set to zero the receive function waits for an unlimited amount of time.

tick_ptr [IN] — Pointer to the tick structure to use when ticks input parameter is set to zero.

Returns

- MQX_OK
- See error codes

Traits

Disables and enables interrupts

See also

[_lwmsgq_deinit](#)

[_lwmsgq_send](#)

The function removes the first message from the queue and copies the message to the user buffer. The message becomes a resource of the task.

Task error codes

- LWMSGQ_INVALID
The *handle* was not valid.
- LWMSGQ_EMPTY

The `LWMSGQ_RECEIVE_BLOCK_ON_EMPTY` flag was not used and no messages were in the message queue.

- **LWMSGQ_TIMEOUT**

No messages were in the message queue before the timeout expired.

- **MQX_CANNOT_CALL_FUNCTION_FROM_ISR**

Function cannot be called from an ISR.

2.1.102 `_lwmsgq_send`

Put a message on a lightweight message queue.

Synopsis

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _lwmsgq_send(
    void                *handle,
    _mqx_max_type_ptr message,
    _mqx_uint            flags)
```

Parameters

handle [IN] — Pointer to the message queue created by `_lwmsgq_init`

message [IN] — Pointer to the message to send.

flags [IN] — `LWMSGQ_SEND_BLOCK_ON_FULL` — Block the task if queue is full.

`LWMSGQ_SEND_BLOCK_ON_SEND` — Block the task after the message is sent.

Returns

- `MQX_OK`
- See error codes

Traits

Disables and enables interrupts

See also

[_lwmsgq_deinit](#)

[_lwmsgq_receive](#)

The function posts a message on the queue. If the queue is full, the task can block and wait or the function returns with `LWMSGQ_FULL`.

Task error codes

- `LWMSGQ_INVALID`
The *handle* was not valid.
- `LWMSGQ_FULL`
The `LWMSGQ_SEND_BLOCK_ON_FULL` flag was NOT USED and message queue was full.
- `MQX_CANNOT_CALL_FUNCTION_FROM_ISR`
The function cannot be called from ISR when using inappropriate blocking *flags*.

2.1.103 `_lwsem_create`

Creates the lightweight semaphore.

Prototype

```
source\kernel\lwsem.c
_mqx_uint _lwsem_create(
    LWSEM_STRUCT_PTR  lwsem_ptr,
    _mqx_int           initial_count)
```

Parameters

lwsem_ptr [IN] — Pointer to the lightweight semaphore to create
initial_count [IN] — Initial semaphore counter

Returns

- MQX_OK
- MQX_EINVAL (lwsem is already initialized)
- MQX_INVALID_LWSEM (If, when in user mode, MQX tries to access a lwsem with inappropriate access rights)

See Also

[_lwsem_destroy](#)

[_lwsem_post](#)

[_lwsem_test](#)

[_lwsem_wait ...](#)

Description

Because lightweight semaphores are a core component, an application need not create the component before it creates lightweight semaphores.

Example

```
LWSEM_STRUCT  my_lwsem;
void *lwsem_error_ptr;
void *td_error_ptr;
...
_lwsem_create(&my_lwsem, 10);
...
result = _lwsem_wait(&my_lwsem);
if (result != MQX_OK) {
    /* The function failed. */
    result = _lwsem_test(&lwsem_error_ptr, &td_error_ptr);
    if (result != MQX_OK) {
        /* Lightweight semaphore component is valid. */
    }
}
...
```

```
result = _lwsem_post(&my_lwsem);  
...  
_lwsem_destroy(&my_lwsem);  
...
```

2.1.104 `_lwsem_destroy`

Destroys the lightweight semaphore.

Prototype

```
source\kernel\lwsem.c  
_mqx_uint _lwsem_destroy(  
    LWSEM_STRUCT_PTR  lwsem_ptr)
```

Parameters

lwsem_ptr [IN] — Pointer to the created lightweight semaphore

Returns

- `MQX_OK` (success)
- `MQX_INVALID_LWSEM` (failure: *lwsem_ptr* does not point to a valid lightweight semaphore)

Traits

- Puts all waiting tasks in their ready queues
- Cannot be called from an ISR

See Also

[_lwsem_create](#)

Example

See `_lwsem_create()`.

2.1.105 `_lwsem_poll`

Poll for the lightweight semaphore.

Prototype

```
source\kernel\lwsem.c  
bool _lwsem_poll(  
    LWSEM_STRUCT_PTR  lwsem_ptr)
```

Parameters

lwsem_ptr [IN] — Pointer to the created lightweight semaphore

Returns

- TRUE (task got the lightweight semaphore)
- FALSE (lightweight semaphore was not available)

See Also

[_lwsem_create](#)

[_lwsem_wait ...](#) family

Description

The function is the nonblocking alternative to the `_lwsem_wait` family of functions.

2.1.106 `_lwsem_post`

Posts the lightweight semaphore.

Prototype

```
source\kernel\lwsem.c  
_mqx_uint _lwsem_post(  
    LWSEM_STRUCT_PTR lwsem_ptr)
```

Parameters

lwsem_ptr [IN] — Pointer to the created lightweight semaphore

Returns

- MQX_OK (success)
- MQX_INVALID_LWSEM (failure: *lwsem_ptr* does not point to a valid lightweight semaphore)

Traits

Might put a waiting task in the task's ready queue

See Also

[_lwsem_create](#)

[_lwsem_wait ...](#)

Description

If tasks are waiting for the lightweight semaphore, MQX removes the first one from the queue and puts it in the task's ready queue.

Example

See `_lwsem_create()`.

2.1.107 _lwsem_test

Tests the data structures (including queues) of the lightweight semaphores component.

Prototype

```
source\kernel\lwsem.c
_mqx_uint _lwsem_test(
    void *lwsem_error_ptr,
    void *td_error_ptr)
```

Parameters

lwsem_error_ptr [OUT] — Pointer to the lightweight semaphore in error (*NULL* if no error is found)

td_error_ptr [OUT] — Pointer to the task descriptor of waiting task that has an error (*NULL* if no error is found)

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_LWSEM	Results of _queue_test()

Traits

- Cannot be called from an ISR
- Disables and enables interrupts

See Also

[_lwsem_create](#)

[_lwsem_destroy](#)

[_queue_test](#)

Example

See `_lwsem_create()`.

2.1.108 `_lwsem_wait ...`

	Wait (in FIFO order) for the lightweight semaphore:
<code>_lwsem_wait()</code>	Until it is available
<code>_lwsem_wait_for()</code>	For the number of ticks (in tick time)
<code>_lwsem_wait_ticks()</code>	For the number of ticks
<code>_lwsem_wait_until()</code>	Until the specified time (in tick time)

Prototype

```
source\kernel\lwsem.c
#include <lwsem.h>
_mqx_uint _lwsem_wait(
    LWSEM_STRUCT_PTR sem_ptr)

_mqx_uint _lwsem_wait_for(
    LWSEM_STRUCT_PTR sem_ptr,
    MQX_TICK_STRUCT_PTR tick_time_timeout_ptr)

_mqx_uint _lwsem_wait_ticks(
    LWSEM_STRUCT_PTR sem_ptr,
    _mqx_uint tick_timeout)

_mqx_uint _lwsem_wait_until(
    LWSEM_STRUCT_PTR sem_ptr,
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

sem_ptr [IN] — Pointer to the lightweight semaphore

tick_time_timeout_ptr [IN] — One of the following:

pointer to the maximum number of ticks to wait
 NULL (unlimited wait)

tick_timeout [IN] — One of the following:

maximum number of ticks to wait
 0 (unlimited wait)

tick_time_ptr [IN] — One of the following:

pointer to the time (in tick time) until which to wait
 NULL (unlimited wait)

Returns

- `MQX_OK`
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_LWSEM	<i>sem_ptr</i> is for a lightweight semaphore that is not longer valid.
MQX_LWSEM_WAIT_TIMEOUT	Timeout expired before the task could get the lightweight semaphore.

Traits

- Might block the calling task
- Cannot be called from an ISR

See Also[_lwsem_create](#)[_lwsem_post](#)[LWSEM_STRUCT](#)[MQX_TICK_STRUCT](#)**TIP**

Because priority inversion might occur if tasks with different priorities access the same lightweight semaphore, we recommend under these circumstances that you use the semaphore component.

Example

See `_lwsem_create()`.

2.1.109 `_lwtimer_add_timer_to_queue`

Adds the lightweight timer to the periodic queue.

Prototype

```
source\kernel\lwtimer.c
#include <lwtimer.h>
_mqx_uint _lwtimer_add_timer_to_queue(
    LWTIMER_PERIOD_STRUCT_PTR period_ptr,
    LWTIMER_STRUCT_PTR        timer_ptr,
    _mx_uint                   ticks,
    LWTIMER_ISR_FPTR           function,
    void                       *parameter)
```

Parameters

- period_ptr* [IN] — Pointer to the periodic queue
- timer_ptr* [IN] — Pointer to the lightweight timer to add to the queue
- ticks* [IN] — Offset (in ticks) from the queues' period to expire at, must be smaller than queue period
- function* [IN] — Function to call when the timer expires
- parameter* [IN] — Parameter to pass to function

Returns

- MQX_OK (success)
- Errors

Error	Description
MQX_LWTIMER_INVALID	<i>period_ptr</i> points to an invalid periodic queue.
MQX_INVALID_PARAMETER	<i>ticks</i> is greater than or equal to the periodic queue's period.

Traits

Disables and enables interrupts

See Also

[_lwtimer_cancel_period](#)
[_lwtimer_cancel_timer](#)
[_lwtimer_create_periodic_queue](#)
[LWTIMER_PERIOD_STRUCT](#)
[LWTIMER_STRUCT](#)

Description

The function inserts the timer in the queue in order of increasing offset from the queue's start time.

2.1.110 `_lwtimer_cancel_period`

Cancels all the lightweight timers in the periodic queue.

Prototype

```
source\kernel\lwtimer.c
#include <lwtimer.h>
_mqx_uint _lwtimer_cancel_period(
    LWTIMER_PERIOD_STRUCT_PTR period_ptr)
```

Parameters

period_ptr [IN] — Pointer to the periodic queue to cancel

Returns

- MQX_OK (success)
- MQX_LWTIMER_INVALID (failure; *period_ptr* points to an invalid periodic queue)

Traits

Disables and enables interrupts

See Also

[_lwtimer_add_timer_to_queue](#)

[_lwtimer_cancel_timer](#)

[_lwtimer_create_periodic_queue](#)

[LWTIMER_PERIOD_STRUCT](#)

2.1.111 `_lwtimer_cancel_timer`

Cancels the outstanding timer request.

Prototype

```
source\kernel\lwtimer.c
#include <lwtimer.h>
mqx_uint _lwtimer_cancel_timer(
    LWTIMER_STRUCT_PTR timer_ptr)
```

Parameters

timer_ptr [IN] — Pointer to the lightweight timer to cancel

Returns

- **MQX_OK** (success)
- **MQX_LWTIMER_INVALID** (failure; *timer_ptr* points to either an invalid timer or to a timer with an periodic queue)

Traits

Disables and enables interrupts

See Also

[_lwtimer_add_timer_to_queue](#)

[_lwtimer_cancel_period](#)

[_lwtimer_create_periodic_queue](#)

[LWTIMER_STRUCT](#)

2.1.112 `_lwtimer_create_periodic_queue`

Creates the periodic timer queue.

Prototype

```
source\kernel\lwtimer.c
#include <lwtimer.h>
_mqx_uint _lwtimer_create_periodic_queue(
    LWTIMER_PERIOD_STRUCT_PTR period_ptr,
    _mx_uint period,
    _mx_uint wait_ticks)
```

Parameters

timer_ptr [IN] — Pointer to the periodic queue

period [IN] — Cycle length (in ticks) of the queue

wait_ticks [IN] — Number of ticks to wait before starting to process the queue

Returns

MQX_OK (success)

Traits

Disables and enables interrupts

See Also

[_lwtimer_add_timer_to_queue](#)

[_lwtimer_cancel_period](#)

[_lwtimer_cancel_timer](#)

[_lwtimer_create_periodic_queue](#)

[LWTIMER_PERIOD_STRUCT](#)

2.1.113 _lwtimer_test

Tests all the periodic queues and their lightweight timers for validity and consistency.

Prototype

```
source\kernel\lwtimer.c
#include <lwtimer.h>
_mqx_uint _lwtimer_test(
    void *period_error_ptr,
    void *timer_error_ptr)
```

Parameters

period_error_ptr [OUT] — Pointer to the first periodic queue that has an error (*NULL* if no error is found)

timer_error_ptr [OUT] — Pointer to the first timer that has an error (*NULL* if no error is found)

Returns

- MQX_OK (no periodic queues have been created or no errors found in any periodic queues or timers)
- Errors (an error was found in a periodic queue or a timer)

Error	Description
Error from _queue_test()	A periodic queue or its queue was in error.
MQX_LWTIMER_INVALID	Invalid periodic queue.

Traits

Disables and enables interrupts

See Also

[_lwtimer_add_timer_to_queue](#)

[_lwtimer_cancel_period](#)

[_lwtimer_cancel_timer](#)

[_lwtimer_create_periodic_queue](#)

2.1.114 _mem_alloc ...

	Allocate this type of memory block:	From:
<code>_mem_alloc()</code>	Private	Default memory pool
<code>_mem_alloc_from()</code>	Private	Specified memory pool
<code>_mem_alloc_system()</code>	System	Default memory pool
<code>_mem_alloc_system_from()</code>	System	Specified memory pool
<code>_mem_alloc_system_zero()</code>	System (zero-filled)	Default memory pool
<code>_mem_alloc_system_zero_from()</code>	System (zero-filled)	Specified memory pool
<code>_mem_alloc_zero()</code>	Private (zero-filled)	Default memory pool
<code>_mem_alloc_zero_from()</code>	Private (zero-filled)	Specified memory pool
<code>_mem_alloc_align()</code>	Private (aligned)	Default memory pool
<code>_mem_alloc_align_from()</code>	Private (aligned)	Specified memory pool
<code>_mem_alloc_at()</code>	Private (start address defined)	Default memory pool
<code>_mem_alloc_system_align()</code>	System (aligned)	Default memory pool
<code>_mem_alloc_system_align_from()</code>	System (aligned)	Specified memory pool

Prototype

```

source\kernel\mem.c
void *_mem_alloc(
    _mem_size  size)

void *_mem_alloc_from(
    _mem_pool_id  pool_id,
    _mem_size      size)

void *_mem_alloc_zero(
    _mem_size  size)

void *_mem_alloc_zero_from(
    _mem_pool_id  pool_id,
    _mem_size      size)

void *_mem_alloc_system(
    _mem_size  size)

void *_mem_alloc_system_from(
    _mem_pool_id  pool_id,
    _mem_size      size)

void *_mem_alloc_system_zero(
    _mem_size  size)

```

```

void *_mem_alloc_system_zero_from(
    _mem_pool_id  pool_id,
    _mem_size     size)

void *_mem_alloc_align(
    _mem_size     size,
    _mem_size     align)

void *_mem_alloc_align_from(
    _mem_pool_id  pool_id,
    _mem_size     size,
    _mem_size     align)

void *_mem_alloc_at(
    _mem_size     size,
    void          *addr)

void *_mem_alloc_system_align(
    _mem_size     size,
    _mem_size     align)

void *_mem_alloc_system_align_from(
    _mem_pool_id  pool_id,
    _mem_size     size,
    _mem_size     align)

```

Parameters

size [IN] — Number of single-addressable units to allocate

pool_id [IN] — Pool from which to allocate the memory block (from **_mem_create_pool()**)

align [IN] — Alignment of the memory block

addr [IN] — Start address of the memory block

Returns

- Pointer to the memory block (success)
- NULL (failure: see task error codes)

Task Error Codes	Description
MQX_CORRUPT_STORAGE_POOL_FREE_LIST	Memory pool freelist is corrupted.
MQX_INVALID_CHECKSUM	Checksum of the current memory block header is incorrect.
MQX_OUT_OF_MEMORY	MQX cannot find a block of the requested size.
MQX_INVALID_CONFIGURATION	User area not aligned on a cache line boundary.
MQX_INVALID_PARAMETER	Requested alignment is not power of 2.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[`_mem_create_pool`](#)

[`_mem_free`](#)

[`_mem_get_highwater`](#)

[`_mem_get_highwater_pool`](#)

[`_mem_get_size`](#)

[`_mem_transfer`](#)

[`_mem_free_part`](#)

[`_msg_alloc`](#)

[`_msg_alloc_system`](#)

[`_task_set_error`](#)

Description

The functions allocate at least *size* single-addressable units; the actual number might be greater. The start address of the block is aligned so that tasks can use the returned pointer as a pointer to any data type without causing an error.

Tasks cannot use memory blocks as messages. Tasks must use `_msg_alloc()` or `_msg_alloc_system()` to allocate messages.

Only the task that allocates a memory block with one of the following functions can free the memory block:

- `_mem_alloc()`
- `_mem_alloc_from()`
- `_mem_alloc_zero()`
- `_mem_alloc_zero_from()`
- `_mem_alloc_align()`
- `_mem_alloc_align_from()`
- `_mem_alloc_at()`

Any task can free a memory block that is allocated with one of the following functions:

- `_mem_alloc_system()`
- `_mem_alloc_system_from()`
- `_mem_alloc_system_zero()`
- `_mem_alloc_system_zero_from()`
- `_mem_alloc_system_align()`
- `_mem_alloc_system_align_from()`

Example

Allocate a memory block for configuration data.

```
config_ptr = _mem_alloc(sizeof(CONFIGURATION_DATA));  
if (config_ptr == NULL) {  
    puts("\nCould not allocate memory.");  
}  
...  
_mem_free(config_ptr);
```

2.1.115 `_mem_copy`

Copies the number of single-addressable units.

Prototype

```
source\psp\cpu_family\mem_copy.c
void _mem_copy(
    void      *src_ptr,
    void      *dest_ptr,
    _mem_size  num_units)
```

Parameters

src_ptr [IN] — Source address

dest_ptr [IN] — Destination address

num_units [IN] — Number of single-addressable units to copy

Returns

None

Traits

Behavior depends on the PSP and the compiler

See Also

[_mem_zero](#)

Description

When possible, MQX uses an algorithm that is faster than a simple byte-to-byte copy operation. MQX optimizes the copy operation to avoid alignment problems.

CAUTION

If the destination address is within the block to copy, MQX overwrites the overlapping area. Under these circumstances, data is lost.

Example

```
char src_rqst[100];
char dst_rqst[100];

_mem_copy((void*)&src_rqst, (void*)&dst_rqst, sizeof(100));
```

2.1.116 `_mem_create_pool`

Creates the memory pool from memory that is outside the default memory pool.

Prototype

```
source\kernel\mem.c
_mem_pool_id _mem_create_pool(
    void      *start,
    _mem_size size)
```

Parameters

start [IN] — Address of the start of the memory pool

size [IN] — Number of single-addressable units in the pool

Returns

- Pool ID (success)
- NULL (failure: see task error codes)

Task error codes	Description
MQX_MEM_POOL_TOO_SMALL	<i>size</i> is less than the minimum allowable message-pool size
MQX_CORRUPT_MEMORY_SYSTEM	Internal data for the message component is corrupted

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_mem_alloc ...](#)

[_task_set_error](#)

Description

Tasks use the pool ID to allocate (variable-size) memory blocks from the pool.

2.1.117 `_mem_extend`

Adds physical memory to the default memory pool.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_extend(
    void      *start_of_pool,
    _mem_size size)
```

Parameters

start_of_pool [IN] — Pointer to the start of the memory to add
size [IN] — Number of single-addressable units to add

Returns

- MQX_OK (success)
- MQX_INVALID_SIZE (failure: see description)
- MQX_INVALID_COMPONENT_HANDLE (Memory pool to extend is not valid.)

See also

[`_mem_get_highwater`](#)

[MQX_INITIALIZATION_STRUCT](#)

Description

The function adds the specified memory to the default memory pool.

The function fails if *size* is less than (3 * **MQX_MIN_MEMORY_STORAGE_SIZE**), as defined in `mem_prv.h`

Example

Add 16 KB, starting at 0x2000, to the default memory pool.

```
...
_mem_extend((void*)0x2000, 0x4000);
...
```


2.1.118 `_mem_extend_pool`

Adds physical memory to the memory pool, which is outside the default memory pool.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_extend_pool(
    _mem_pool_id pool_id,
    void *start_of_pool,
    _mem_size size)
```

Parameters

pool_id [IN] — Pool to which to add memory (from `_mem_create_pool()`)
start_of_pool [IN] — Pointer to the start of the memory to add
size [IN] — Number of single-addressable units to add

Returns

- MQX_OK (success)
- MQX_INVALID_SIZE (failure: see description)
- MQX_INVALID_COMPONENT_HANDLE (Memory pool to extend is not valid.)

See Also

[_mem_create_pool](#)

[_mem_get_highwater_pool](#)

Description

The function adds the specified memory to the memory pool.

The function fails if *size* is less than $(3 * \text{MIN_MEMORY_STORAGE_SIZE})$, as defined in *mem_prv.h*.

2.1.119 `_mem_free`

Frees the memory block.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_free(
    void    *mem_ptr)
```

Parameters

mem_ptr [IN] — Pointer to the memory block to free

Returns

- MQX_OK (success)
- Errors (failure)

Errors/Task Error Codes	Description
MQX_INVALID_CHECKSUM	Block's checksum is not correct, indicating that at least some of the block was overwritten.
MQX_INVALID_POINTER	<i>mem_ptr</i> is <i>NULL</i> , not in the pool, or misaligned.
MQX_NOT_RESOURCE_OWNER	If the block was allocated with <code>_mem_alloc()</code> or <code>_mem_alloc_zero()</code> , only the task that allocated it can free part of it.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_mem_alloc ...](#)

[_mem_free_part](#)

[_task_set_error](#)

Description

If the memory block was allocated with one of the following functions, only the task that owns the block can free it:

- `_mem_alloc()`
- `_mem_alloc_from()`
- `_mem_alloc_zero()`
- `_mem_alloc_zero_from()`

Any task can free a memory block that was allocated with one of the following functions:

- `_mem_alloc_system()`

- `_mem_alloc_system_from()`
- `_mem_alloc_system_zero()`
- `_mem_alloc_system_zero_from()`
- `_mem_alloc_system_align`
- `_mem_alloc_system_align_from`

Example

See `_mem_alloc()`.

2.1.120 `_mem_free_part`

Free part of the memory block.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_free_part(
    void      *mem_ptr,
    _mem_size requested_size)
```

Parameters

mem_ptr [IN] — Pointer to the memory block to trim
requested_size [IN] — Size (in single-addressable units) to make the block

Returns

- MQX_OK (success)
- See errors (failure)

Errors and task error codes

- MQX_INVALID_SIZE — One of the following:
 - *requested_size* is less than 0
 - Size of the original block is less than *requested_size*

Task error codes from `_mem_free()`

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_mem_free](#)

[_mem_alloc ...](#)

[_mem_get_size](#)

[_task_set_error](#)

Description

Under the same restriction as for `_mem_free()`, the function trims from the end of the memory block.

A successful call to the function frees memory only if *requested_size* is sufficiently smaller than the size of the original block. To determine whether the function freed memory, call `_mem_get_size()` before and after calling `_mem_free_part()`.

Example

See `_mem_get_size()`.

2.1.121 `_mem_get_error`

Gets a pointer to the memory block that is corrupted.

Prototype

```
source\kernel\mem.c
void *_mem_get_error(void)
```

Parameters

None

Returns

Pointer to the memory block that is corrupted

See Also

[_mem_test](#)

Description

If `_mem_test()` indicates an error in the default memory pool, `_mem_get_error()` indicates which block has the error.

In each memory block header, MQX maintains internal information, including a checksum of the information. As tasks call functions from the `_mem_` family, MQX recalculates the checksum and compares it with the original. If the checksums do not match, MQX marks the block as corrupted.

A block will be corrupted if:

- A task writes past the end of an allocated memory block and into the header information in the next block. This can occur if:
 - the task allocated a block smaller than it needed
 - a task overflows its stack
 - a pointer is out of range
- A task randomly overwrites memory in the default memory pool

Example

A low-priority task tests the default memory pool.

```
void Memory_Check_Task(void)
{
    _mqx_uint result;
    while (1)
    {
        result = _mem_test();
        if (result != MQX_OK)
        {
            printf("\nTest of default memory pool failed.");
            printf("\n    error = %x", result);
            printf("\n    block = %x", _mem_get_error());
            printf("\n    Highwater = 0x%lx", _mem_get_highwater());
        }
    }
}
```

```
}  
}  
}
```

2.1.122 `_mem_get_error_pool`

Gets the last memory block that caused a memory-pool error in the pool.

Prototype

```
source\kernel\mem.c  
void *_mem_get_error_pool(  
    mem_pool_id    pool_id)
```

Parameters

pool_id [IN] — Memory pool from which to get the block

Returns

Pointer to the memory block

See Also

[_mem_test_pool](#)

Description

If `_mem_test_pool()` indicates an error, `_mem_get_error_pool()` indicates which block has the error.

2.1.123 `_mem_get_highwater`

Gets the highest memory address that MQX has allocated in the default memory pool.

Prototype

```
source\kernel\mem.c  
void *_mem_get_highwater(void)
```

Parameters

None

Returns

Highest address allocated in the default memory pool

See Also

[`_mem_alloc ...`](#)

[`_mem_extend`](#)

[`_mem_get_highwater_pool`](#)

Description

The function gets the highwater mark; that is, the highest memory address ever allocated by MQX in the default memory pool. The mark does not decrease if tasks free memory in the default memory pool.

If a task extends the default memory pool (`_mem_extend()`) with an area above the highwater mark and MQX subsequently allocates memory from the extended memory, the function returns an address from the extended memory.

Example

See `_mem_get_error()`.

2.1.124 `_mem_get_highwater_pool`

Gets the highest memory address that MQX has allocated in the pool.

Prototype

```
source\kernel\mem.c  
void *_mem_get_highwater_pool(  
    _mem_pool_id pool_id)
```

Parameters

pool_id [IN] — Pool for which to get the highwater mark (from `_mem_create_pool()`)

Returns

Highest address allocated in the memory pool

See Also

[_mem_alloc ...](#)

[_mem_create_pool](#)

[_mem_extend_pool](#)

[_mem_get_highwater](#)

Description

The function gets the highwater mark; that is, the highest memory address ever allocated in the memory pool. The mark does not decrease if tasks free blocks in the pool.

If a task extends the memory pool (`_mem_extend_pool()`) with an area above the highwater mark and MQX subsequently allocates memory from the extended memory, the function returns an address from the extended memory.

Example

See `_mem_get_error()`.

2.1.125 `_mem_get_size`

Gets the size of the memory block.

Prototype

```
source\kernel\mem.c
_mem_size _mem_get_size(
    void      *mem_ptr)
```

Parameters

mem_ptr [IN] — Pointer to the memory block

Returns

- Number of single-addressable units in the block (success)
- 0 (failure)

Task Error Codes

Error	Description
MQX_CORRUPT_STORAGE_POOL	One of the following: <ul style="list-style-type: none"> • <i>mem_ptr</i> does not point to a block that was allocated with a function from the <code>_mem_alloc</code> family • memory is corrupted
MQX_INVALID_CHECKSUM	Checksum is not correct because part of the memory block header was overwritten.
MQX_INVALID_POINTER	<i>mem_ptr</i> is NULL or improperly aligned.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_mem_free](#)

[_mem_alloc ...](#)

[_mem_free_part](#)

[_task_set_error](#)

Description

The size is the actual size of the memory block and might be larger than the size that a task requested.

Example

```
original_size = _mem_get_size(ptr);
if (_mem_free_part(ptr, original_size - 40) == MQX_OK) {
```

```
new_size = mem_get_size(ptr);  
if (new_size == original_size) {  
    printf("Block was not large enough to trim.");  
}  
}
```

2.1.126 `_mem_set_pool_access`

Sets (lightweight) memory pool access rights for User-mode tasks.

Prototype

```
source\kernel\lwmem.c
_mqx_uint _mem_set_pool_access(
    _lwmem_pool_id mem_pool_id,
    uint32_t access)
```

Parameters

mem_pool_id [IN] — (lightweight) memory pool for access rights to set (returned by [_lwmem_create_pool](#))

access [IN] — Access rights to set. Possible values:

- POOL_USER_RW_ACCESS
- POOL_USER_RO_ACCESS
- POOL_USER_NO_ACCESS

Returns

- MQX_OK

Description

This function sets access rights for a (lightweight) memory pool. Setting correct access rights is important for tasks and other code running in the User-mode. User-mode access to a memory pool whose access rights are not set properly causes memory protection exception to be risen.

2.1.127 `_mem_sum_ip`

Gets the one's complement checksum over the block of memory.

Prototype

```
source\psp\cpu_family\ipsum.S
uint32_t mem_sum_ip(
    uint32_t    initial_value,
    _mem_size   length,
    void        *location)
```

Parameters

initial_value [IN] — Value at which to start the checksum

length [IN] — Number of units, each of which is of the type that can hold the maximum data address for the processor

location [IN] — Start of the block of memory

Returns

- Checksum (between 0 and 0xFFFF)
- 0 if and only if all summands are 0

Description

The checksum is used for packets in Internet protocols. The checksum is the 16-bit one's complement of the one's complement sum of all 16-bit words in the block of memory (as defined in RFC 791).

To get one checksum for multiple blocks, set *initial_value* to 0, call `_mem_sum_ip()` for the first block, set *initial_value* to the function's return value, call `_mem_sum_ip()` for the next block, and so on.

2.1.128 `_mem_swap_endian`

Converts data to the other endian format.

Prototype

```
source\kernel\mem.c
void _mem_swap_endian(
    unsigned char* definition,
    void          *data)
```

Parameters

definition [IN] — Pointer to a *NULL*-terminated array, each element of which defines the size (in single-addressable units) of each field in the data structure that defines the data to convert

data [IN] — Pointer to the data to convert

Returns

None

See Also

[`_msg_swap_endian_data`](#)

[`_msg_swap_endian_header`](#)

Example

```
typedef struct
{
    _task_id    INFO[ARRAY_SIZE];
    _mqx_uint    READ_INDEX;
    _mqx_uint    WRITE_INDEX;
} MY_MSG_DATA;

MY_MSG_DATA msg_data;

unsigned char my_data_def[] =
{sizeof(msg_data.INFO), sizeof(msg_data.READ_INDEX),
  sizeof(msg_data.WRITE_INDEX), 0};

...
_mem_swap_endian((unsigned char *)my_data_def, &msg_data);
...
```

2.1.129 `_mem_test`

Tests memory that the memory component uses to allocate memory from the default memory pool.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_test(void)
```

Parameters

None

Returns

- MQX_OK (no errors found)
- Errors

Error	Description
MQX_CORRUPT_STORAGE_POOL	A memory pool pointer is not correct.
MQX_CORRUPT_STORAGE_POOL_FREE_LIST	Memory pool freelist is corrupted.
MQX_INVALID_CHECKSUM	Checksum of the current memory block header is incorrect (header is corrupted).

Traits

- Can be called by only one task at a time (see description)
- Disables and enables interrupts

See Also

[_mem_alloc ...](#)

[_mem_get_error](#)

[_mem_test_pool](#)

Description

The function checks the checksums of all memory-block headers. If the function detects an error, `_mem_get_error()` gets the block in error.

The function can be called by only one task at a time because it keeps state-in-progress variables that MQX controls. This mechanism lets other tasks allocate and free memory while `_mem_test()` runs.

Example

See `_mem_get_error()`.

2.1.130 `_mem_test_all`

Tests the memory in all memory pools.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_test_all(
    _mem_pool_id _PTR pool_id)
```

Parameters

pool_id [OUT] — Pointer to the memory pool in error (initialized only if an error was found):

Returns

- MQX_OK (no errors found)
- Errors

Error	Description
Errors from <code>_mem_test()</code>	A memory pool has an error.
Errors from <code>_queue_test()</code>	Memory-pool queue has an error.

See Also

[_mem_test](#)

[_mem_test_pool](#)

[_queue_test](#)

2.1.131 `_mem_test_and_set`

Tests and sets a memory location.

Prototype

```
source\psp\cpu_family\dispatch.assembler
_mqx_uint _mem_test_and_set(
    unsigned char *location_ptr)
```

Parameters

location_ptr [IN] — Pointer to the single-addressable unit to be set

Returns

- 0 (location is modified)
- 0x80 (location is not modified)

Traits

Behavior depends on the PSP

Description

The function can be used to implement mutual exclusion between tasks.

If the single-addressable unit was 0, the function sets the high bit. If possible, the function uses a bus-cycle indivisible instruction.

Example

```
char my_mutex;
if (_mem_test_and_set(&my_mutex) == 0){
    /*It was available, now I have it, and I can do some work. */
    ...
}
```

2.1.132 `_mem_test_pool`

Tests the memory in the memory pool

Prototype

```
source\kernel\mem.c  
_mqx_uint _mem_test_pool(  
    _mem_pool_id pool_id)
```

Parameters

pool_id [IN] — Memory pool to test

Returns

- MQX_OK (no errors found)
- See `_mem_test()` (errors found)

See Also

[_mem_get_error_pool](#)

[_mem_test](#)

[_task_set_error](#)

Description

If `_mem_test_pool()` indicates an error, `_mem_get_error_pool()` indicates which block has the error.

2.1.133 `_mem_transfer`

Transfers the ownership of the memory block from one task to another.

Prototype

```
source\kernel\mem.c
_mqx_uint _mem_transfer(
    void      *block_ptr,
    _task_id  source,
    _task_id  target)
```

Parameters

block_ptr [IN] — Memory block whose ownership is to be transferred

source [IN] — Task ID of the current owner

target [IN] — Task ID of the new owner

Returns

- MQX_OK (success)
- Errors (failure)

Error / Task Error Code	Description
MQX_INVALID_CHECKSUM	Block's checksum is not correct, indicating that at least some of the block was overwritten.
MQX_INVALID_POINTER	<i>block_ptr</i> is <i>NULL</i> or misaligned.
MQX_INVALID_TASK_ID	<i>source</i> or <i>target</i> does not represent a valid task.
MQX_NOT_RESOURCE_OWNER	Memory block is not a resource of the task represented by <i>source</i> .

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_mem_alloc ...](#)

[_mqx_get_system_task_id](#)

[_task_set_error](#)

Example

Transfers memory-block ownership from this task to the system and back.

```
/* Make a memory block a system block so that Task B can use it: */
_mem_transfer(ptr, _task_get_id(), _mqx_get_system_task_id());

/* Task B said it was finished using the block. */
_mem_transfer(ptr, _mqx_get_system_task_id(), _task_get_id());
...
```

2.1.134 `_mem_zero`

Fills the region of memory with 0x0.

Prototype

```
source\psp\cpu_family\mem_zero.c
void _mem_zero(
    void      *ptr,
    _mem_size  num_units)
```

Parameters

ptr [IN] — Start address of the memory to be filled

num_units [IN] — Number of single-addressable units to fill

Returns

None

See also

[_mem_copy](#)

Example

```
char my_array[BUFSIZE];
...
_mem_zero(my_array, sizeof(my_array));
```

2.1.135 `_mmu_add_vregion`

Adds the physical memory region to the MMU page tables. If level 2 translation required and enabled, L2 table is allocated here.

Prototype

```
source\psp\cpu_family\mmu_xxx.c
#include <psp.h>
_mqx_uint _mmu_add_vregion(
    void      *paddr,
    void      *vaddr,
    _mem_size size,
    _mqx_uint  flags)
```

Parameters

paddr [IN] — Physical address of the start of the memory region to be added
vaddr [IN] — Virtual address to correspond to *paddr*
size [IN] — Number of single-addressable units in the memory region
flags [IN] — Flags to be associated with the memory region (PSP related)

Returns

- MQX_OK
- Errors

Error	Description
MQX_COMPONENT_DOES_NOT_EXIST	_mmu_vinit() was not previously called.
MQX_INVALID_PARAMETER	Incorrect input parameter.
MQX_OUT_OF_MEMORY	Unable to allocate L2 table.

See Also

[_mmu_vinit](#)

Example

Adds a memory region that includes a flash device. The physical memory region and virtual memory region are the same.

```
uint32_t result;
...
result = _mmu_add_vregion(BSP_FLASH_BASE, BSP_FLASH_BASE, BSP_FLASH_SIZE,
    PSP_PAGE_TABLE_SECTION_SIZE(PSP_PAGE_TABLE_SECTION_SIZE_1MB)
    PSP_PAGE_TYPE(PSP_PAGE_TYPE_CACHE_NON)
    PSP_PAGE_DESCR(PSP_PAGE_DESCR_ACCESS_RW_ALL) );
```

2.1.136 `_mmu_vdisable`

Disables (stop) and deinitializes the MMU. Free all level 2 tables if level 2 is supported.

Prototype

```
source\psp\cpu_family\mmu_xxx.c
#include <psp.h>
_mqx_uint _mmu_vdisable(void)
```

Parameters

None

Returns

- `MQX_OK`
- `MQX_COMPONENT_DOES_NOT_EXIST` (`_mmu_vinit()` was not previously called)

See Also

[_mmu_vinit](#)

[_mmu_venable](#)

Description

The function disables all virtual addresses; applications can access physical addresses only.

2.1.137 `_mmu_venable`

Enables (starts) the MMU to provide the virtual memory component.

Prototype

```
source\psp\cpu_family\mmu_xxx.c
#include <psp.h>
_mqx_uint _mmu_venable(void)
```

Parameters

None

Returns

- **MQX_OK**
- **MQX_COMPONENT_DOES_NOT_EXIST** (`_mmu_vinit()` was not previously called)

See Also

[_mmu_vinit](#)

[_mmu_vdisable](#)

Description

The function enables the MMU, allowing an application to access virtual addresses.

2.1.138 `_mmu_vinit`

Initializes the MMU to provide the virtual memory component. This function prepares MMU L1 table with default flag.

Prototype

```
source\psp\cpu_family\mmmu_xxx.c
#include <psp.h>
_mqx_uint _mmu_vinit(
    _mqx_uint flags,
    void      *base_ptr)
```

Parameters

flags [IN] — Flags that are specific to the CPU type; they might be used, for example, to select the MMU page size (see your PSP release note)

base_ptr [IN] — Base address of the MMU L1 table.

Returns

- MQX_OK
- Errors

Error	Description
MQX_COMPONENT_DOES_NOT_EXIST	<code>_cpu_type_initialize_support()</code> was not previously called (see the PSP release note).
MQX_INVALID_PARAMETER	One or both of the following: <ul style="list-style-type: none"> • L1 table points to NULL • Address of L1 table is not aligned • Invalid flags

See Also

[_mmu_venable](#)

[_mmu_vdisable](#)

Description

The function initializes the MMU and the MMU page tables, but does not enable the MMU.

Example

Initialize the MMU on the Vybrid ARM[®] Cortex[®]-A5 processor.

```
_mqx_uint result;
...
result = _mmu_vinit(PSP_PAGE_TABLE_SECTION_SIZE(PSP_PAGE_TABLE_SECTION_SIZE_1MB)
PSP_PAGE_DESCR(PSP_PAGE_DESCR_ACCESS_RW_ALL)
PSP_PAGE_TYPE(PSP_PAGE_TYPE_STRONG_ORDER), (void*)L1PageTable);
```


2.1.139 _mmu_vtop

Gets the physical address that corresponds to the virtual address.

Prototype

```
source\psp\cpu_family\mmu_xxx.c
#include <psp.h>
_mqx_uint _mmu_vtop(
void *va,
void *pa)
```

Parameters

va [IN] — Virtual address
pa [OUT] — Physical address

Returns

- MQX_OK
- Errors

Error	Description
MQX_INVALID_POINTER	<i>vaddr</i> is invalid.

See Also

[_mmu_vinit](#)

Example

Get the physical address that corresponds to the virtual address of a DMA device.

```
void *addr;
...
if (_mmu_vtop(virtual_addr, &addr) == MQX_OK) {
    _dma_set_start(addr);
}
...
```

2.1.140 `_mqx`

Initializes and starts MQX on the processor.

Prototype

```
source\kernel\mqx.c
_mqx_uint _mqx(
    MQX_INITIALIZATION_STRUCT_PTR init_struct_ptr)
```

Parameters

init_struct_ptr [IN] — Pointer to the MQX initialization structure for the processor

Returns

- Does not return (success)
- If application called `_mqx_exit()`, error code that it passed to `_mqx_exit()` (success)
- Errors (failure)

Error	Description
Errors from <code>_int_install_isr()</code>	MQX cannot install the interrupt subsystem.
Errors from <code>_io_init()</code>	MQX cannot install the I/O subsystem.
Errors from <code>_mem_alloc_system()</code>	There is not enough memory to allocate either the interrupt stack or the interrupt table.
Errors from <code>_mem_alloc_zero()</code>	There is not enough memory to allocate the ready queues.
MQX_KERNEL_MEMORY_TOO_SMALL	<i>init_struct_ptr</i> does not specify enough kernel memory.
MQX_OUT_OF_MEMORY	There is not enough memory to allocate either the ready queues, the interrupt stack, or the interrupt table.
MQX_TIMER_ISR_INSTALL_FAIL	MQX cannot install the periodic timer ISR.

Traits

Must be called exactly once per processor

See Also

[`_mqx_exit`](#)

[`_int_install_isr`](#)

[`_mem_alloc ...`](#)

[`MQX_INITIALIZATION_STRUCT`](#)

[`TASK_TEMPLATE_STRUCT`](#)

Description

The function does the following:

- initializes the default memory pool and memory components
- initializes kernel data
- performs BSP-specific initialization, which includes installing the periodic timer
- performs PSP-specific initialization
- creates the interrupt stack
- creates the ready queues
- starts MQX tasks
- starts autostart application tasks

Example

Start MQX.

```
extern MQX_INITIALIZATION_STRUCT MQX_init_struct;

result = _mqx(&MQX_init_struct);
if (result != MQX_OK) {
    /*An error occurred. */
    ...
}
```

2.1.141 `_mqx_bsp_revision`

Pointer to the global string that represents the version of the BSP.

Prototype

```
source\kernel\bsp\bsp\init_bsp.c  
const char *_mqx_bsp_revision
```

See Also

[_mqx_copyright](#)

[_mqx_date](#)

[_mqx_generic_revision](#)

[_mqx_io_revision](#)

[_mqx_version](#)

[_mqx_psp_revision](#)

Example

```
puts(_mqx_bsp_revision);
```

2.1.142 `_mqx_copyright`

Pointer to the global MQX copyright string.

Prototype

```
source\kernel\mqx.c  
const char *_mqx_copyright
```

See Also

[_mqx_bsp_revision](#)

[_mqx_date](#)

[_mqx_generic_revision](#)

[_mqx_io_revision](#)

[_mqx_version](#)

[_mqx_psp_revision](#)

Example

```
puts(_mqx_copyright);
```

2.1.143 `_mqx_date`

Pointer to the string that indicates the date and time when the MQX library was built.

Prototype

```
source\kernel\mqx.c  
const char *_mqx_date
```

See also

[_mqx_bsp_revision](#)

[_mqx_copyright](#)

[_mqx_generic_revision](#)

[_mqx_io_revision](#)

[_mqx_version](#)

[_mqx_psp_revision](#)

Example

```
puts(_mqx_date);
```

2.1.144 `_mqx_exit`

Terminate the MQX application and return to the environment that started the application.

Prototype

```
source\kernel\mqx.c
void _mqx_exit(
    _mqx_uint error_code)
```

Parameters

error_code [IN] — Error code to return to the function that called `_mqx()`

Returns

None

Traits

Behavior depends on the BSP

See Also

[_mqx](#)

Description

The function returns back to the environment that called `_mqx()`. If the application has installed the MQX exit handler ([_mqx_set_exit_handler](#)), `_mqx_exit()` calls the MQX exit handler before it exits. By default, `_bsp_exit_handler` is installed as the MQX exit handler in each BSP.

NOTE

It is important to ensure that the environment (boot call stack) the MQX is returning to is in the consistent state. This is not provided by distributed MQX BSPs, because the boot stack is reused (rewritten) by MQX Kernel data. Set the boot stack outside of Kernel data section to support correct `_mqx_exit` functionality.

Example

```
#define FATAL_ERROR 1

if (task_id == NULL) {
    printf("Application error.\n");
    _mqx_exit(FATAL_ERROR);
}
```

2.1.145 **_mqx_fatal_error**

Indicates that an error occurred that is so severe that MQX or the application can no longer function.

Prototype

```
source\kernel\mqx.c
void _mqx_fatal_error(
    _mqx_uint  error)
```

Parameters

error [IN] — Error code

Returns

None

Traits

Terminates the application by calling `_mqx_exit()`

See Also

[_mqx_exit](#)

[_mqx](#)

[_int_exception_isr](#)

Description

The function logs an error in kernel log (if it has been created and configured to log errors) and calls `_mqx_exit()`.

MQX calls `_mqx_fatal_error()` if it detects an unhandled interrupt while it is in `_int_exception_isr()`.

If an application calls `_mqx_fatal_error()` when it detects a serious error, you can use this to help you debug by setting a breakpoint in the function.

Example

MQX detects a fatal error.

```
if ((unsigned char*)function_call_frame_ptr >
    (unsigned char*)kernel_data->INTERRUPT_STACK_PTR)
{
    /* MQX walked past the end of the interrupt stack and
    ** therefore the default memory pool is corrupted.
    */
    _mqx_fatal_error(MQX_CORRUPT_INTERRUPT_STACK);
}
```


2.1.146 `_mqx_generic_revision`

Pointer to the global string that indicates the revision number of generic MQX code.

Prototype

```
source\kernel\mqx.c  
const char *_mqx_generic_revision
```

See Also

[_mqx_bsp_revision](#)

[_mqx_copyright](#)

[_mqx_date](#)

[_mqx_io_revision](#)

[_mqx_version](#)

[_mqx_psp_revision](#)

Example

```
puts(_mqx_generic_revision);
```

2.1.147 `_mqx_get_counter`

Gets a unique number.

Prototype

```
source\kernel\mqx.c  
_mqx_uint _mqx_get_counter(void)
```

Parameters

None

Returns

- 16-bit number for 16-bit processors or a 32-bit number for 32-bit processors (unique for the processor and never 0)

2.1.148 `_mqx_get_cpu_type`

Gets the CPU type.

Prototype

```
source\kernel\mqx.c
_mqx_uint _mqx_get_cpu_type(void)
```

Parameters

None

Returns

- **CPU_TYPE** field of kernel data

See Also

[_mqx_set_cpu_type](#)

Description

CPU types begin with **PSP_CPU_TYPE_** and are defined in *source\psp\cpu_family\cpu_family.h*.

Example

Set and get the CPU type.

```
#include <powerpc.h>
_mqx_set_cpu_type(PSP_CPU_TYPE_POWERPC_750);
...
if (_mqx_get_cpu_type() == PSP_CPU_TYPE_POWERPC_750) {
    printf("CPU type is PowerPC 750.");
}
```

2.1.149 `_mqx_get_exit_handler`

Gets a pointer to the MQX exit handler, which MQX calls when it exits.

Prototype

```
source\kernel\mqx.c  
MQX_EXIT_FPTR mqx_get_exit_handler(void)
```

Parameters

None

Returns

Pointer to the MQX exit handler

See Also

[_mqx_exit](#)

[_mqx_set_exit_handler](#)

Example

See `_mqx_set_exit_handler()`.

2.1.150 `_mqx_get_initialization`

Gets a pointer to the MQX initialization structure.

Prototype

```
source\kernel\mqx.c  
MQX_INITIALIZATION_STRUCT_PTR _mqx_get_initialization(void)
```

Parameters

None

Returns

Pointer to the MQX initialization structure in kernel data

See Also

[_mqx](#)

[MQX_INITIALIZATION_STRUCT](#)

2.1.151 `_mqx_get_kernel_data`

Gets a pointer to kernel data.

Prototype

```
source\kernel\mqx.c  
void *_mqx_get_kernel_data(void)
```

Parameters

None

Returns

Pointer to kernel data

See Also

[_mqx](#)

[MQX_INITIALIZATION_STRUCT](#)

Description

The address of kernel data corresponds to **START_OF_KERNEL_MEMORY** in the MQX initialization structure that the application used to start MQX on the processor.

Example

Check the default I/O channel.

```
kernel_data = _mqx_get_kernel_data();  
if (kernel_data->INIT.IO_CHANNEL) {  
    ...  
}
```

2.1.152 `_mqx_get_system_task_id`

Gets the task ID of System Task.

Prototype

```
source\kernel\mqx.c  
_task_id _mqx_get_system_task_id(void)
```

Parameters

None

Returns

Task ID of System Task

See Also

[_mem_transfer](#)

Description

System resources are owned by System Task.

Example

See [_mem_transfer\(\)](#).

2.1.153 `_mqx_get_tad_data`, `_mqx_set_tad_data`

<code>_mqx_get_tad_data()</code>	Gets the TAD_RESERVED field from the task descriptor.
<code>_mqx_set_tad_data()</code>	Sets the TAD_RESERVED field in the task descriptor.

Prototype

```
source\kernel\mqx.c
void *_mqx_get_tad_data(
    void      *td)

_mqx_set_tad_data(
    void      *td,
    void      *tad_data)
```

Parameters

td [IN] — Task descriptor
tad_data [IN] — New value for TAD_RESERVED

Returns

- `_mqx_get_tad_data()`: TAD_RESERVED for *td*

Description

Third-party compilers can use the functions in their runtime libraries.

2.1.154 _mqx_idle_task

Idle Task.

Prototype

```
source\kernel\idletask.c
void _mqx_idle_task(
    uint32_t parameter)
```

Parameters

parameter [IN] — Not used

Returns

None

Description

Idle Task is an MQX task that runs if all application tasks are blocked.

The function implements a simple counter, whose size depends on the CPU.

CPU	Number of bits in the counter
16-bit	64
32-bit	128

You can read the counter from a debugger and calculate idle CPU time.

2.1.155 `_mqx_io_revision`

Pointer to the global string that represents the I/O version for the BSP.

Prototype

```
source\bsp\platform\init_bsp.c  
const char *_mqx_io_revision
```

See Also

[_mqx_bsp_revision](#)

[_mqx_copyright](#)

[_mqx_date](#)

[_mqx_generic_revision](#)

[_mqx_version](#)

[_mqx_psp_revision](#)

Example

```
puts(_mqx_io_revision);
```

2.1.156 _mqx_monitor_type

The type of monitor used.

Prototype

```
source\kernel\mqx.c
const _mqx_uint _mqx_monitor_type
```

Parameters

None

Returns

None

Description

Monitor types are defined in: *source\include\mqx.h*.

TIP

On some targets, you can use this variable to turn off caches and MMUs if they are present. For details, see your BSP release notes.

Example

```
#include <mcebx860.h>
...
if ((_mqx_monitor_type == MQX_MONITOR_TYPE_NONE) ||
    (_mqx_monitor_type == MQX_MONITOR_TYPE_BDM))
{
    ...
}
```

2.1.157 `_mqx_psp_revision`

Pointer to the global string that indicates the PSP revision number.

Prototype

```
source\kernel\mqx.c  
const char *_mqx_psp_revision
```

See Also

[_mqx_bsp_revision](#)

[_mqx_copyright](#)

[_mqx_date](#)

[_mqx_generic_revision](#)

[_mqx_io_revision](#)

[_mqx_version](#)

Example

```
puts(_mqx_psp_revision);
```

2.1.158 `_mqx_set_cpu_type`

Sets the CPU type.

Prototype

```
source\kernel\mqx.c  
void _mqx_set_cpu_type(  
    _mqx_uint  cpu_type)
```

Parameters

cpu_type [IN] — CPU type to set

Returns

None

Traits

Does not verify that *cpu_type* is valid

See Also

[_mqx_get_cpu_type](#)

[MQX_INITIALIZATION_STRUCT](#)

Description

The function sets **CPU_TYPE** in kernel data. The MQX Host Tools family of products uses CPU type. CPU types begin with **PSP_CPU_TYPE_** and are defined in *source\psp\cpu_family\cpu_family.h*.

Example

See [Section 2.1.148](#), “`_mqx_get_cpu_type()`.”

2.1.159 `_mqx_set_exit_handler`

Sets the address of the MQX exit handler, which MQX calls when it exits.

Prototype

```
source\kernel\mqx.c
void _mqx_set_exit_handler(
    MQX_EXIT_FPTR entry)
```

Parameters

entry [IN] — Pointer to the exit handler

Returns

None

See Also

[_mqx_get_exit_handler](#)

[_mqx_exit](#)

Example

Set and get the exit handler.

```
/* Set the BSP exit handler, which is called by _mqx_exit(): */
_mqx_set_exit_handler(_bsp_exit_handler);
...
printf("Exit handler is 0x%lx", (uint32_t)mqx_get_exit_handler());
```

2.1.160 `_mqx_version`

A string that indicates the version of MQX.

Prototype

```
source\kernel\mqx.c  
const char *_mqx_version
```

See Also

[_mqx_bsp_revision](#)

[_mqx_copyright](#)

[_mqx_date](#)

[_mqx_generic_revision](#)

[_mqx_io_revision](#)

[_mqx_psp_revision](#)

Example

```
puts(_mqx_version);
```

2.1.161 `_mqx_zero_tick_struct`

A constant zero-initialized tick structure that an application can use to initialize one of its tick structures to zero.

Prototype

```
source\kernel\mqx.c  
const MQX_TICK_STRUCT _mqx_zero_tick_struct
```

See Also

[_time_add ...](#)

[_ticks_to_time](#)

[_time_diff, _time_diff_ticks](#)

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_init_ticks](#)

[_time_set, _time_set_ticks](#)

Description

The constant can be used in conjunction with the **_time_add** family of functions to convert units to tick time.

Example

See `_time_add_day_to_ticks()`.

2.1.162 `_msg_alloc`

Allocates a message from the private message pool.

Prototype

```
source\kernel\msg.c
include <message.h>
void *_msg_alloc(
    _pool_id pool_id)
```

Parameters

pool_id [IN] — A pool ID from `_msgpool_create()`

Returns

- Pointer to a message (success)
- NULL (failure)

Task Error Codes	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGPOOL_INVALID_POOL_ID	<i>pool_id</i> is not valid.
MSGPOOL_OUT_OF_MESSAGES	All the messages in the pool are allocated .
Task error codes from <code>_mem_alloc_system()</code>	(If MQX needs to grow the pool.)

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[`_msg_alloc_system`](#)

[`_msg_free`](#)

[`_msgpool_create`](#)

[`_msgpool_destroy`](#)

[`_task_set_error`](#)

[`_mem_alloc ...`](#)

MESSAGE_HEADER_STRUCT

Description

The size of the message is determined by the message size that a task specified when it called `_msgpool_create()`. The message is a resource of the task until the task either frees it (`_msg_free()`) or puts it on a message queue (`_msgq_send` family of functions.)

Example

See `_msgpool_create()`.

2.1.163 `_msg_alloc_system`

Allocates a message from a system message pool.

Prototype

```
source\kernel\msg.c
#include <message.h>
void *_msg_alloc_system(
    _msg_size  message_size)
```

Parameters

message_size [IN] — Maximum size (in single-addressable units) of the message

Returns

- Pointer to a message of at least *message_size* single-addressable units (success)
- NULL (failure: message component is not created)

Task Error Codes	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
Task error codes from <code>_mem_alloc_system()</code>	(If MQX needs to grow the pool.)

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_mem_alloc ...](#)

[_msg_alloc](#)

[_msg_free](#)

[_msgpool_create_system](#)

[_msgq_send](#)

[_task_set_error](#)

MESSAGE_HEADER_STRUCT

Description

The size of the message is determined by the message size that a task specified when it called `_msgpool_create_system()`.

The message is a resource of the task until the task either frees it (`_msg_free()`) or puts it on a message queue (`_msgq_send` family of functions.)

Example

See `_msgq_send()`.

2.1.164 `_msg_available`

Gets the number of free messages in the message pool.

Prototype

```
source\kernel\msg.c
#include <message.h>
_mqx_uint _msg_available(
    _pool_id pool_id)
```

Parameters

pool_id [IN] — One of the following:

- private message pool for which to get the number of free messages
- MSGPOOL_NULL_POOL_ID** (for system message pools)

Returns

- Depending on *pool_id* (success):
- number of free messages in the private message pool
- number of free messages in all system message pools
- 0 (success: no free messages)
- 0 (failure: see description)

Traits

If *pool_id* does not represent a valid private message pool, calls **_task_set_error()** to set the task error code to **MSGPOOL_INVALID_POOL_ID**

See Also

[_msgpool_create](#)
[_msgpool_destroy](#)
[_msg_free](#)
[_msg_alloc_system](#)
[_task_set_error](#)
[_msg_create_component](#)

Description

The function fails if either:

- message component is not created
- *pool_id* is for a private message pool, but does not represent a valid one

Example

See `_msgpool_create()`.

2.1.165 _msg_create_component

Creates the message component.

Prototype

```
source\kernel\msg.c
#include <message.h>
_mqx_uint _msg_create_component(void)
```

Parameters

None

Returns

- MQX_OK (success)
- Errors (failure)

Error	Description
MSGPOOL_POOL_NOT_CREATED	MQX cannot allocate the data structures for message pools.
MSGQ_TOO_MANY_QUEUES	MQX cannot allocate the data structures for message queues.

Task Error Codes

- Task error codes from _mem_alloc_system_zero()
- Task error codes from _mem_free()

Traits

On failure, sets the task error code (see task error codes)

See Also

[_msgq_open](#)

[_msgpool_create](#)

[_msgq_open_system](#)

[_msgpool_create_system](#)

[_mem_alloc ...](#)

[_mem_free](#)

Description

The function uses fields in the MQX initialization structure to create the number of message pools (**MAX_MSGPOOLS**) and message queues (**MAX_MSGQS**). MQX creates the message component if it is not created when an application calls one of:

- [_msgpool_create\(\)](#)
- [_msgpool_create_system\(\)](#)

- `_msgq_open()`
- `_msgq_open_system()`

2.1.165.1 Example

See `_msgpool_create()`.

2.1.166 `_msg_free`

Free the message.

Prototype

```
source\kernel\msg.c
#include <message.h>
void _msg_free(
    void *msg_ptr)
```

Parameters

msg_ptr [IN] — Pointer to the message to be freed

Returns

None

Task Error Codes

- MQX_INVALID_POINTER — *msg_ptr* does not point to a valid message.
- MQX_NOT_RESOURCE_OWNER — Message is already freed.
- MSGQ_MESSAGE_IS_QUEUED — Message is in a queue.

Traits

If the function does not free the message, it calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_msgpool_create](#)

[_msgpool_create_system](#)

[_msgpool_destroy](#)

[_msg_alloc_system](#)

[_msg_alloc](#)

[_task_set_error](#)

MESSAGE_HEADER_STRUCT

Description

Only the task that has the message as its resource can free the message. A message becomes a task's resource when the task allocates the message, and it continues to be a resource until the task either frees it or puts it in a message queue. A message becomes a resource of the task that got it from a message queue.

The function returns the message to the message pool from which it was allocated.

Example

See `_msgpool_create()`.

2.1.167 `_msg_swap_endian_data`

Converts the data portion of the message to the other endian format.

Prototype

```
source\kernel\msg.c
#include <message.h>
void _msg_swap_endian_data(
    unsigned char      *definition,
    MESSAGE_HEADER_STRUCT_PTR msg_ptr)
```

Parameters

definition [IN] — Pointer to an array (*NULL*-terminated), each element of which defines the size (in single-addressable units) of fields in the data portion of the message

msg_ptr [IN] — Pointer to the message whose data is to be converted

Returns

None

Traits

Sets CONTROL in the message header to indicate the correct endian format for the processor

See also

[_mem_swap_endian](#)

[MSG_MUST_CONVERT_DATA_ENDIAN](#)

[MESSAGE_HEADER_STRUCT](#)

Description

The function calls `_mem_swap_endian()` and uses *definition* to swap single-addressable units:

message_ptr + sizeof(MESSAGE_HEADER_STRUCT)

The macro `MSG_MUST_CONVERT_DATA_ENDIAN` determines whether the data portion of the message needs to be converted to the other endian format.

Example

Compare with the example for `_mem_swap_endian()`.

Determine whether the message comes from a processor with the other endian format and convert the data portion of the message to the other endian format if necessary.

```
typedef struct my_msg_data
{
    _task_id    INFO[ARRAY_SIZE];
    _mqx_uint    READ_INDEX;
    _mqx_uint    WRITE_INDEX;
} MY_MSG_DATA;
```



```

typedef struct my_msg_struct
{
    MSG_HEADER_STRUCT  HEADER;
    MY_MSG_DATA        DATA;
} MY_MSG_STRUCT;

MY_MSG_STRUCT *my_msg_ptr;

_mem_size my_data_def[] =
{
    sizeof(my_msg_ptr->DATA.INFO),
    sizeof(my_msg_ptr->DATA.READ_INDEX),
    sizeof(my_msg_ptr->DATA.WRITE_INDEX),
    0
};

if MSG_MUST_CONVERT_DATA_ENDIAN((my_msg_ptr->HEADER.CONTROL) {
    _msg_swap_endian_data((unsigned char *)my_data_def,
        MESSAGE_HEADER_STRUCT_PTR)my_msg_ptr);
};

```

2.1.168 `_msg_swap_endian_header`

Converts the message header to the other endian format.

Prototype

```
source\kernel\msg.c
#include <message.h>
void _msg_swap_endian_header(
    MESSAGE_HEADER_STRUCT_PTR message_ptr)
```

Parameters

message_ptr [IN] — Pointer to a message whose header is to be converted

Returns

None

Traits

Sets CONTROL in the message header to indicate the correct endian format for the processor

See Also

[_mem_swap_endian](#)

[_msg_swap_endian_data](#)

[MSG_MUST_CONVERT_HDR_ENDIAN](#)

[MESSAGE_HEADER_STRUCT](#)

Description

The function is not needed for general application code because the IPC component converts the message header. Use it only if you are writing IPC message drivers for a new BSP.

The function calls `_mem_swap_endian()` and uses the field sizes of **MESSAGE_HEADER_STRUCT** to convert the header to the other endian format.

The macro **MSG_MUST_CONVERT_HDR_ENDIAN** determines whether the message header needs to be converted to the other endian format.

Example

```
MSG_HEADER_STRUCT_PTR msg_ptr;

if (MSG_MUST_CONVERT_HDR_ENDIAN(msg_ptr->CONTROL)) {
    _msg_swap_endian_header(msg_ptr);
}
```

2.1.169 _msgpool_create

Creates a private message pool.

Prototype

```
source\kernel\msgpool.c
#include <message.h>
_pool_id _msgpool_create(
    uint16_t message_size,
    uint16_t num_messages,
    uint16_t grow_number,
    uint16_t grow_limit)
```

Parameters

message_size [IN] — Size (in single-addressable units) of the messages (including the message header) to be created for the message pool

num_messages [IN] — Initial number of messages to be created for the message pool

grow_number [IN] — Number of messages to be added if all the messages are allocated

grow_limit [IN] — If *grow_number* is not equal to 0; one of the following:

maximum number of messages that the pool can have

0 (unlimited growth)

Returns

- Pool ID to access the message pool (success)
- 0 (failure)

Task error codes

Error	Description
MSGPOOL_MESSAGE_SIZE_TOO_SMALL	<i>message_size</i> is less than the size of the message header structure
MQX_OUT_OF_MEMORY	MQX cannot allocate memory to create the message pool
MSGPOOL_OUT_OF_POOLS	Maximum number of message pools have been created, where the number is defined at initialization time in MAX_MSGPOOLS in the MQX initialization structure
Task error codes from _mem_alloc_system()	—
Task error codes from _msg_create_component()	—

Traits

- Creates the message component if it was not previously created
- On failure, calls **_task_set_error()** to set the task error code (see task error codes)

See Also[_msgpool_create_system](#)[_msgpool_destroy](#)[_msg_alloc](#)[_task_set_error](#)[_mem_alloc ...](#)[_msg_create_component](#)**MQX_INITIALIZATION_STRUCT****Description**

Any task can allocate messages from the pool by calling **_msg_alloc()** with the pool ID.

Example

Create a private message pool and allocate a message from it.

```
_pool_id          pool;
MESSAGE_HEADER_STRUCT_PTR msg_ptr;

_msg_create_component();
pool = _msgpool_create(100, 10, 10, 50);
...
if (_msg_available(pool)) {
    msg_ptr = _msg_alloc(pool);
    ...
    _msg_free(msg_ptr);
}
...
_msgpool_destroy(pool);
```

2.1.170 `_msgpool_create_system`

Creates a system message pool.

Prototype

```
source\kernel\msgpool.c
#include <message.h>
bool _msgpool_create_system(
    uint16_t message_size,
    uint16_t num_messages,
    uint16_t grow_number,
    uint16_t grow_limit)
```

Parameters

message_size [IN] — Size (in single-addressable units) of the messages (including the message header) to be created for the message pool

num_messages [IN] — Initial number of messages to be created for the pool

grow_number [IN] — Number of messages to be added if all the messages are allocated

grow_limit [IN] — If *grow_number* is not 0; one of the following:

maximum number of messages that the pool can have

0 (unlimited growth)

Returns

- TRUE (success)
- FALSE (failure)

Traits

- Creates the message component if it was not previously created
- On failure, calls `_task_set_error()` to set the task error code as described for `_msgpool_create()`

See Also

[`_msgpool_create`](#)

[`_msgpool_destroy`](#)

[`_msg_alloc_system`](#)

[`_task_set_error`](#)

[`MQX_INITIALIZATION_STRUCT`](#)

Description

Tasks can subsequently allocate messages from the pool by calling `_msg_alloc_system()`.

Example

See `_msgq_send()`.

2.1.171 `_msgpool_destroy`

Destroys the private message pool.

Prototype

```
source\kernel\msgpool.c
#include <message.h>
_mqx_uint _msgpool_destroy(
    _pool_id pool_id)
```

Parameters

pool_id [IN] — Pool to destroy

Returns

- MQX_OK
- Errors

Error	Description
MSGPOOL_ALL_MESSAGES_NOT_FREE	All messages in the message pool have not been freed.
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGPOOL_INVALID_POOL_ID	<i>pool_id</i> does not represent a message pool that was created by <code>_msgpool_create()</code> .

Traits

Calls `_mem_free()`, which on error sets the task error code

See Also

[_msgpool_create](#)

[_msg_free](#)

[_msg_alloc](#)

[_mem_free](#)

Description

Any task can destroy the private message pool as long as all its messages have been freed.

Example

See `_msgpool_create()`.

2.1.172 _msgpool_test

Tests all the message pools.

Prototype

```
source\kernel\msgpool.c
#include <message.h>
_mqx_uint _msgpool_test(
    void *pool_error_ptr,
    void *msg_error_ptr)
```

Parameters

pool_error_ptr [OUT] — (Initialized only if an error is found) If the message in a message pool has an error; one of the following:

pointer to a pool ID if the message is from a private message pool

pointer to a system message pool if the message is from a system message pool

msg_error_ptr [OUT] — Pointer to the message that has an error (initialized only if an error is found)

Returns

- MQX_OK (all messages in all message pools passed)
- Errors

Errors	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_INVALID_MESSAGE	At least one message in at least one message pool failed.

Traits

Disables and enables interrupts

See also

[_msgpool_create](#)

[_msgpool_create_system](#)

Description

The function checks the validity of each message in each private and system message pool. It reports the first error that it finds.

2.1.173 `_msgq_close`

Closes the message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
bool _msgq_close(
    _queue_id queue_id)
```

Parameters

queue_id [IN] — Queue ID of the message queue to be closed

Returns

- TRUE (success)
- FALSE (failure)

Task Error Codes

Error	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_INVALID_QUEUE_ID	<i>queue_id</i> is not valid for this processor.
MSGQ_NOT_QUEUE_OWNER	Task that got <i>queue_id</i> did so by opening a private message queue (<code>_msgq_open()</code>) and is not the task calling <code>_msgq_close()</code> .
MSGQ_QUEUE_IS_NOT_OPEN	<i>queue_id</i> does not represent a queue that is open.
Task error codes from <code>_msg_free()</code>	(If MQX cannot free messages that are in the queue.)

Traits

- Calls `_msg_free()` to free messages that are in the queue
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See also

[_msgq_open_system](#)

[_msgq_open](#)

[_msg_free](#)

[_msgq_send](#)

[_task_set_error](#)

Description

Only the task that opens a private message queue (**_msgq_open()**) can close it. Any task can close an opened system message queue (**_msgq_open_system()**).

- If **_msgq_close()** closes the message queue, it frees any messages that are in the queue.
- If **_msgq_close()** closes the message queue, a task can no longer use *queue_id* to access the message queue.
- The message queue can subsequently be opened again with **_msgq_open()** or **_msgq_open_system()**.

2.1.174 `_msgq_get_count`

Gets the number of messages in the message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_mqx_uint _msgq_get_count(
    _queue_id queue_id)
```

Parameters

queue_id [IN] — One of the following:

queue ID of the queue to be checked

MSGQ_ANY_QUEUE (get the number of messages waiting in all message queues that the task has open)

Returns

- Number of messages (success)
- 0 (success: queue is empty)
- 0 (failure)

Task Error Codes

Error	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_INVALID_QUEUE_ID	<i>queue_id</i> is not valid for this processor.
MSGQ_QUEUE_IS_NOT_OPEN	<i>queue_id</i> does not represent a message queue that is open.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See also

[_msgq_open](#)

[_msgq_open_system](#)

[_msgq_receive ...](#)

[_msgq_poll](#)

[_task_set_error](#)

Description

The message queue must be previously opened on this processor.

2.1.175 `_msgq_get_id`

Converts a message-queue number and processor number to a queue ID.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_queue_id _msgq_get_id(
    _processor_number processor_number,
    _queue_number queue_number)
```

Parameters

processor_number [IN] — One of the following:

- processor on which the message queue resides
- 0 (indicates the local processor)

queue_number [IN] — Image-wide unique number that identifies the message queue

Returns

- Queue ID for the queue (success)
- **MSGQ_NULL_QUEUE_ID** (failure: *_processor_number* is not valid)

See Also

[_msgq_open_system](#)

[_msgq_open](#)

Description

The queue ID might not represent an open message queue. The queue ID can be used with functions that access message queues.

Example

See `_msgq_send()`.

2.1.176 _msgq_get_notification_function

Gets the notification function and its data that are associated with the private or the system message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_mqx_uint _msgq_get_notification_function(
    _queue_id    queue_id,
    MSGQ_NOTIFICATION_FPTR
        *notification_function_ptr,
    void *notification_data_ptr)
```

Parameters

queue_id [IN] — Queue ID of the message queue for which to get the notification function

notification_function_ptr [OUT] — Pointer (which might be *NULL*) to the function that MQX calls when it puts a message in the message queue

notification_data_ptr [OUT] — Pointer (which might be *NULL*) to data that MQX passes to the notification function

Returns

- MQX_OK
- Errors

Error	Description
MSGQ_INVALID_QUEUE_ID	<i>queue_id</i> does not represent a valid message queue on this processor.
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_QUEUE_IS_NOT_OPEN	<i>queue_id</i> does not represent an open message queue.

Traits

On error, does not initialize *notification_function_ptr* or *notification_data_ptr*

See Also

[_msgq_open_system](#)

[_msgq_open](#)

[_msgq_set_notification_function](#)

2.1.177 `_msgq_get_owner`

Gets the task ID of the task that owns the message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_task_id _msgq_get_owner(
    _queue_id queue_id)
```

Parameters

queue_id [IN] — Queue ID of the message queue

Returns

- Task ID (success)
- MQX_NULL_TASK_ID (failure)

Task Error Codes

Task Error Codes	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MQX_INVALID_PROCESSOR_NUMBER	Processor number that <i>queue_id</i> specifies is not valid.
MSGQ_QUEUE_IS_NOT_OPEN	Message queue with queue ID <i>queue_id</i> is not open.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_msgq_open](#)

[_msgq_open_system](#)

[_msgq_receive ...](#)

[_msgq_send family](#)

[_task_set_error](#)

2.1.178 `_msgq_open`

Opens the private message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_queue_id _msgq_open(
    _queue_number queue_number,
    uint16_t       max_queue_size)
```

Parameters

queue_number [IN] — One of the following:

queue number of the message queue to be opened on this processor (min. 8, max. as defined in the MQX initialization structure)

MSGQ_FREE_QUEUE (MQX opens an unopened message queue)

max_queue_size [IN] — One of the following:

maximum queue size

0 (unlimited size)

Returns

- Queue ID (success)
- MSGQ_NULL_QUEUE_ID (failure)

Task Error Codes

Task Error Codes	Description
MSGQ_INVALID_QUEUE_NUMBER	<i>queue_number</i> is out of range
MSGQ_QUEUE_IN_USE	One of the following: <ul style="list-style-type: none"> • message queue is already open • MQX cannot get a queue number for an unopened queue

Task error codes from `_msg_create_component()`

Traits

- Creates the message component if it was not previously created
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_msgq_close](#)

[_msgq_open_system](#)

[_msg_create_component](#)

[_msgq_set_notification_function](#)

[_task_set_error](#)

Description

The open message queue has a *NULL* notification function.

Only the task that opens a private message queue can receive messages from the queue.

A task can subsequently attach a notification function and notification data to the message queue with [_msgq_set_notification_function\(\)](#).

Example

See [_msgq_send\(\)](#).

2.1.179 _msgq_open_system

Opens the system message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_queue_id _msgq_open_system(
    _queue_number    queue_number,
    uint16_t         max_queue_size,
    MSGQ_NOTIFICATION_FPTR notification_function,
    void              *notification_data)
```

Parameters

queue_number [IN] — One of the following:

system message queue to be opened (min. 8, max. as defined in the MQX initialization structure)

MSGQ_FREE_QUEUE (MQX chooses an unopened system queue number)

max_queue_size [IN] — One of the following:

maximum queue size

0 (unlimited size)

notification_function [IN] — One of the following:

pointer to the function that MQX calls when it puts a message in the queue

NULL (MQX does not call a function when it puts a message in the queue)

notification_data [IN] — Data that MQX passes when it calls *notification_function*

Returns

- Queue ID (success)
- 0 (failure)

Task Error Codes

Task Error Codes	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_MESSAGE_NOT_AVAILABLE	There are no messages in the message queue.
MSGQ_NOT_QUEUE_OWNER	Task is not the owner of the private message queue.
MSGQ_QUEUE_IS_NOT_OPEN	Queue is not open.

Traits

- Creates the message component if it was not previously created
- On failure, calls **_task_set_error()** to set the task error code as described for **_msgq_open()**

See Also

[**_msgq_close**](#)

[**_msgq_open**](#)

[**_msgq_poll**](#)

[**_msgq_set_notification_function**](#)

[**_task_set_error**](#)

Description

Once a system message queue is opened, any task can use the queue ID to receive messages with **_msgq_poll()**.

- Tasks cannot receive messages from system message queues with **_msgq_receive()**.
- The notification function can get messages from the message queue with **_msgq_poll()**.
- A task can change the notification function and its data with **_msgq_set_notification_function()**.

2.1.180 `_msgq_peek`

Gets a pointer to the message that is at the start of the message queue, but do not remove the message.

Prototype

```
source\kernel\msgq.c
#include <message.h>
void *_msgq_peek(
    _queue_id queue_id)
```

Parameters

queue_id [IN] — Queue to look at

Returns

- Pointer to the message that is at the start of the message queue (success)
- NULL (failure)

Task Error Codes

Task Error Codes	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_INVALID_QUEUE_ID	queue_id is not valid.
MSGQ_MESSAGE_NOT_AVAILABLE	There are no messages in the message queue.
MSGQ_NOT_QUEUE_OWNER	Task is not the owner of the private message queue.
MSGQ_QUEUE_IS_NOT_OPEN	Queue is not open.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_msgq_get_count](#)

[_msgq_open_system](#)

[_msgq_receive ...](#)

[_msgq_send](#)

[_task_set_error](#)

[_msg_create_component](#)

MESSAGE_HEADER_STRUCT

Description

Call `_msgq_get_count()` first to determine whether there are messages in the queue. If there are no messages, `_msgq_peek()` calls `_task_set_error()` with **MSGQ_MESSAGE_NOT_AVAILABLE**.

2.1.181 _msgq_poll

Polls the message queue for a message, but do not wait if a message is not in the queue. The function is a non-blocking alternative to **_msgq_receive()**; therefore, ISRs can use it.

Prototype

```
source\kernel\msgq.c
#include <message.h>
void *_msgq_poll(
    _queue_id queue_id)
```

Parameters

queue_id [IN] — Private or system message queue from which to receive a message

Returns

- Pointer to a message (success)
- NULL (failure)

Task Error Codes

Task Error Codes	Description
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_INVALID_QUEUE_ID	<i>queue_id</i> is not valid or is not on this processor.
MSGQ_MESSAGE_NOT_AVAILABLE	There are no messages in the message queue.
MSGQ_NOT_QUEUE_OWNER	Queue is a private message queue that the task does not own.
MSGQ_QUEUE_IS_NOT_OPEN	Queue is not open.

Traits

On failure, calls **_task_set_error()** to set the task error code (see task error codes)

See Also

[_msgq_get_count](#)

[_msgq_open_system](#)

[_msgq_receive ...](#)

[_msgq_send](#)

[_task_set_error](#)

[_msg_create_component](#)

[MESSAGE_HEADER_STRUCT](#)

Description

The function is the only way for tasks to receive messages from a system message queue.

- If a system message queue has a notification function, the function can get messages from the queue with **_msgq_poll()**.
- If a message is returned, the message becomes a resource of the task.

Example

```
#define    TEST_QUEUE    16
#define    MAX_SIZE      10
void      *msg_ptr;
_queue_id my_qid;

my_qid = _msgq_open(TEST_QUEUE, MAX_SIZE);

msg_ptr = _msgq_poll(my_qid);
```

2.1.182 _msgq_receive ...

	Wait for a message from the private message queue:
<code>_msgq_receive()</code>	For the number of milliseconds
<code>_msgq_receive_for()</code>	For the number of ticks (in tick time)
<code>_msgq_receive_ticks()</code>	For the number of ticks
<code>_msgq_receive_until()</code>	Until the specified time (in tick time)

Prototype

```

source\kernel\msgq.c
#include <message.h>
void *_msgq_receive(
    _queue_id  queue_id,
    uint32_t   ms_timeout)

void *_msgq_receive_for(
    _queue_id      queue_id,
    MQX_TICK_STRUCT_PTR tick_time_timeout_ptr)

void *_msgq_receive_ticks(
    _queue_id  queue_id,
    _mqx_uint  tick_timeout)

void *_msgq_receive_until(
    _queue_id      queue_id,
    MQX_TICK_STRUCT_PTR tick_time_ptr)

```

Parameters

queue_id [IN] — One of the following:

- private message queue from which to receive a message
- MSGQ_ANY_QUEUE (any queue that the task owns)

ms_timeout [IN] — One of the following:

- maximum number of milliseconds to wait. After the timeout elapses without the message, the function returns.
- 0 (unlimited wait)

tick_time_timeout_ptr [IN] — One of the following:

- pointer to the maximum number of ticks to wait
- NULL (unlimited wait)

tick_timeout [IN] — One of the following:

- maximum number of ticks to wait
- 0 (unlimited wait)

tick_time_ptr [IN] — One of the following:

- Pointer to the time (in tick time) until which to wait
- NULL (unlimited wait)

Returns

- Pointer to a message (success)
- NULL (failure)

Task Error Codes

Task Error Codes	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.
MSGQ_INVALID_QUEUE_ID	<i>queue_id</i> is for a specific queue, but the ID is not valid.
MSGQ_MESSAGE_NOT_AVAILABLE	No messages were in the message queue before the timeout expired.
MSGQ_NOT_QUEUE_OWNER	Message is not a resource of the task.
MSGQ_QUEUE_IS_NOT_OPEN	One of the following: <ul style="list-style-type: none"> • specific queue is not open • <i>queue_id</i> is MSGQ_ANY_QUEUE, but the task has no queues open

Traits

- If no message is available, blocks the task until the message queue gets a message or the timeout expires
- Cannot be called from an ISR
- On failure, calls **_task_set_error()** to set the task error code (see task error codes)

See Also

[_msgq_get_count](#)

[_msgq_open](#)

[_msgq_poll](#)

[_msgq_send](#)

[_task_set_error](#)

[MESSAGE_HEADER_STRUCT](#)

Description

The function removes the first message from the queue and returns a pointer to the message. The message becomes a resource of the task.

The function cannot be used to receive messages from system message queues; this must be done with `_msgq_poll()`.

Example

See `_msgq_send()`.

2.1.183 `_msgq_send`

Sends the message to the message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
bool _msgq_send(
    void *msg_ptr)
```

Parameters

msg_ptr IN — Pointer to the message to be sent

Returns

- TRUE (success: see description)
- FALSE (failure)

Task error codes

Task error code	Meaning	Msg. accepted	Msg. freed
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created	No	No
MSGQ_INVALID_MESSAGE	<i>msg_ptr</i> is <i>NULL</i> or points to a message that is one of: <ul style="list-style-type: none"> • not valid • on a message queue • free 	No	No
MSGQ_INVALID_QUEUE_ID	Target ID is not a valid queue ID	No	Yes
MSGQ_QUEUE_FULL	Target message queue has reached its maximum size	No	Yes
MSGQ_QUEUE_IS_NOT_OPEN	Target ID does not represent an open message queue	No	Yes
Task error codes from <code>_msg_free()</code>	(If message needs to be freed)	Yes	No

Traits

- Might dispatch a task
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_msg_alloc_system](#)

[_msg_alloc](#)

[_msgq_open](#)

`_msgq_receive ...`

`_msgq_poll`

`_msgq_send_priority`

`_msgq_send_urgent`

`_msg_free`

`_task_set_error`

`MESSAGE_HEADER_STRUCT`

Description

The function sends a message (priority 0) to a private message queue or a system message queue. The function does not block. The message must be from one of:

- `_msg_alloc()`
- `_msg_alloc_system()`
- `_msgq_poll()`
- `_msgq_receive()`

The message must be overlaid with **MESSAGE_HEADER_STRUCT**, with the data portion following the header. In the header, the sending task sets:

- **TARGET_ID** to a valid queue ID for the local processor or for a remote processor (if **TARGET_ID** is for a remote processor, the function cannot verify the ID or determine whether the maximum size of the queue is reached)
- **SIZE** to the number of single-addressable units in the message, including the header

If the message is for a message queue on:	MQX sends the message to:
Local processor	The message queue
Remote processor	The remote processor

If the function returns successfully, the message is no longer a resource of the task.

Example

```
void TaskB(void)
{
    MESSAGE_HEADER_STRUCT_PTR msg_ptr;
    _queue_id taskb_qid;
    _queue_id main_qid;
    _pool_id pool;

    _msgpool_create_system(sizeof(MESSAGE_HEADER_STRUCT), 4, 0, 0);

    taskb_qid = _msgq_open(TASKB_QUEUE, 0);
    main_qid = _msgq_get_id(0, MAIN_QUEUE);

    msg_ptr = _msg_alloc_system(sizeof(MESSAGE_HEADER_STRUCT));
    while (TRUE) {
        msg_ptr->TARGET_QID = main_qid;
        msg_ptr->SOURCE_QID = taskb_qid;
        if (_msgq_send(msg_ptr) == FALSE){
            /* There was an error sending the message. */
        }
        msg_ptr = _msgq_receive(taskb_qid, 0);
    }
}
```

2.1.184 _msgq_send_broadcast

Sends the message to multiple message queues.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_mqx_uint _msgq_send_broadcast(
    void          *input_msg_ptr,
    _queue_id     *qid_ptr,
    _pool_id      pool_id)
```

Parameters

input_msg_ptr [IN] — Pointer to the message to be sent

qid_ptr [IN] — Pointer to an array of queue IDs, terminated by MSGQ_NULL_QUEUE_ID, to which a copy of the message is to be sent

pool_id [IN] — One of the following:

pool ID to allocate messages from

MSGPOOL_NULL_POOL_ID (messages will be allocated from a system message pool)

Returns

- Number that represents the size of the array of queue IDs (success)
- Number less than the size of the array of queue IDs (failure)

Task Error Codes

Task Error Codes	Description
MQX_INVALID_PARAMETER	<i>qid_ptr</i> does not point to a valid queue ID.
MSGPOOL_OUT_OF_MESSAGES	MQX could not allocate a message from the message pool.
MSGQ_INVALID_MESSAGE	<i>msg_ptr</i> does not point to a message that was allocated as described for _msgq_send().

- Task error codes from _msg_alloc() — (If *pool_id* represents a private message pool.)
- Task error codes from _msg_alloc_system() — (If *pool_id* represents a system message pool.)

Traits

- Calls _mem_copy()
- Calls _mem_alloc() or _mem_alloc_system() depending on whether *pool_id* represents a private or system message pool
- Might dispatch one or more tasks
- On failure, calls _task_set_error() to set the task error code (see task error codes)

See Also[_msgq_send](#)[_msgq_receive ...](#)[_msgq_poll](#)[_msgq_send_priority](#)[_msgq_send_urgent](#)[_task_set_error](#)[_mem_alloc ...](#)[_mem_copy](#)**MESSAGE_HEADER_STRUCT****Description**

For conditions on the message, see [_msgq_send\(\)](#).

The function sends a priority 0 message.

For each copy of the message, the function sets the target queue ID in the message header with a queue ID from the array of queue IDs.

The function does not block.

If the function returns successfully, the message is no longer a resource of the task.

It is the responsibility of the application to handle the consequences of messages being lost.

Example

```

MESSAGE_HEADER_STRUCT_PTR  msg_ptr;
_queue_id                  bcast_list = {taskb_qid,
                                         main_qid,
                                         MSGQ_NULL_QUEUE_ID};

_pool_id                   pool;
...
pool = _msgpool_create(sizeof(MESSAGE_HEADER_STRUCT), 4, 0, 0);
...
msg_ptr->SOURCE_QID = taskb_qid;
if (_msgq_send_broadcast(msg_ptr, bcast_list, pool) == 2) {
    /* All the messages were sent. */
}

```

2.1.185 `_msgq_send_priority`

Sends the priority message to the message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
bool _msgq_send_priority(
    void      *input_msg_ptr,
    _mqx_uint priority)
```

Parameters

input_msg_ptr [IN] — Pointer to the message to be sent

priority [IN] — Priority of the message, between:

0 (lowest)

MSG_MAX_PRIORITY (highest; 15)

Returns

- TRUE (success)
- FALSE (failure)

Task error codes

As described for `_msgq_send()`

MSGQ_INVALID_MESSAGE_PRIORITY

Priority is greater than **MSG_MAX_PRIORITY** (message is not accepted and is not freed).

Traits

- Might dispatch a task
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[`_msgq_send`](#)

[`_msg_alloc_system`](#)

[`_msg_alloc`](#)

[`_msgq_send_broadcast`](#)

[`_msgq_send_urgent`](#)

[`_msgq_receive ...`](#)

[`_msgq_poll`](#)

[`_task_set_error`](#)

[**MESSAGE_HEADER_STRUCT**](#)

Description

The function inserts the message in a message queue based on the priority of the message; it inserts higher-priority messages ahead of lower-priority ones. Messages with the same priority are inserted in FIFO order.

If the function returns successfully, the message is no longer a resource of the task.

Messages sent with `_msgq_send()` and `_msgq_send_broadcast()` are priority 0 messages.

Example

Task B sends a priority-one message and an urgent message to main queue. If the task that owns main queue is not waiting for a message or is of equal or lower priority than Task B, it receives the urgent message before the priority-one message.

```
void TaskB(void)
{
    MESSAGE_HEADER_STRUCT_PTR  priority_msg_ptr;
    MESSAGE_HEADER_STRUCT_PTR  urgent_msg_ptr;
    _queue_id                   taskb_qid;
    _queue_id                   main_qid;

    taskb_qid = _msgq_open(TASKB_QUEUE, 0);
    main_qid = _msgq_get_id(0, MAIN_QUEUE);
    ...
    while (TRUE) {
        priority_msg_ptr->TARGET_QID = urgent_msg_ptr->TARGET_QID =
            main_qid;
        priority_msg_ptr->SOURCE_QID = urgent_msg_ptr->SOURCE_QID =
            taskb_qid;
        if (_msgq_send_priority(priority_msg_ptr, 1)){
            _msgq_send_urgent(urgent_msg_ptr);
        }
        ...
    }
}
```

2.1.186 `_msgq_send_queue`

Sends the message directly to the private or system message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
bool _msgq_send_queue(
    void      *msg_ptr,
    _queue_id qid)
```

Parameters

msg_ptr [IN] — Pointer to the message to be sent
qid [IN] — Message queue into which to put the message

Returns

- TRUE (success)
- FALSE (failure)

Traits

- Might dispatch a task
- On failure, calls `_task_set_error()` to set the task error code as described for `_msgq_send()`

See Also

[_msgq_send](#)
[_msgq_send_broadcast](#)
[_msgq_send_urgent](#)
[_msgq_send_priority](#)
[_msg_alloc_system](#)
[_msg_alloc](#)
[_msgq_open](#)
[_msgq_receive ...](#)
[_msgq_poll](#)
[_task_set_error](#)

MESSAGE_HEADER_STRUCT

Description

The function sends the message as described for [_msgq_send](#) to the queue specified by parameter *qid* despite the target queue ID in the message header.

Target queue ID of the message must be always filled up before sending.

If the function returns successfully, the message is no longer a resource of the task.

Example

IPC router sends messages with different TARGET_QID into the routing queue.

```
_mqx_uint _ipc_msg_route_internal
{
    ...
    route_ptr = (IPC_MSG_ROUTING_STRUCT_PTR)_ipc_msg_processor_route_exists(pnum);
    if (!route_ptr) {
        _task_set_error(MSGQ_INVALID_QUEUE_ID);
        return(FALSE);
    }
    queue = route_ptr->QUEUE;
    result = _msgq_send_queue(message, BUILD_QID(kernel_data->INIT.PROCESSOR_NUMBER,
queue));
    ...
}
```


2.1.187 `_msgq_send_urgent`

Sends the urgent message to the message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
bool _msgq_send_urgent(
    void *msg_ptr)
```

Parameters

msg_ptr [IN] — Pointer to the message to be sent

Returns

- TRUE (success)
- FALSE (failure)

Traits

- Might dispatch a task
- On failure, calls `_task_set_error()` to set the task error code as described for `_msgq_send()`

See Also

[_msgq_send](#)

[_msgq_send_priority](#)

[_msgq_send_queue](#)

[_msg_alloc_system](#)

[_msg_alloc](#)

[_msgq_receive ...](#)

[_msgq_poll](#)

[_task_set_error](#)

MESSAGE_HEADER_STRUCT

Description

The function sends the message as described for `_msgq_send()`.

The function puts the message at the start of the message queue, ahead of any other urgent messages.

If the function returns successfully, the message is no longer a resource of the task.

Example

See `_msgq_send_priority()`.

2.1.188 _msgq_set_notification_function

Sets the notification function for the private or the system message queue.

Prototype

```
source\kernel\msgq.c
#include <message.h>
MSGQ_NOTIFICATION_FPTR _msgq_set_notification_function(
    _queue_id      qid,
    MSGQ_NOTIFICATION_FPTR notification_function,
    void           *notification_data)
```

Parameters

qid [IN] — Private or system message queue for which to install the notification function

notification_function [IN] — Function that MQX calls when MQX puts a message in the queue

notification_data [IN] — Data that MQX passes when it calls *notification_function*

Returns

See description

Return value	Meaning	Notification function installed?
Pointer to the previous notification function	Success	Yes
NULL	Success: Previous notification function was <i>NULL</i>	Yes
NULL	Failure	No

Task Error Codes

Task Error Codes	Description
MQX_OK	Notification function is installed; the previous function was <i>NULL</i> .
MSGQ_INVALID_QUEUE_ID	<i>qid</i> is not valid.
MSGQ_QUEUE_IS_NOT_OPEN	Queue is not open.
MQX_COMPONENT_DOES_NOT_EXIST	Message component is not created.

Traits

On failure, calls **_task_set_error()** to set the task error code (see description and task error codes)

See Also[**_msgq_open_system**](#)[**_msgq_open**](#)[**_msgq_poll**](#)[**_msgq_get_notification_function**](#)[**_task_set_error**](#)**Description**

If the message queue is a system message queue, the function replaces the notification function and data that were installed with **_msgq_open_system()**.

The notification function for a system message queue can get messages from the queue with **_msgq_poll()**.

The notification function for a private message queue cannot get messages from the queue.

2.1.189 `_msgq_test`

Tests all messages in all open message queues.

Prototype

```
source\kernel\msgq.c
#include <message.h>
_mqx_uint _msgq_test(
    void *queue_error_ptr,
    void *msg_error_ptr)
```

Parameters

queue_error_ptr [OUT] — Pointer to the message queue that has a message with an error (initialized only if an error is found)

msg_error_ptr [OUT] — Pointer to the message that has an error (initialized only if an error is found)

Returns

- MQX_OK (success: no errors are found)
- MSGQ_INVALID_MESSAGE (success: an error is found)
- MQX_COMPONENT_DOES_NOT_EXIST (Failure: Message component is not created.)

Traits

Disables and enables interrupts

See Also

[_msgq_open](#)

[_msgq_open_system](#)

Description

The function checks the consistency and validity of all messages in all private and system message queues that are open.

Example

A low-priority task tests message queues. If the task finds an invalid message, it exits MQX.

```
MESSAGE_HEADER_STRUCT_PTR    msg_ptr;
_mqx_uint                    queue_number;
...
if (_msgq_test(&queue_number, &msg_ptr) != MQX_OK) {
    printf("Message queue %ld, msg_ptr 0x%lx is not valid.",
        queue_number, msg_ptr);
    _mqx_exit();
}
...
```

2.1.190 `_mutatr_destroy`

Deinitializes the mutex attributes structure.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutatr_destroy(
    MUTEX_ATTR_STRUCT_PTR attr_ptr)
```

Parameters

attr_ptr [IN] — Pointer to the mutex attributes structure; initialized with `_mutatr_init()`

Returns

- `MQX_EOK` (success)
- `MQX_EINVAL` (failure: *attr_ptr* is `NULL` or points to an invalid attributes structure)

See Also

[`_mutatr_init`](#)

[`MUTEX_ATTR_STRUCT`](#)

Description

To reuse the mutex attributes structure, a task must reinitialize the structure.

Example

See `_mutatr_get_priority_ceiling()`.

2.1.191 `_mutatr_get_priority_ceiling`, `_mutatr_set_priority_ceiling`

<code>_mutatr_get_priority_ceiling()</code>	Gets the priority value of the mutex attributes structure.
<code>_mutatr_set_priority_ceiling()</code>	Sets the priority value of the mutex attributes structure.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutatr_get_priority_ceiling(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint               *priority_ptr)

_mqx_uint _mutatr_set_priority_ceiling(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint               priority)
```

Parameters

attr_ptr [IN] — Pointer to an initialized mutex attributes structure
priority_ptr [OUT] — Pointer to the current priority
priority [IN] — New priority

Returns

- MQX_EOK (success)
- MQX_EINVAL (failure: *attr_ptr* is NULL or points to an invalid attributes structure)

See Also

[_mutatr_init](#)

MUTEX_ATTR_STRUCT

Description

Priority applies only to mutexes whose scheduling protocol is priority protect.

Example

```
MUTEX_ATTR_STRUCT mutex_attributes;
_mqx_uint priority;
...
if (_mutatr_init(&mutex_attributes) != MQX_EOK) {
    result = _mutatr_set_sched_protocol(&mutex_attributes,
        MUTEX_PRIO_PROTECT | MUTEX_PRIO_INHERIT);
    result = _mutatr_set_priority_ceiling(&mutex_attributes, 6);
    ...
    result = _mutatr_get_priority_ceiling(&mutex_attributes,
        &priority);
```

```
if (result == MQX_EOK) {
    printf("\nPriority ceiling is %ld", priority);
    result = _mutex_init(&mutex, &mutex_attributes);
    result = _mutatr_destroy(&mutex_attributes);
    if (result != MQX_EOK) {
        /* Could not initialize the mutex. */
    }
}
```

2.1.192 `_mutatr_get_sched_protocol`, `_mutatr_set_sched_protocol`

<code>_mutatr_get_sched_protocol()</code>	Gets the scheduling protocol of the mutex attributes structure.
<code>_mutatr_set_sched_protocol()</code>	Sets the scheduling protocol of the mutex attributes structure.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutatr_get_sched_protocol(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint               *protocol_ptr)

_mqx_uint _mutatr_set_sched_protocol(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint               protocol)
```

Parameters

attr_ptr [IN] — Pointer to an initialized mutex attributes structure
protocol_ptr [OUT] — Pointer to the current scheduling protocol
protocol [IN] — New scheduling protocol (see scheduling protocols)

Returns

- MQX_EOK (success)
- MQX_EINVAL (failure: *attr_ptr* is NULL or points to an invalid attributes structure)

See Also

[_mutatr_init](#)

[_mutatr_get_priority_ceiling](#), [_mutatr_set_priority_ceiling](#)

[MUTEX_ATTR_STRUCT](#)

Scheduling Protocols

Protocol	Description
MUTEX_PRIO_INHERIT	(Priority inheritance) If the task that locks the mutex has a lower priority than any task that is waiting for the mutex, MQX temporarily raises the task priority to the level of the highest-priority waiting task while the task locks the mutex.

Protocol	Description
MUTEX_PRIO_PROTECT	(Priority protect) If the task that locks the mutex has a lower priority than the mutex, MQX temporarily raises the task priority to the level of the mutex while the task locks the mutex. If this is set, priority inheritance must be set.
MUTEX_NO_PRIO_INHERIT	(Priority none) Priority of the mutex or of tasks waiting for the mutex does not affect the priority of the task that locks the mutex.

Example

See `_mutatr_get_priority_ceiling()`.

2.1.193 `_mutatr_get_spin_limit`, `_mutatr_set_spin_limit`

<code>_mutatr_get_spin_limit()</code>	Gets the spin limit of the mutex attributes structure.
<code>_mutatr_set_spin_limit()</code>	Sets the spin limit of the mutex attributes structure.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutatr_get_spin_limit(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint *spin_count_ptr)

_mqx_uint _mutatr_set_spin_limit(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint spin_count)
```

Parameters

attr_ptr [IN] — Pointer to an initialized mutex attributes structure
spin_count_ptr [OUT] — Pointer to the current spin limit
spin_count [IN] — New spin limit

Returns

- MQX_EOK (success)
- MQX_EINVAL (failure: *attr_ptr* is NULL or points to an invalid attributes structure)

See Also

[_mutatr_init](#)

[_mutatr_get_wait_protocol](#), [_mutatr_set_wait_protocol](#)

[MUTEX_ATTR_STRUCT](#)

Description

Spin limit applies only to mutexes whose waiting policy is limited spin. Spin limit is the number of times that a task spins (is rescheduled) while it waits for the mutex.

Example

```
MUTEX_ATTR_STRUCT mutex_attributes;
_mqx_uint spin;
...
if (_mutatr_init(&mutex_attributes) != MQX_EOK) {
    result = _mutatr_set_wait_protocol(&mutex_attributes,
        MUTEX_LIMITED_SPIN);
    result = _mutatr_set_spin_limit(&mutex_attributes, 20);
    ...
}
```

```
result = _mutatr_get_spin_limit(&mutex_attributes, &spin);  
if (result == MQX_EOK) {  
    printf("\nSpin count is %ld", spin);  
    result = _mutex_init(&mutex, &mutex_attributes);  
}  
}
```

2.1.194 `_mutatr_get_wait_protocol`, `_mutatr_set_wait_protocol`

<code>_mutatr_get_wait_protocol()</code>	Gets the waiting policy of the mutex attributes structure.
<code>_mutatr_set_wait_protocol()</code>	Sets the waiting policy of the mutex attributes structure.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutatr_get_wait_protocol(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint               *waiting_protocol_ptr)

_mqx_uint _mutatr_set_wait_protocol(
    MUTEX_ATTR_STRUCT_PTR attr_ptr,
    _mqx_uint               waiting_protocol)
```

Parameters

attr_ptr [IN] — Pointer to an initialized mutex attributes structure
waiting_protocol_ptr [OUT] — Pointer to the current waiting protocol
waiting_protocol [IN] — New waiting protocol (see waiting protocols)

Returns

- MQX_EOK (success)
- MQX_EINVAL (failure: *attr_ptr* is NULL or points to an invalid attribute structure)

See Also

[`_mutatr_init`](#)

[`_mutatr_get_spin_limit`, `_mutatr_set_spin_limit`](#)

[`MUTEX_ATTR_STRUCT`](#)

2.1.194.1 Waiting protocols

Waiting Protocols	Description
MUTEX_SPIN_ONLY	If the mutex is already locked, MQX timeslices the task until another task unlocks the mutex
MUTEX_LIMITED_SPIN	If the mutex is already locked, MQX timeslices the task for a number of times before the lock attempt fails. If this is set, the spin limit should be set.
MUTEX_QUEUEING	If the mutex is already locked, MQX blocks the task until another task unlocks the mutex, at which time MQX gives the mutex to the first task that requested it.
MUTEX_PRIORITY_QUEUEING	If the mutex is already locked, MQX blocks the task until another task unlocks the mutex, at which time MQX gives the mutex to the highest-priority task that is waiting for it.

Example

See `_mutatr_get_spin_limit()`.

2.1.195 _mutatr_init

Initializes the mutex attributes structure to default values.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutatr_init(
    MUTEX_ATTR_STRUCT_PTR attr_ptr)
```

Parameters

attr_ptr [IN] — Pointer to the mutex attributes structure to initialize

Returns

- MQX_EOK (success)
- MQX_EINVAL (failure: *attr_ptr* is *NULL*)

See Also

[_mutex_init](#)

[_mutatr_destroy](#)

MUTEX_ATTR_STRUCT

Description

The function initializes the mutex attributes structure to default values and validates the structure. It must be called before a task can modify the values of the mutex attributes structure.

The function does not affect any mutexes already initialized with this structure.

Mutex attribute	Field in MUTEX_ATTR_STRUCT	Default value
Scheduling protocol	POLICY	MUTEX_NO_PRIO_INHERIT
—	VALID	TRUE
Priority	PRIORITY	0
Spin limit	COUNT	0
Waiting protocol	WAITING_POLICY	MUTEX_QUEUEING

Example

See [_mutatr_get_spin_limit\(\)](#).

2.1.196 **_mutex_create_component**

Creates the mutex component.

Prototype

```
source\kernel\mutex.c  
#include <mutex.h>  
_mqx_uint _mutex_create_component(void)
```

Parameters

None

Returns

- MQX_OK (success)
- MQX_OUT_OF_MEMORY (failure)

SeeAlso

[_mutex_init](#)

[_mutatr_init](#)

Description

MQX calls the function if the mutex component is not created when a task calls **_mutex_init()**.

2.1.197 _mutex_destroy

Deinitializes the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_destroy(
    MUTEX_STRUCT_PTR  mutex_ptr)
```

Parameters

mutex_ptr [IN] — Pointer to the mutex to be deinitialized

Returns

- MQX_EOK
- Errors

Error	Description
MQX_EINVAL	<i>mutex_ptr</i> does not point to a valid mutex (mutex is locked).
MQX_INVALID_COMPONENT_BASE	Mutex component data is not valid.
MQX_COMPONENT_DOES_NOT_EXIST	Mutex component is not created.

Traits

Puts in their ready queues all tasks that are waiting for the mutex; their call to `_mutex_lock()` returns MQX_EINVAL

See Also

[_mutex_init](#)

Description

To reuse the mutex, a task must reinitialize it.

2.1.198 `_mutex_get_priority_ceiling`, `_mutex_set_priority_ceiling`

<code>_mutex_get_priority_ceiling()</code>	Gets the priority of the mutex.
<code>_mutex_set_priority_ceiling()</code>	Sets the priority of the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_get_priority_ceiling(
    MUTEX_STRUCT_PTR  mutex_ptr,
    _mqx_uint          *priority_ptr)

_mqx_uint _mutex_set_priority_ceiling(
    MUTEX_STRUCT_PTR  mutex_ptr,
    _mqx_uint          priority,
    _mqx_uint          *old_priority_ptr)
```

Parameters

mutex_ptr [IN] — Pointer to the mutex
priority_ptr [OUT] — Pointer to the current priority
priority [IN] — New priority
old_priority_ptr [OUT] — Pointer to the previous priority

Returns

- MQX_EOK
- Errors

Errors

- MQX_EINVAL — One of the following:
 - *mutex_ptr* does not point to a valid mutex structure
 - *priority_ptr* is *NULL*

See Also

[_mutex_init](#)

Description

The functions operate on an initialized mutex; whereas, `_mutatr_get_priority_ceiling()` and `_mutatr_set_priority_ceiling()` operate on an initialized mutex attributes structure.

Example

```
MUTEX_STRUCT  mutex;
_mqx_uint     priority;

if (_mutex_set_priority_ceiling(&mutex, 6, &priority) == MQX_EOK){
    result = _mutex_get_priority_ceiling(&mutex, &priority);
    if (result == MQX_EOK) {
        printf("\nCurrent priority of mutex is %lx", priority);
    }
}
```

2.1.199 `_mutex_get_wait_count`

Gets the number of tasks that are waiting for the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_get_wait_count(
    MUTEX_STRUCT_PTR  mutex_ptr)
```

Parameters

mutex_ptr [IN] — Pointer to the mutex

Returns

- Number of tasks that are waiting for the mutex (success)
- MAX_MQX_UINT (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code to `MQX_EINVAL`

See Also

[_mutex_lock](#)

[_task_set_error](#)

2.1.200 `_mutex_init`

Initializes the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_init(
    MUTEX_STRUCT_PTR    mutex_ptr,
    MUTEX_ATTR_STRUCT_PTR attr_ptr)
```

Parameters

- mutex_ptr* [IN] — Pointer to the mutex to be initialized
- attr_ptr* [IN] — One of the following:
- pointer to an initialized mutex attributes structure
 - NULL (use default attributes as defined for `_mutatr_init()`)

Returns

- MQX_EOK
- Errors

Error	Description
MQX_EINVAL	One of the following: <ul style="list-style-type: none"><i>mutex_ptr</i> is <i>NULL</i><i>attr_ptr</i> is not initializeda value in <i>attr_ptr</i> is not correct
MQX_INVALID_COMPONENT_BASE	Mutex component data is not valid.

Traits

Creates the mutex component if it was not previously created

See Also

[_mutex_destroy](#)

[_mutatr_init](#)

Example

See `_mutatr_get_spin_limit()`.

2.1.201 `_mutex_lock`

Locks the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_lock(
    MUTEX_STRUCT_PTR  mutex_ptr)
```

Parameters

mutex_ptr [IN] — Pointer to the mutex to be locked

Returns

- MQX_EOK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_EBUSY	Mutex is already locked.
MQX_EDEADLK	Task already has the mutex locked.
MQX_EINVAL	One of the following: <ul style="list-style-type: none"> • <i>mutex_ptr</i> is <i>NULL</i> • mutex was destroyed

Traits

- Might block the calling task
- Cannot be called from an ISR

See Also

[_mutex_init](#)

[_mutex_try_lock](#)

[_mutex_unlock](#)

[_mutatr_init](#)

[_mutatr_get_wait_protocol, _mutatr_set_wait_protocol](#)

[_mutex_destroy](#)

Description

If the mutex is already locked, the task waits according to the waiting protocol of the mutex.

Example

```
MUTEX_STRUCT mutex;  
...  
result = _mutex_lock(&mutex);  
if (result == MQX_EOK) {  
    ...  
    result = _mutex_unlock(&mutex);  
}
```

2.1.202 _mutex_test

Tests the mutex component.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_test(
    void *mutex_error_ptr)
```

Parameters

mutex_error_ptr [OUT] — See description

Returns

See description

Traits

Disables and enables interrupts

See Also

[_mutex_create_component](#)

[_mutex_init](#)

Description

The function tests:

- mutex component data
- MQX queue of mutexes
- each mutex
- waiting queue of each mutex

Return value	Meaning	mutex_error_ptr
MQX_OK	No errors were found	NULL
MQX_CORRUPT_QUEUE	Queue of mutexes is not valid	Pointer to the invalid queue
MQX_EINVAL	One of: <ul style="list-style-type: none"> • a mutex is not valid • a mutex queue is not valid 	Pointer to the mutex with the error
MQX_INVALID_COMPONENT_BASE	Mutex component data is not valid	NULL

Example

```
void *mutex_ptr;  
...  
if (_mutex_test(&mutex_ptr) != MQX_EOK) {  
    printf("Mutex component failed test. Mutex 0x%lx is not valid.",  
        mutex_ptr);  
    _mqx_exit();  
}
```


2.1.203 `_mutex_try_lock`

Tries to lock the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint _mutex_try_lock(
    MUTEX_STRUCT_PTR  mutex_ptr)
```

Parameters

mutex_ptr [IN] — Pointer to the mutex

Returns

- MQX_EOK
- Errors

Error	Description
MQX_EBUSY	Mutex is currently locked.
MQX_EDEADLK	Task already has the mutex locked.
MQX_EINVAL	One of the following: <ul style="list-style-type: none"> • mutex_ptr is NULL • mutex has been destroyed

See Also

[_mutex_create_component](#)

[_mutex_init](#)

[_mutex_lock](#)

[_mutex_unlock](#)

[_mutatr_init](#)

Description

If the mutex is not currently locked, the task locks it. If the mutex is currently locked, the task continues to run; it does not block.

Example

```
MUTEX_STRUCT mutex;
...
result = _mutex_try_lock(&mutex);
if (result == MQX_EOK) {
    ...
    result = _mutex_unlock(&mutex);
}
```

2.1.204 __mutex_unlock

Unlocks the mutex.

Prototype

```
source\kernel\mutex.c
#include <mutex.h>
_mqx_uint __mutex_unlock(
    MUTEX_STRUCT_PTR  mutex_ptr)
```

Parameters

mutex_ptr [IN] — Pointer to the mutex

Returns

- MQX_EOK (success)
- MQX_EINVAL (failure: mutex_ptr does not point to a valid mutex)

Traits

Might put a task in the task's ready queue

See Also

[__mutex_create_component](#)

[__mutex_init](#)

[__mutex_lock](#)

[__mutex_try_lock](#)

[__mutatr_init](#)

Description

If tasks are waiting for the mutex, MQX removes the first one from the mutex queue and puts the task in the task's ready queue.

Example

See `__mutex_lock()`.

2.1.205 `_name_add`

Adds the name and its associated number to the names database.

Prototype

```
source\kernel\name.c
#include <name.h>
_mqx_uint _name_add(
    char      *name,
    _mqx_max_type number)
```

Parameters

name [IN] — Name to add

number [IN] — Number to be associated with the name

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_COMPONENT_BASE	Name component data is not valid.
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for the name component.
NAME_EXISTS	Name is already in the names database.
NAME_TABLE_FULL	Names database is full.
NAME_TOO_LONG	Name is longer than NAME_MAX_NAME_SIZE.
NAME_TOO_SHORT	Name is \0.

Traits

- Creates the name component with default values if it was not previously created
- Cannot be called from an ISR

See Also

[_name_create_component](#)

[_name_delete](#)

[_name_find](#)

Example

See `_name_create_component()`.

2.1.206 `_name_create_component`

Creates the name component.

Prototype

```
source\kernel\name.c
#include <name.h>
_mqx_uint _name_create_component(
    _mx_uint initial_number,
    _mx_uint grow_number,
    _mx_uint maximum_number)
```

Parameters

initial_number [IN] — Initial number of names that can be stored

grow_number [IN] — Number of the names to add if the initial number are stored

maximum_number [IN] — If *grow_number* is not 0; one of the following:

maximum number of names

0 (unlimited number)

Returns

Error	Description
MQX_OK	Success; one of: <ul style="list-style-type: none"> name component is created name component was already created
MQX_OUT_OF_MEMORY	Failure: MQX cannot allocate memory for the name component.

See Also

[`_name_add`](#)

[`_name_delete`](#)

[`_name_find`](#)

Description

If an application previously called the function and *maximum_number* is greater than what was specified, MQX changes the maximum number of names to *maximum_number*.

If an application does not explicitly create the name component, MQX does so with the following default values the first time that a task calls `_name_add()`.

Parameter	Default
<i>initial_number</i>	8
<i>grow_number</i>	8
<i>maximum_number</i>	0 (unlimited)

Example

```
_mqx_uint result;
...
/* Create name component with initially 5 names allowed, adding
** additional names in groups of 5, and limiting the total to 30:
*/
result = _name_create_component(5, 5, 30);
if (result != MQX_OK) {
    /* An error was found. */
    return result;
}
result = _name_add("TASK_A_Q", (_mqx_max_type)my_qid);
...
result = _name_find("TASK_A_Q", &value);
if (result == MQX_OK) {
    qid = (_queue_id)value;
}
...
result = _name_delete("TASK_A_Q");
```

2.1.207 `_name_delete`

Deletes the name and its associated number from the names database.

Prototype

```
source\kernel\name.c
#include <name.h>
_mqx_uint _name_delete(
    char *name)
```

Parameters

name [IN] — Name to delete

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_COMPONENT_DOES_NOT_EXIST	Name component is not created.
MQX_INVALID_COMPONENT_BASE	Name component data is not valid.
NAME_NOT_FOUND	Name is not in the names database.

Traits

Cannot be called from an ISR

See Also

[_name_add](#)

[_name_create_component](#)

[_name_find](#)

Example

See `_name_create_component()`.

2.1.208 `_name_find`

Gets the number that is associated with the name in the names database.

Prototype

```
source\kernel\name.c
#include <name.h>
_mqx_uint _name_find(
    char          *name,
    _mqx_max_type_ptr number_ptr)
```

Parameters

name [IN] — Pointer to the name for which to get the associated number

number_ptr [OUT] — Pointer to the number

Returns

- MQX_OK
- Errors

Error	Description
MQX_COMPONENT_DOES_NOT_EXIST	Name component is not created.
MQX_INVALID_COMPONENT_BASE	Name component data is not valid.
NAME_NOT_FOUND	Name is not in the names database.

See Also

[_name_add](#)

[_name_create_component](#)

[_name_delete](#)

Example

See `_name_create_component()`.

2.1.209 `_name_find_by_number`

Gets the name that is associated with the number in the names database.

Prototype

```
source\kernel\name.c
#include <name.h>
_mqx_uint _name_find_by_number(
    _mqx_max_type number,
    char          *name_ptr)
```

Parameters

number [IN] — Number for which to get the associated name

name_ptr [OUT] — Pointer to the name

Returns

- MQX_OK
- Errors

Error	Description
MQX_INVALID_COMPONENT_BASE	Name component data is not valid.
NAME_NOT_FOUND	Number is not in the names database.

See Also

[_name_add](#)

[_name_create_component](#)

[_name_delete](#)

Description

The function finds the first entry in the database that matches the number and returns its name.

2.1.210 `_name_test`

Tests name component.

Prototype

```
source\kernel\name.c
#include <name.h>
_mqx_uint _name_test(
    void *base_error_ptr,
    void *ext_error_ptr)
```

Parameters

base_error_ptr [OUT] — See description

ext_error_ptr [OUT] — See description

Returns

- MQX_OK
- See description

Traits

Disables and enables interrupts

See Also

[_name_add](#)

[_name_create_component](#)

[_name_delete](#)

Description

The function tests the data structures that are associated with the name component.

Return	<i>base_error_ptr</i>	<i>ext_error_ptr</i>
MQX_CORRUPT_QUEUE (Task queue that is associated with the name component is incorrect)	NULL	NULL
MQX_INVALID_COMPONENT_BASE (MQX found an error in a name component data structure)	Pointer to the name table that has an error	Pointer to the name table that has an error

Example

```
_mqx_uint    result;
void         *table_ptr;
```

```
void          *error_ptr;

result = _name_test(&table_ptr, &error_ptr);
if (result != MQX_OK) {
    /* Name component is not valid. */
}
```

2.1.211 `_partition_alloc`, `_partition_alloc_zero`

<code>_partition_alloc()</code>	Allocates a private partition block from the partition.
<code>_partition_alloc_zero()</code>	Allocates a zero-filled private partition block from the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
void *_partition_alloc(
    _partition_id partition_id)

void *_partition_alloc_zero(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition from which to allocate the partition block

Returns

- Pointer to the partition block (success)
- NULL (failure)

Task Error Codes

Task Error Codes	Description
PARTITION_BLOCK_INVALID_CHECKSUM	MQX found an incorrect checksum in the partition block header.
PARTITION_INVALID	<i>partition_id</i> does not represent a valid partition.
PARTITION_OUT_OF_BLOCKS	All the partition blocks in the partition are allocated (for static partitions only).
Task error code set by <code>_mem_alloc_system()</code>	MQX cannot allocate memory for the partition block (for dynamic partitions only).

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_partition_alloc_system](#), [_partition_alloc_system_zero](#)

[_partition_create](#)

[_task_set_error](#)

[_mem_alloc ...](#)

Description

The functions allocate a fixed-size memory block, which the task owns.

Example

Create a dynamic partition, allocate a private partition block, and then free the block.

```
#include <mqx.h>
#include <partition.h>

#define PACKET_SIZE      0x200
#define PACKET_COUNT     100

void part_function(void)
{
    _partition_id  packet_partition;
    void          *packet_ptr;

    /* Create a dynamic partition: */
    packet_partition = _partition_create(PACKET_SIZE, PACKET_COUNT,
        0, 0);
    ...
    /* Allocate a partition block: */
    packet_ptr = _partition_alloc(packet_partition);
    ...
    /* Free the partition block: */
    _partition_free(packet_ptr);
}
```

2.1.212 `_partition_alloc_system`, `_partition_alloc_system_zero`

<code>_partition_alloc_system()</code>	Allocates a system partition block from the partition.
<code>_partition_alloc_system_zero()</code>	Allocates a zero-filled system partition block from the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
void *_partition_alloc_system(
    _partition_id partition_id)

void *_partition_alloc_system_zero(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition from which to allocate the partition block

Returns

- Pointer to the partition block (success)
- NULL (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code as described for `_partition_alloc()`

See Also

[_partition_alloc](#), [_partition_alloc_zero](#)

[_partition_create](#)

[_task_set_error](#)

Description

The functions allocate a fixed-size block of memory that is not owned by any task.

2.1.213 `_partition_calculate_blocks`

Calculates the number of partition blocks in a static partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_calculate_blocks(
    _mem_size partition_size,
    _mem_size block_size)
```

Parameters

partition_size [IN] — Number of single-addressable units that the partition can occupy

block_size [IN] — Number of single-addressable units in one partition block of the partition

Returns

Number of partition blocks in the partition

See Also

[`_partition_calculate_size`](#)

[`_partition_create_at`](#)

Description

When a task creates a static partition (`_partition_create_at()`), it specifies the size of the partition and the size of partition blocks. The function `_partition_calculate_blocks()` calculates how many blocks MQX actually created, taking into account internal headers.

2.1.214 `_partition_calculate_size`

Calculates the number of single-addressable units in a partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mem_size _partition_calculate_size(
    _mqx_uint  number_of_blocks,
    _mem_size  block_size)
```

Parameters

number_of_blocks [IN] — Number of partition blocks in the partition

block_size [IN] — Number of single-addressable units in one partition block in the partition

Returns

Number of single-addressable units in the partition

See Also

[_partition_calculate_blocks](#)

[_partition_create](#)

[_partition_create_at](#)

Description

If an application wants to use as much as possible of some memory that is outside the default memory pool, it can use the function to determine the maximum number of blocks that can be created.

For a dynamic partition, the application might want to limit (based on the results of the function) the amount of memory in the default memory pool that it uses to create the partition.

2.1.215 `_partition_create`

Creates the partition in the default memory pool (a dynamic partition).

Prototype

```
source\kernel\partition.c
#include <partition.h>
_partition_id _partition_create(
    _mem_size  block_size,
    _mqx_uint  initial_blocks,
    _mqx_uint  grow_blocks,
    _mqx_uint  maximum_blocks)
```

Parameters

block_size [IN] — Number of single-addressable units in each partition block

initial_blocks [IN] — Initial number of blocks in the partition

grow_blocks [IN] — Number of blocks by which to grow the partition if all the partition blocks are allocated

maximum_blocks [IN] — If *grow_blocks* is not 0; one of:
 maximum number of blocks in the partition
 0 (unlimited growth)

Returns

- Partition ID (success)
- PARTITION_NULL_ID (failure)

Task Error Codes

- MQX_INVALID_PARAMETER — *block_size* is 0.
- Task error codes returned by [_mem_alloc ...](#)

Traits

- Creates the partition component if it were not previously created
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_partition_alloc](#), [_partition_alloc_zero](#)

[_partition_alloc_system](#), [_partition_alloc_system_zero](#)

[_partition_calculate_size](#)

[_partition_create_at](#)

[_partition_destroy](#)

[_task_set_error](#)

[_mem_alloc ...](#)

Description

The function creates a partition of fixed-size partition blocks in the default memory pool.

Example

See `_partition_alloc()`.

2.1.216 `_partition_create_at`

Creates the partition at the specific location outside the default memory pool (a static partition).

Prototype

```
source\kernel\partition.c
#include <partition.h>
_partition_id _partition_create_at(
    void          *partition_location,
    _mem_size     partition_size,
    _mem_size     block_size)
```

Parameters

partition_location [IN] — Pointer to the start of the partition
partition_size [IN] — Number of single-addressable units in the partition
block_size [IN] — Number of single-addressable units in each partition block in the partition

Returns

- Partition ID (success)
- PARTITION_NULL_ID (failure)

Task Error Codes

- MAX_INVALID_PARAMETER — One of the following:
 - *block_size* is 0
 - *partition_size* is too small

Traits

- Creates the partition component if it were not previously created
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_partition_alloc, _partition_alloc_zero](#)
[_partition_alloc_system, _partition_alloc_system_zero](#)
[_partition_calculate_size](#)
[_partition_create](#)
[_partition_extend](#)
[_task_set_error](#)

Example

```
#include <mqx.h>
#include <partition.h>

#define PART_SIZE      0x4000
```

```
#define PART_ADDR1    0x200000
#define PART_ADDR2    0x300000
#define PACKET_SIZE   100

void part_function(void)
{
    _partition_id  packet_partition;
    void           *packet_ptr;

    /* Create a static partition: */
    packet_partition =
        _partition_create_at(PART_ADDR1, PART_SIZE, PACKET_SIZE);
    ...
    /* Allocate a partition block: */
    packet_ptr = _partition_alloc(packet_partition);

    /* Extend the partition: */
    if (packet_ptr == NULL) {
        _partition_extend(packet_partition, PART_ADDR1, PART_SIZE);
        packet_ptr = _partition_alloc(packet_partition);
    }
    ...
    /* Free the partition block: */
    _partition_free(packet_ptr);
}
```

2.1.217 `_partition_create_component`

Creates the partition component.

Prototype

```
source\kernel\partition.c  
#include <partition.h>  
_mqx_uint _partition_create_component(void)
```

Parameters

None

Returns

- MQX_OK (success)
- Errors (failure)

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_OUT_OF_MEMORY	MQX is out of memory.

Traits

- Cannot be called from an ISR
- Might block the calling task

See Also

[`_partition_create`](#)

[`_partition_destroy`](#)

2.1.218 `_partition_destroy`

Destroys a partition that is in the default memory pool (a dynamic partition).

Prototype

```
source\kernel\partition.c
_mqx_uint _partition_destroy(
    _partition_id partition)
```

Parameters

partition_id [IN] — Partition ID of the partition to destroy

Returns

- MQX_OK
- Errors

Error	Description
Errors from <code>_mem_free()</code>	
MQX_INVALID_PARAMETER	<i>partition_id</i> is invalid.
PARTITION_ALL_BLOCKS_NOT_FREE	There are allocated partition blocks in the partition.
PARTITION_INVALID_TYPE	Partition is not a dynamic partition.

See Also

[_mem_free](#)

[_partition_create](#)

[_partition_free](#)

Description

If all the partition blocks in a dynamic partition are first freed, any task can destroy the partition.

2.1.219 `_partition_extend`

Adds partition blocks to the static partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_extend(
    _partition_id partition_id,
    void         *partition_location,
    _mem_size     partition_size)
```

Parameters

partition_id [IN] — Static partition to extend
partition_location [IN] — Pointer to the beginning of the memory to add
partition_size [IN] — Number of single-addressable units to add

Returns

- MQX_OK
- Errors

Error	Description
MQX_INVALID_PARAMETER	One of the following: <ul style="list-style-type: none"> • <i>partition_size</i> is 0 • <i>partition_id</i> does not represent a static partition
PARTITION_INVALID	<i>partition_id</i> does not represent a valid partition.

See Also

[_partition_create_at](#)

[_partition_alloc](#), [_partition_alloc_zero](#)

Description

The function extends a partition that was created with [_partition_create_at\(\)](#). Based on the size of the partition's partition blocks, the function divides the additional memory into partition blocks and adds them to the partition.

Example

See [_partition_create_at\(\)](#).

2.1.220 `_partition_free`

Frees the partition block and returns it to the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_free(
    void *mem_ptr)
```

Parameters

mem_ptr [IN] — Pointer to the partition block to free

Returns

- MQX_OK
- Errors

Error	Description
MQX_NOT_RESOURCE_OWNER	Task is not the one that owns the partition block.
PARTITION_BLOCK_INVALID_CHECKSUM	Checksum in the partition block header is not correct; the integrity of the partition is in question.
PARTITION_INVALID	<i>mem_ptr</i> is part of a partition that is not valid.

See Also

[`_partition_alloc`](#), [`_partition_alloc_zero`](#)

[`_partition_alloc_system`](#), [`_partition_alloc_system_zero`](#)

[`_partition_create`](#)

Description

If the partition block was allocated by:	It can be freed by:
<code>_partition_alloc()</code> or <code>_partition_alloc_zero()</code>	Task that allocated it
<code>_partition_alloc_system()</code> or <code>_partition_alloc_system_zero()</code>	Any task

Example

See `_partition_alloc()`.

2.1.221 `_partition_get_block_size`

Gets the size of the partition blocks in the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mem_size _partition_get_block_size(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition about which to get info

Returns

- Number of single-addressable units in a partition block (success)
- 0 (failure)

Task Error Codes

- PARTITION_INVALID — *partition_id* does not represent a valid partition.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_partition_get_free_blocks](#)

[_partition_get_max_used_blocks](#)

[_partition_get_total_blocks](#)

[_partition_get_total_size](#)

[_partition_create_at](#)

[_task_set_error](#)

Description

If the processor supports memory alignment, the function might return a value that is larger than what was specified when the partition was created.

Example

Print the attributes of a partition.

```
#include <mqx.h>
#include <partition.h>

void print_partition_info(_partition_id partition)
{
    printf("\nBlock size  %x",
        _partition_get_block_size(partition));
}
```



```
printf("\nFree blocks %x",
    _partition_get_free_blocks(partition));
printf("\nUsed blocks %x",
    _partition_get_max_used_blocks(partition));
printf("\nTotal blocks %x",
    _partition_get_total_blocks(partition));
printf("\nTotal size %x",
    _partition_get_total_size(partition));
}
```

2.1.222 `_partition_get_free_blocks`

Gets the number of free partition blocks in the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_get_free_blocks(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition for which to get info

Returns

- Number of free partition blocks (success)
- MAX_MQX_UINT (failure)

Task Error Codes

- PARTITION_INVALID — *partition_id* does not represent a valid partition.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_partition_get_block_size](#)

[_partition_get_max_used_blocks](#)

[_partition_get_total_blocks](#)

[_partition_get_total_size](#)

[_task_set_error](#)

Example

See `_partition_get_block_size()`.

2.1.223 `_partition_get_max_used_blocks`

Gets the number of allocated partition blocks in the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_get_max_used_blocks(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition for which to get info

Returns

- Number of allocated partition blocks (success)
- 0 (failure)

Task Error Codes

- PARTITION_INVALID — *partition_id* does not represent a valid partition.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error code)

See Also

[_partition_get_block_size](#)

[_partition_get_free_blocks](#)

[_partition_get_total_blocks](#)

[_partition_get_total_size](#)

[_task_set_error](#)

Example

See `_partition_get_block_size()`.

2.1.224 `_partition_get_total_blocks`

Gets the total number of partition blocks in the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_get_total_blocks(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition for which to get info

Returns

- Total number of partition blocks in the partition (success)
- 0 (failure)

Task Error Codes

- PARTITION_INVALID — *partition_id* does not represent a valid partition.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error code)

See Also

[_partition_get_block_size](#)

[_partition_get_free_blocks](#)

[_partition_get_max_used_blocks](#)

[_partition_get_total_size](#)

[_task_set_error](#)

Description

The function returns the sum of the number of free partition blocks and the number of allocated partition blocks in the partition.

Example

See `_partition_get_block_size()`.

2.1.225 `_partition_get_total_size`

Gets the size of the partition.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mem_size _partition_get_total_size(
    _partition_id partition_id)
```

Parameters

partition_id [IN] — Partition for which to get info

Returns

- Number of single-addressable units in the partition (success)
- 0 (failure)

Task Error Codes

- PARTITION_INVALID — *partition_id* does not represent a valid partition.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error code)

See Also

[_partition_get_block_size](#)

[_partition_get_free_blocks](#)

[_partition_get_max_used_blocks](#)

[_partition_get_total_blocks](#)

[_partition_extend](#)

[_task_set_error](#)

Description

The size of the partition includes extensions and internal overhead.

Example

See `_partition_get_block_size()`.

2.1.226 `_partition_test`

Tests all partitions.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_test(
    _partition_id *partpool_in_error,
    void *partpool_block_in_error,
    void *block_in_error)
```

Parameters

partpool_in_error [OUT] — Pointer to the partition pool in error (initialized only if an error is found)

partpool_block_in_error [OUT] — Pointer to the partition pool block in error (internal to MQX)

block_in_error [OUT] — Pointer to the partition block in error (initialized only if an error is found)

Returns

- MQX_OK (no partitions had errors)
- Errors

Error	Description
PARTITION_BLOCK_INVALID_CHECKSUM	MQX found a partition block with an incorrect checksum.
PARTITION_INVALID	MQX found an invalid partition.

Traits

Disables and enables interrupts

See Also

[_partition_alloc](#), [_partition_alloc_zero](#)

[_partition_alloc_system](#), [_partition_alloc_system_zero](#)

[_partition_create](#)

[_partition_free](#)

2.1.227 `_partition_transfer`

Transfers the ownership of the partition block.

Prototype

```
source\kernel\partition.c
#include <partition.h>
_mqx_uint _partition_transfer(
    void      *mem_ptr,
    _task_id  new_owner_id)
```

Parameters

mem_ptr [IN] — Pointer to the partition block to transfer

new_owner_id [IN] — Task ID of new owner

Returns

- MQX_OK
- See errors

Error	Description
PARTITION_BLOCK_INVALID_CHECKSUM	Checksum of the partition block header is not correct, which indicates that <i>mem_ptr</i> might not point to a valid partition block.
PARTITION_INVALID_TASK_ID	<i>task_id</i> is not valid.

See Also

[_partition_alloc](#), [_partition_alloc_zero](#)

[_partition_alloc_system](#), [_partition_alloc_system_zero](#)

Description

Any task can transfer the ownership of a private partition block or a system partition block.

If *new_owner_id* is the System Task ID, the partition block becomes a system partition block.

If the ownership of a system partition block is transferred to a task, the partition block becomes a resource of the task.

2.1.228 `_queue_dequeue`

Removes the first element from the queue.

Prototype

```
source\kernel\queue.c
QUEUE_ELEMENT_STRUCT_PTR _queue_dequeue(
    QUEUE_STRUCT_PTR    q_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue from which to remove the first element; initialized with `_queue_init()`

Returns

- Pointer to removed first queue element
- NULL (Queue is empty)

See Also

[_queue_enqueue](#)

[_queue_init](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

CAUTION

If *q_ptr* is not a pointer to **QUEUE_STRUCT**, the function might behave unpredictably.

Example

```
typedef struct my_queue_element_struct
{
    QUEUE_ELEMENT_STRUCT  HEADER;
    _mqx_uint              MY_DATA;
} MY_QUEUE_ELEMENT_STRUCT; * MY_QUEUE_ELEMENT_STRUCT_PTR;

MY_QUEUE_ELEMENT_STRUCT_PTR  element_ptr;
MY_QUEUE_ELEMENT_STRUCT      element1;
MY_QUEUE_ELEMENT_STRUCT      element2;
QUEUE_STRUCT                  my_queue;
_mqx_uint                     i;
_mqx_uint                     result;
...
_queue_init(&my_queue, 0);
result = _queue_enqueue(&my_queue,
    (QUEUE_ELEMENT_STRUCT_PTR)&element1);
result = _queue_enqueue(&my_queue,
    (QUEUE_ELEMENT_STRUCT_PTR)&element2);
```



```
...
/* Empty the queue: */
i = _queue_get_size(&my_queue);
while (i) {
    element_ptr =
        (MY_QUEUE_ELEMENT_STRUCT_PTR)_queue_dequeue(&my_queue);
    i--;
}
```

2.1.229 `_queue_enqueue`

Adds the element to the end of the queue.

Prototype

```
source\kernel\queue.c
bool _queue_enqueue(
    QUEUE_STRUCT_PTR    q_ptr,
    QUEUE_ELEMENT_STRUCT_PTR e_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue to which to add the element; initialized with `_queue_init()`
e_ptr [IN] — Pointer to the element to add

Returns

- TRUE (success)
- FALSE (failure: the queue is full)

See also

[_queue_init](#)

[_queue_dequeue](#)

[_queue_init](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

CAUTION

The function might behave unpredictably if either:

- *q_ptr* is not a pointer to **QUEUE_STRUCT**
- *e_ptr* is not a pointer to **QUEUE_ELEMENT_STRUCT**

Example

See `_queue_dequeue()`.

2.1.230 `_queue_get_size`

Gets the number of elements in the queue.

Prototype

```
source\kernel\queue.c  
_mqx_uint _queue_get_size(  
    QUEUE_STRUCT_PTR q_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue for which to get info; initialized with `_queue_init()`

Returns

Number of elements in the queue

See Also

[_queue_enqueue](#)

[_queue_init](#)

[QUEUE_STRUCT](#)

CAUTION

If *q_ptr* is not a pointer to `QUEUE_STRUCT`, the function might behave unpredictably.

Example

See `_queue_insert()`.

2.1.231 `_queue_head`

Gets a pointer to the element at the start of the queue, but do not remove the element.

Prototype

```
source\kernel\queue.c  
QUEUE_ELEMENT_STRUCT_PTR _queue_head(  
    QUEUE_STRUCT_PTR    q_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue to use; initialized with `_queue_init()`

Returns

- Pointer to the element that is at the start of the queue
- NULL (queue is empty)

See Also

[_queue_dequeue](#)

[_queue_init](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

CAUTION

If *q_ptr* is not a pointer to `QUEUE_STRUCT`, the function might behave unpredictably.

Example

See `_queue_insert()`.

2.1.232 _queue_init

Initializes the queue.

Prototype

```
source\kernel\queue.c  
void _queue_init(  
    QUEUE_STRUCT_PTR q_ptr,  
    uint16_t size)
```

Parameters

q_ptr [IN] — Pointer to the queue to initialize

size [IN] — One of the following:

maximum number of elements that the queue can hold

0 (unlimited number)

Returns

None

See Also

[_queue_enqueue](#)

[_queue_dequeue](#)

[QUEUE_STRUCT](#)

CAUTION

If *q_ptr* is not a pointer to **QUEUE_STRUCT**, the function might behave unpredictably.

Example

See [_queue_insert\(\)](#).

2.1.233 `_queue_insert`

Inserts the element in the queue.

Prototype

```
source\kernel\queue.c
bool _queue_insert(
    QUEUE_STRUCT_PTR      q_ptr,
    QUEUE_ELEMENT_STRUCT_PTR qe_ptr,
    QUEUE_ELEMENT_STRUCT_PTR e_ptr)
```

Parameters

- q_ptr* [IN] — Pointer to the queue to insert into; initialized with `_queue_init()`
- qe_ptr* [IN] — One of the following:
- pointer to the element after which to insert the new element
 - NULL (insert the element at the start of the queue)
- e_ptr* [IN] — Pointer to the element to insert

Returns

- TRUE (success)
- FALSE (failure: queue is full)

See Also

[_queue_init](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

CAUTION

The function might behave unpredictably if either:

- *q_ptr* is not a pointer to **QUEUE_STRUCT**
- *e_ptr* is not a pointer to **QUEUE_ELEMENT_STRUCT**

Example

Insert an element into a queue using a particular sorting algorithm.

```
typedef struct my_queue_element_struct
{
    QUEUE_ELEMENT_STRUCT  HEADER;
    _mqx_uint             MY_DATA;
} MY_QUEUE_ELEMENT_STRUCT, * MY_QUEUE_ELEMENT_STRUCT_PTR;

void my_queue_insert(MY_QUEUE_ELEMENT_STRUCT_PTR  connection_ptr)
{
    MY_QUEUE_ELEMENT_STRUCT_PTR  conn2_ptr;
    MY_QUEUE_ELEMENT_STRUCT_PTR  conn_prev_ptr;
```

```

QUEUE_STRUCT          queue;
QUEUE_STRUCT          *queue_ptr;
_mqx_uint             count;

queue_ptr = &queue;
_queue_init(queue_ptr, 0);

/* If the queue is empty, simply enqueue the element: */
if (_queue_is_empty(queue_ptr)) {
    _queue_enqueue(queue_ptr,
        (QUEUE_ELEMENT_STRUCT_PTR)connection_ptr);
    return;
}
/* Search the queue for the particular location to put
   the element: */
conn_prev_ptr =
    (MY_QUEUE_ELEMENT_STRUCT_PTR)_queue_head(queue_ptr);
conn2_ptr      =
    (MY_QUEUE_ELEMENT_STRUCT_PTR)_queue_next(queue_ptr,
        (QUEUE_ELEMENT_STRUCT_PTR)conn_prev_ptr);
count          = _queue_get_size(queue_ptr) + 1;
while (--count) {
    ...
    if (/* found the location, */) {
        break;
    }
    conn_prev_ptr = conn2_ptr;
    conn2_ptr      = _queue_next(queue_ptr,
        (QUEUE_ELEMENT_STRUCT_PTR)conn2_ptr);
}

_queue_insert(queue_ptr,
    (QUEUE_ELEMENT_STRUCT_PTR)conn_prev_ptr,
    (QUEUE_ELEMENT_STRUCT_PTR)connection_ptr);
...
}

```

2.1.234 `_queue_is_empty`

Determines whether the queue is empty.

Prototype

```
source\kernel\queue.c  
bool _queue_is_empty(  
    QUEUE_STRUCT_PTR  q_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue for which to get info; initialized with `_queue_init()`

Returns

- TRUE (queue is empty)
- FALSE (queue is not empty)

See Also

[_queue_init](#)

[QUEUE_STRUCT](#)

CAUTION

If *q_ptr* is not a pointer to `QUEUE_STRUCT`, the function might behave unpredictably.

Example

See `_queue_insert()`.

2.1.235 `_queue_next`

Gets a pointer to the element after this one in the queue, but do not remove the element.

Prototype

```
source\kernel\queue.c
QUEUE_ELEMENT_STRUCT_PTR _queue_next(
    QUEUE_STRUCT_PTR      q_ptr,
    QUEUE_ELEMENT_STRUCT_PTR e_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue for which to get info; initialized with `_queue_init()`
e_ptr [IN] — Get the element after this one

Returns

- Pointer to the next queue element (success)
- NULL (failure: see description)

See Also

[_queue_init](#)

[_queue_dequeue](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

CAUTION

The function might behave unpredictably if either:

- *q_ptr* is not a pointer to **QUEUE_STRUCT**
- *e_ptr* is not a pointer to **QUEUE_ELEMENT_STRUCT**

Description

The function returns *NULL* if either:

- *e_ptr* is *NULL*
- *e_ptr* is a pointer to the last element

Example

See `_queue_insert()`.

2.1.236 `_queue_test`

Tests the queue.

Prototype

```
source\kernel\queue.c
_mqx_uint _queue_test(
    QUEUE_STRUCT_PTR q_ptr,
    void *element_in_error_ptr)
```

Parameters

q_ptrm [IN] — Pointer to the queue to test; initialized with `_queue_init()`
element_in_error_ptr [OUT] — Pointer to the first element with an error (initialized only if an error is found)

Returns

- MQX_OK (no errors are found)
- MQX_CORRUPT_QUEUE (an error is found)

See Also

[_queue_init](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

Description

The function checks the queue pointers to ensure that they form a circular, doubly linked list, with the same number of elements that the queue header specifies.

Example

Test a mutex's queue.

```
result = _queue_test(&mutex_ptr->WAITING_TASKS, mutex_error_ptr);
if (result != MQX_OK) {
    /* An error occurred. */
    ...
}
```

2.1.237 `_queue_unlink`

Removes the element from the queue.

Prototype

```
source\kernel\queue.c
void _queue_unlink(
    QUEUE_STRUCT_PTR    q_ptr,
    QUEUE_ELEMENT_STRUCT_PTR e_ptr)
```

Parameters

q_ptr [IN] — Pointer to the queue from which to remove the element; initialized with `_queue_init()`

e_ptr [IN] — Pointer to the element to remove

Returns

None

See Also

[_queue_init](#)

[_queue_dequeue](#)

[QUEUE_STRUCT](#)

[QUEUE_ELEMENT_STRUCT](#)

CAUTION

The function might behave unpredictably if either:

- *q_ptr* is not a pointer to **QUEUE_STRUCT**
- *e_ptr* is not a pointer to **QUEUE_ELEMENT_STRUCT**

Example

Remove an element from its queue if processing for it is finished.

```
typedef struct my_queue_element_struct
{
    QUEUE_ELEMENT_STRUCT  HEADER;
    _mqx_uint             MY_DATA;
    bool                  FINISHED;
} MY_QUEUE_ELEMENT_STRUCT;

MY_QUEUE_ELEMENT_STRUCT element;
QUEUE_STRUCT            my_queue;

...

if (element.FINISHED) {
    _queue_unlink(&my_queue, (QUEUE_ELEMENT_STRUCT_PTR)&element);
}
```

2.1.238 `_sched_get_max_priority`

Gets the maximum priority that a task can be.

Prototype

```
source\kernel\sched.c  
_mqx_uint _sched_get_max_priority(  
    _mqx_uint policy)
```

Parameters

policy — Not used

Returns

0 (always)

See Also

[_sched_get_min_priority](#)

Description

POSIX compatibility requires the function and the parameter.

Example

```
_mqx_uint highest_priority;  
...  
highest_priority = _sched_get_max_priority(MQX_SCHED_RR);
```

2.1.239 `_sched_get_min_priority`

Gets the minimum priority that an application task can be.

Prototype

```
source\kernel\sched.c  
_mqx_uint _sched_get_min_priority(  
    _mqx_uint policy)
```

Parameters

policy — Not used

Returns

Minimum priority that an application task can be (the numerical value one less than the priority of Idle Task)

See also

[_sched_get_max_priority](#)

Description

POSIX compatibility requires the function and the parameter.

The minimum priority that a task can be is set when MQX starts; it is the priority of the lowest-priority task in the task template list.

Example

```
_mqx_uint minimum_task_priority;  
...  
minimum_task_priority = _sched_get_min_priority(MQX_SCHED_RR);
```

2.1.240 `_sched_get_policy`

Gets the scheduling policy.

Prototype

```
source\kernel\sched.c
_mqx_uint _sched_get_policy(
    _task_id      task_id,
    _mqx_uint     *policy_ptr)
```

Parameters

task_id [IN] — One of the following:

task on this processor for which to get info

MQX_DEFAULT_TASK_ID (get the policy for the processor)

MQX_NULL_TASK_ID (get the policy for the calling task)

policy_ptr [OUT] — Pointer to the scheduling policy (see scheduling policies)

Returns

- MQX_OK (success)
- MQX_SCHED_INVALID_TASK_ID (failure: task_id is not a valid task on this processor)

See also

[_sched_set_policy](#)

Scheduling Policies

- MQX_SCHED_FIFO — FIFO
- MQX_SCHED_RR — Round robin.

Example

Set the scheduling policy to round robin for the active task and verify the change.

```
_mqx_uint policy;
...
policy = _sched_set_policy(_task_get_id(), MQX_SCHED_RR);
...
result = _sched_get_policy(_task_get_id(), &policy);
```

2.1.241 `_sched_get_rr_interval`, `_sched_get_rr_interval_ticks`

Get the time slice in:	
<code>_sched_get_rr_interval()</code>	Milliseconds
<code>_sched_get_rr_interval_ticks()</code>	Tick time

Prototype

```
source\kernel\sched.c
uint32_t _sched_get_rr_interval(
    _task_id      task_id,
    uint32_t      *ms_ptr)

_mqx_uint _sched_get_rr_interval_ticks(
    _task_id      task_id,
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

task_id [IN] — One of the following:

task on this processor for which to get info

MQX_DEFAULT_TASK_ID (get the time slice for the processor)

MQX_NULL_TASK_ID (get the time slice for the calling task)

ms_ptr [OUT] — Pointer to the time slice (in milliseconds)

tick_time_ptr [OUT] — Pointer to the time slice (in tick time)

Returns

- MQX_OK (success)
- MAX_MQX_UINT (`_sched_get_rr_interval()` failure)
- See task error codes (`_sched_get_rr_interval_ticks()` failure)

Task Error Codes

- MQX_SCHED_INVALID_PARAMETER_PTR — *time_ptr* is *NULL*.
- MQX_SCHED_INVALID_TASK_ID — *task_id* is not a valid task on this processor.

Traits

On failure, calls `_task_set_error()` to set the task error codes (see task error codes)

See Also

[_sched_set_rr_interval](#), [_sched_set_rr_interval_ticks](#)

[_task_set_error](#)

Example

```
uint32_t time_slice;
...
result = _sched_get_rr_interval(_task_get_id(), &time_slice);
```

2.1.242 `_sched_set_policy`

Sets the scheduling policy.

Prototype

```
source\kernel\sched.c
_mqx_uint _sched_set_policy(
    _task_id task_id,
    _mqx_uint policy)
```

Parameters

task_id [IN] — One of the following:

task on this processor for which to set info

MQX_DEFAULT_TASK_ID (set the policy for the processor)

MQX_NULL_TASK_ID (set the policy for the calling task)

policy [IN] — New scheduling policy; one of the following:

MQX_SCHED_FIFO

MQX_SCHED_RR

Returns

- Previous scheduling policy (success)
- MAX_MQX_UINT (failure)

Task Error Codes

- MQX_SCHED_INVALID_POLICY — *policy* is not one of the allowed policies.
- MQX_SCHED_INVALID_TASK_ID — *task_id* is not a valid task on this processor.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_sched_get_policy](#)

[_task_set_error](#)

Example

See `_sched_get_policy()`.

2.1.243 `_sched_set_rr_interval, _sched_set_rr_interval_ticks`

Set the time slice in:	
<code>_sched_set_rr_interval()</code>	Milliseconds
<code>_sched_set_rr_interval_ticks()</code>	Tick time

Prototype

```
source\kernel\sched.c
uint32_t _sched_set_rr_interval(
    _task_id  task_id,
    uint32_t  ms_interval)

uint32_t _sched_set_rr_interval_ticks(
    _task_id  task_id,
    MQX_TICK_STRUCT_PTR  new_rr_interval_ptr,
    MQX_TICK_STRUCT_PTR  old_rr_interval_ptr)
```

Parameters

task_id [IN] — One of the following:

task ID for a task on this processor for which to set info

MQX_DEFAULT_TASK_ID (set the time slice for the processor)

MQX_NULL_TASK_ID (set the time slice for the calling task)

ms_interval [IN] — New time slice (in milliseconds)

new_rr_interval_ptr [IN] — Pointer to the new time slice (in tick time)

old_rr_interval_ptr [OUT] — Pointer to the previous time slice (in tick time)

Returns

- Previous time slice (success)
- MAX_MQX_UINT (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code to **MQX_SCHED_INVALID_TASK_ID**

See Also

[_sched_get_rr_interval, _sched_get_rr_interval_ticks](#)

[_task_set_error](#)

Example

Set the time slice to 50 milliseconds for the active task.

```
uint32_t result;
...
result = _sched_set_rr_interval(task_get_id(), 50);
```

2.1.244 `_sched_yield`

Puts the active task at the end of its ready queue.

Prototype

```
source\kernel\sched.c  
void _sched_yield(void)
```

Parameters

None

Returns

None

Traits

Might dispatch another task

Description

The function effectively performs a timeslice. If there are no other tasks in this ready queue, the task continues to be the active task.

Example

A task timeslices itself after a certain number of counts.

```
_mqx_uint counter = 0;  
...  
if (++counter == TIME_SLICE_COUNT) {  
    counter = 0;  
    _sched_yield();  
}
```

2.1.245 `_sem_close`

Closes the connection to the semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_close(
    void *sem_handle)
```

Parameters

sem_handle [IN] — Semaphore handle from `_sem_open()` or `_sem_open_fast()`

Returns

- MQX_OK
- Errors

Error	Description
Error code from <code>_mem_free()</code>	Task is not the one that opened the connection.
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
SEM_INVALID_SEMAPHORE_HANDLE	<ul style="list-style-type: none"> • <i>sem_handle</i> is not a valid semaphore connection • semaphore is no longer valid

Traits

- If the semaphore is strict, posts the appropriate number of times to the semaphore for this connection
- Might dispatch tasks that are waiting for the semaphore
- Cannot be called from an ISR

See Also

[_sem_destroy](#), [_sem_destroy_fast](#)

[_sem_open](#), [_sem_open_fast](#)

Example

See `_sem_open()`

2.1.246 `_sem_create`

Creates a named semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_create(
    char      *name,
    _mqx_uint  sem_count,
    _mqx_uint  flags)
```

Parameters

name [IN] — Name by which to identify the semaphore

sem_count [IN] — Number of requests that can concurrently have the semaphore

flags [IN] — Bit flags: 0 or as in description

Returns

- MQX_OK (success)
- Errors (failure)

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_COMPONENT_DOES_NOT_EXIST	Semaphore component was not created and cannot be created.
MQX_INVALID_COMPONENT_BASE	Semaphore component data is not valid.
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for the semaphore.
SEM_INCORRECT_INITIAL_COUNT	<i>sem_count</i> cannot be 0 if SEM_STRICT is set.
SEM_INVALID_POLICY	SEM_STRICT must be set if SEM_PRIORITY_INHERITANCE is set.
SEM_SEMAPHORE_EXISTS	Semaphore with the name exists.
SEM_SEMAPHORE_TABLE_FULL	Semaphore names database is full and cannot be expanded.

Traits

- Creates the semaphore component with default values if it were not previously created
- Cannot be called from an ISR
- On failure, calls `_task_set_error()` to set the task error code (see errors)

See Also[_sem_create_component](#)[_sem_destroy](#), [_sem_destroy_fast](#)[_sem_open](#), [_sem_open_fast](#)[_sem_close](#)[_task_set_error](#)**Description**

After the semaphore is created, tasks open a connection to it with [_sem_open\(\)](#) and close the connection with [_sem_close\(\)](#). A named semaphore is destroyed with [_sem_destroy\(\)](#).

Bit flag	Set	Not set
SEM_PRIORITY_INHERITANCE (SEM_STRICT must also be set)	If a task that waits for the semaphore has a higher priority than a task that owns the semaphore, MQX boosts the priority of one of the owning tasks to the priority of the waiting task. When the boosted task posts its semaphore, MQX returns its priorities to its original values.	MQX does not boost priorities
SEM_PRIORITY_QUEUEING	Task that waits for the semaphore is queued according to the task's priority. Within a priority, tasks are in FIFO order.	Task that waits for the semaphore is queued in FIFO order
SEM_STRICT	<ul style="list-style-type: none"> Task must wait for the semaphore before it can post the semaphore 	Task need not wait before posting
	<ul style="list-style-type: none"> <i>sem_count</i> must be greater than or equal to 1 	<i>sem_count</i> must be greater than or equal to 0

Example

See [_sem_create_component\(\)](#).

2.1.247 **_sem_create_component**

Creates the semaphore component.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_create_component(
    _mqx_uint  initial_number,
    _mqx_uint  grow_number,
    _mqx_uint  maximum_number)
```

Parameters

initial_number [IN] — Initial number of semaphores that can be created

grow_number [IN] — Number of semaphores to be added when the initial number have been created

maximum_number [IN] — If *grow_number* is not 0; one of:
 maximum number of semaphores that can be created
 0 (unlimited number)

Returns

- MQX_OK (success)
- MQX_OUT_OF_MEMORY (failure: MQX cannot allocate memory for semaphore component data)

Traits

On failure, the task error code might be set

See Also

[_sem_create](#)

[_sem_create_fast](#)

[_sem_open, _sem_open_fast](#)

[_task_set_error](#)

Description

If an application previously called the function and *maximum_number* is greater than what was specified, MQX changes the maximum number of semaphores to *maximum_number*.

If an application does not explicitly create the semaphore component, MQX does so with the following default values the first time that a task calls **_sem_create()** or **_sem_create_fast()**.

Parameter	Default
initial_number	8
grow_number	8
maximum_number	0 (unlimited)

Example

```

_mqx_uint result;
...
/* Create semaphore component: */
result = _sem_create_component(5, 5, 30);

if (result != MQX_OK) {
    /* An error occurred. */
}

/* Create a named semaphore of maximum count 1: */
result = _sem_create(".servo", 1, SEM_PRIORITY_QUEUEING);
if (result != MQX_OK) {
    /* An error occurred. */
}

/* Create a fast semaphore of maximum count 3: */
result = _sem_create_fast(SEM_DODAD, 3, SEM_PRIORITY_QUEUEING);
if (result != MQX_OK) {
    /* An error occurred. */
}

/* Use the semaphores. */

/* Destroy both semaphores: */
result = _sem_destroy("servo", TRUE);
if (result != MQX_OK) {
    /* An error occurred. */
}

result = _sem_destroy_fast(SEM_DODAD, TRUE);
if (result != MQX_OK) {
    /* An error occurred. */
}

```

2.1.248 **`_sem_create_fast`**

Creates the fast semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_create_fast(
    _mqx_uint  sem_index,
    _mqx_uint  initial_count,
    _mqx_uint  flags)
```

Parameters

sem_index [IN] — Number by which to identify the semaphore
initial_count [IN] — Number of tasks that can concurrently have the semaphore
flags [IN] — Bit flags, as described for **`_sem_create()`**

Returns

- MQX_OK
- Error, as described for **`_sem_create()`**

Traits

- Creates the semaphore component with default values if it was not previously created
- Cannot be called from an ISR
- On error, the task error code might be set

See Also

[**`_sem_create_component`**](#)

[**`_sem_destroy`**, \[**`_sem_destroy_fast`**\]\(#\)](#)

[**`_sem_open`**, \[**`_sem_open_fast`**\]\(#\)](#)

[**`_sem_close`**](#)

[**`_sem_create`**](#)

Description

After the semaphore is created, tasks open a connection to it with **`_sem_open_fast()`** and close the connection with **`_sem_close()`**. A fast semaphore is destroyed with **`_sem_destroy_fast()`**.

Example

See [**`_sem_create_component\(\)`**](#).

2.1.249 `_sem_destroy`, `_sem_destroy_fast`

`_sem_destroy()` Destroys the named semaphore.
`_sem_destroy_fast()` Destroys the fast semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_destroy(
    char      *name,
    bool      force_destroy)

_mqx_uint _sem_destroy_fast(
    _mx_uint  index,
    bool      force_destroy)
```

Parameters

name [IN] — Name of the semaphore to destroy, created using `_sem_create()`
force_destroy [IN] — See description
index [IN] — Number that identifies the semaphore to destroy, created using `_sem_create_fast()`

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_COMPONENT_DOES_NOT_EXIST	Semaphore component is not created.
MQX_INVALID_COMPONENT_BASE	Semaphore component data is not valid.
SEM_INVALID_SEMAPHORE	Semaphore data that is associated with <i>name</i> or <i>index</i> is not valid.
SEM_SEMAPHORE_NOT_FOUND	<i>name</i> or <i>index</i> is not in the semaphore names database.

Traits

Cannot be called from an ISR

See Also

[_sem_close](#)

[_sem_create](#)

[_sem_create_fast](#)

Description

<i>force_destroy</i> is <i>TRUE</i>	<i>force_destroy</i> is <i>FALSE</i>
<ul style="list-style-type: none">• Tasks that are waiting for the semaphore are readied.• Semaphore is destroyed after all the owners post the semaphore.	<ul style="list-style-type: none">• Semaphore is destroyed after the last waiting task gets and posts the semaphore.• This is the action if the semaphore is strict.

Example

See `_sem_create_component()`.

2.1.250 `_sem_get_value`

Gets the value of the semaphore counter; that is, the number of subsequent requests that can get the semaphore without waiting.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_get_value(
    void *users_sem_handle)
```

Parameters

users_sem_handle [IN] — Semaphore handle from `_sem_open()` or `_sem_open_fast()`

Returns

- Current value of the semaphore counter (success)
- MAX_MQX_UINT (failure)

Task Error Codes

Task Error Code	Description
SEM_INVALID_SEMAPHORE	<i>sem_ptr</i> does not point to a valid semaphore.
SEM_INVALID_SEMAPHORE_HANDLE	<i>sem_ptr</i> is not a valid semaphore handle.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_sem_open](#), [_sem_open_fast](#)

[_sem_post](#)

[_sem_get_wait_count](#)

[_sem_wait ...](#)

[_task_set_error](#)

2.1.251 **_sem_get_wait_count**

Gets the number of tasks that are waiting for the semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_get_wait_count(
    void *sem_handle)
```

Parameters

sem_handle [IN] — Semaphore handle from **_sem_open()** or **_sem_open_fast()**

Returns

- Number of tasks waiting for the semaphore (success)
- MAX_MQX_UINT (failure)

Traits

On failure, calls **_task_set_error()** to set the task error code as for **_sem_get_value()**

See Also

[_sem_open](#), [_sem_open_fast](#)

[_sem_post](#)

[_sem_get_value](#)

[_sem_wait ...](#)

[_task_set_error](#)

2.1.252 `_sem_open`, `_sem_open_fast`

`_sem_open()` Opens a connection to the named semaphore.
`_sem_open_fast()` Opens a connection to the fast semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_open(
    char *name,
    void *sem_handle)

_mqx_uint _sem_open_fast(
    _mqx_uint index,
    void *sem_handle)
```

Parameters

name [IN] — Name that identifies the semaphore that was created using `_sem_create()`
sem_handle [OUT] — Pointer to the semaphore handle, which is a connection to the semaphore
index [IN] — Number that identifies the semaphore that was created using `_sem_create_fast()`

Returns

- MQX_OK
- Errors

Error	Description
MQX_COMPONENT_DOES_NOT_EXIST	Semaphore component is not created.
MQX_INVALID_COMPONENT_BASE	Semaphore component data is not valid.
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for the connection.
SEM_INVALID_SEMAPHORE	Data that is associated with the semaphore is not valid.
SEM_SEMAPHORE_DELETED	Semaphore is in the process of being destroyed.
SEM_SEMAPHORE_NOT_FOUND	<i>name</i> is not in the semaphore names database.

See also

[_sem_close](#)

[_sem_create](#)

[_sem_post](#)

[_sem_wait ...](#)

Example

TaskA(void)

```

{
    void *sem_handle;
    _mqx_uint result;

    /* Create a semaphore of maximum count 1: */
    result = _sem_create("phaser", 1, SEM_PRIORITY_QUEUEING);
    if (result == MQX_OK) {
        result = _sem_open("three", &sem_handle);
    }

    while (result != MQX_OK) {
        /* Wait for the semaphore: */
        result = _sem_wait(sem_handle, timeout);
        if (result == MQX_OK) {
            /* Perform work. */
            result = _sem_post(sem_handle);
        }
    }
    /* An error occurred. */
    _sem_close(sem_handle);
}

TaskB(void)
{
    void *sem_handle;
    _mqx_uint result;

    result = _sem_open("three", &sem_handle);
    while (result != MQX_OK) {
        /* Wait for the semaphore: */
        result = _sem_wait(sem_handle, timeout);
        if (result == MQX_OK) {
            /* Perform other work. */
            result = _sem_post(sem_handle);
        }
    }
    /* An error occurred. */
    _sem_close(sem_handle);
}

```

2.1.253 `_sem_post`

Posts the semaphore.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_post(
    void *sem_handle)
```

Parameters

sem_handle [IN] — Semaphore handle from `_sem_open()` or `_sem_open_fast()`

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
SEM_CANNOT_POST	Semaphore is strict and the task has not first waited for the semaphore.
SEM_INVALID_SEMAPHORE	<i>sem_handle</i> represents a semaphore that is no longer valid.
SEM_INVALID_SEMAPHORE_COUNT	Semaphore data is corrupted.
SEM_INVALID_SEMAPHORE_HANDLE	One of the following: <ul style="list-style-type: none"> • <i>sem_handle</i> is not a valid semaphore handle • semaphore is strict and <i>sem_handle</i> was obtained by another task

Traits

- Might put a task in its ready queue
- For a strict semaphore, cannot be called from an ISR (ISR can call the function for a non-strict semaphore)

See Also

[_sem_open, _sem_open_fast](#)

[_sem_get_wait_count](#)

[_sem_get_value](#)

[_sem_wait ...](#)

Description

MQX gives the semaphore to the first waiting task and puts the task in the task's ready queue.

Example

See [_sem_open](#), [_sem_open_fast](#).

2.1.254 `_sem_test`

Tests the semaphore component.

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_test(
    void *sem_error_ptr)
```

Parameters

sem_error_ptr [OUT] — Pointer to the semaphore that has an error (*NULL* if no errors are found)

Returns

- MQX_OK (no errors are found)
- See errors (an error is found)

Error	MQX found an error in:
MQX_CORRUPT_QUEUE	A semaphore queue
MQX_INVALID_COMPONENT_BASE	Semaphore component data
SEM_INVALID_SEMAPHORE	Semaphore data

Traits

Disables and enables interrupts

See Also

[_sem_close](#)

[_sem_create](#)

[_sem_create_fast](#)

[_sem_open, _sem_open_fast](#)

[_sem_post](#)

[_sem_wait ...](#)

Description

The function does the following:

- verifies semaphore component data
- verifies the integrity of the entries in the semaphore names database
- for each semaphore, checks:
 - validity of data (**VALID** field)
 - integrity of the queue of waiting tasks
 - integrity of the queue of tasks that have the semaphore

2.1.255 `_sem_wait ...`

Wait for the semaphore:	
<code>_sem_wait()</code>	For the number of milliseconds
<code>_sem_wait_for()</code>	For the number of ticks (in tick time)
<code>_sem_wait_ticks()</code>	For the number of ticks
<code>_sem_wait_until()</code>	Until the specified time (in tick time)

Prototype

```
source\kernel\sem.c
#include <sem.h>
_mqx_uint _sem_wait(
    void      *sem_handle,
    uint32_t  ms_timeout)

_mqx_uint _sem_wait_for(
    void      *sem_handle,
    MQX_TICK_STRUCT_PTR  tick_time_timeout_ptr)

_mqx_uint _sem_wait_ticks(
    void      *sem_handle,
    _mqx_uint  tick_timeout)

_mqx_uint _sem_wait_until(
    void      *sem_handle,
    MQX_TICK_STRUCT_PTR  tick_time_ptr)
```

Parameters

sem_handle [IN] — Semaphore handle from `_sem_open()` or `_sem_open_fast()`

ms_timeout [IN] — One of the following:

maximum number of milliseconds to wait for the semaphore. After the timeout elapses without the semaphore signalled, the function returns.

0 (unlimited wait)

tick_time_timeout_ptr [IN] — One of the following:

pointer to the maximum number of ticks to wait

NULL (unlimited wait)

tick_timeout [IN] — One of the following:

maximum number of ticks to wait

0 (unlimited wait)

tick_time_ptr [IN] — One of the following:

pointer to the time (in tick time) until which to wait

NULL (unlimited wait)

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_EDEADLK	Function was aborted to prevent deadlock: the task has all the semaphore locks and, since the semaphore is strict, the task cannot post to “wake” itself.
SEM_INVALID_SEMAPHORE	<i>sem_handle</i> is for a semaphore that is no longer valid.
SEM_INVALID_SEMAPHORE_HANDLE	One of the following: <ul style="list-style-type: none"> • <i>sem_handle</i> is not a valid semaphore handle • <i>sem_handle</i> was obtained by another task
SEM_SEMAPHORE_DELETED	MQX is in the process of destroying the semaphore.
SEM_WAIT_TIMEOUT	Timeout expired before the task can get the semaphore.

Traits

- Might block the calling task
- Cannot be called from an ISR

See Also

[_sem_open](#), [_sem_open_fast](#)

[_sem_post](#)

[_sem_get_wait_count](#)

[_sem_get_value](#)

[_sem_create](#)

[_sem_create_fast](#)

[MQX_TICK_STRUCT](#)

Description

If the task cannot get the semaphore, MQX queues the task according to the semaphore’s queuing policy, which is set when the semaphore is created.

Example

See [_sem_open](#), [_sem_open_fast](#).

2.1.256 `_str_mqx_uint_to_hex_string`

Converts the `_mqx_uint` value to a hexadecimal string.

Prototype

```
source\string\str_utos.c  
void _str_mqx_uint_to_hex_string(  
    _mqx_uint  number  
    char       *string_ptr)
```

Parameters

number [IN] — Number to convert

string_ptr [OUT] — Pointer to the hexadecimal string equivalent of number

Returns

None

See Also

[_strlen](#)

2.1.257 `_strnlen`

Gets the length of the length-limited string.

Prototype

```
source\string\strnlen.c
_mqx_uint _strnlen(
    char      *string_ptr
    _mx_uint  max_length)
```

Parameters

string_ptr [IN] — Pointer to the string

max_length [OUT] — Maximum number characters in the string

Returns

Number of characters in the string

See Also

[_str_mqx_uint_to_hex_string](#)

2.1.258 `_task_abort`

Makes a task run its task exit handler and then destroys itself.

Prototype

```
source\kernel\task.c
_mqx_uint _task_abort(
    _task_id task_id)
```

Parameters

task_id [IN] — One of the following:
 task ID of the task to be destroyed
MQX_NULL_TASK_ID (abort the calling task)

Returns

- **MQX_OK** (success)
- **MQX_INVALID_TASK_ID** (failure: *task_id* does not represent a valid task)

See Also

[_task_destroy](#)

[_task_get_exit_handler](#), [_task_set_exit_handler](#)

Example

Task B creates Task A and later aborts it.

```
#include <mqx.h>

void Exit_Handler(void)
{
    printf("Task %x has aborted\n", _task_get_id());
}

void TaskA(uint32_t param)
{
    _task_set_exit_handler(_task_get_id(), Exit_Handler);
    while (TRUE) {
        ...
        _sched_yield();
    }
}

void TaskB(uint32_t param)
{
    _task_id taska_id;

    taska_id = _task_create(0, TASKA, 0);
    ...

    _task_abort(taska_id);
}
```

2.1.259 `_task_block`

Blocks the active task.

Prototype

```
source\psp\cpu_family\dispatch.assembler  
void _task_block(void)
```

Parameters

None

Returns

None

Traits

Dispatches another task

See also

[_task_ready](#)

[_task_restart](#)

Description

The function removes the active task from the task's ready queue and sets the **BLOCKED** bit in the **STATE** field of the task descriptor.

The task does not run again until another task explicitly makes it ready with `_task_ready()`.

Example

See `_task_ready()`.

2.1.260 `_task_check_stack`

Determines whether the stack for the active task is currently out of bounds.

Prototype

```
source\kernel\task.c  
bool _task_check_stack(void)
```

Parameters

None

Returns

- TRUE (stack is out of bounds)
- FALSE (stack is not out of bounds)

See Also

[_task_set_error](#)

Description

The function indicates whether the stack is currently past its limit. The function does not indicate whether the stack previously passed its limit.

2.1.261 `_task_create`, `_task_create_blocked`, `_task_create_at`

<code>_task_create()</code>	Creates the task and make it ready
<code>_task_create_blocked()</code>	Creates the task, but do not make it ready
<code>_task_create_at()</code>	Creates the task with the stack location specified

Prototype

```
source\kernel\task.c
_task_id _task_create(
    _processor_number  processor_number,
    _mqx_uint          template_index,
    uint32_t           parameter)

_task_id _task_create_blocked(
    _processor_number  processor_number,
    _mqx_uint          template_index,
    uint32_t           parameter)

_task_id _task_create_at(
    _processor_number  processor_number,
    _mqx_uint          template_index,
    uint32_t           parameter,
    void               *stack_ptr,
    _mem_size          stack_size)
```

Parameters

processor_number [IN] — One of the following:

processor number of the processor where the task is to be created
 0 (create on the local processor)

template_index [IN] — One of the following:

index of the task template in the processor's task template list to use for the child task
 0 (use the task template that *create_parameter* defines)

parameter [IN]

template_index is not 0 — pointer to the parameter that MQX passes to the child task
template_index is 0 — pointer to the task template

stack_ptr [IN] — The location where the stack and TD are to be created.

stack_size [IN] — The size of the stack.

Returns

- Task ID of the child task (success)
- MQX_NULL_TASK_ID (failure)

Task Error Codes

Task Error Code	Description
MQX_INVALID_PROCESSOR_NUMBER	<i>processor_number</i> is not one of the allowed processor numbers.
MQX_NO_TASK_TEMPLATE	<i>template_index</i> is not in the task template list.
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for the task data structures.

Traits

- If the child is on another processor, blocks the creator until the child is created
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)
- For `_task_create()`:
 - If the child is on the same processor, preempts the creator if the child is a higher priority

See Also

[_task_abort](#)

[_task_block](#)

[_task_destroy](#)

[_task_get_parameter ..., _task_set_parameter ...](#)

[_task_ready](#)

[_task_set_error](#)

[MQX_INITIALIZATION_STRUCT](#)

[TASK_TEMPLATE_STRUCT](#)

Example

Create an instance of Receiver task.

```
#define RECEIVER_TEMPLATE (0x100)

result = _task_create(0, RECEIVER_TEMPLATE, 0);

if (result == MQX_NULL_TASK_ID) {
    printf("\nCould not create receiver task.");
} else {
    /* Task with a task ID equal to result was created */
    ...
}
```

2.1.262 `_task_destroy`

Destroys the task.

Prototype

```
source\kernel\task.c
_mqx_uint _task_destroy(
    _task_id task_id)
```

Parameters

task_id [IN] — One of the following:

task ID of the task to be destroyed

MQX_NULL_TASK_ID (destroy the calling task)

Returns

- **MQX_OK**
- **MQX_INVALID_TASK_ID**

Traits

- If the task being destroyed is remote, blocks the calling task until the task is destroyed
- If the task being destroyed is local, does not block the calling task
- If the task being destroyed is the active task, blocks it

See Also

[`_task_create`](#), [`_task_create_blocked`](#), [`_task_create_at`](#)

[`_task_get_creator`](#)

[`_task_get_id`](#)

[`_task_abort`](#)

Description

The function does the following for the task being destroyed:

- frees memory resources that the task allocated with functions from the **_mem** and **_partition** families
- closes all queues that the task owns and frees all the queue elements
- frees any other component resources that the task owns

Example

If the second task cannot be created, destroy the first task.

```
_task_id first_born;
_task_id second_born;

first_born = _task_create(PROCESSOR_ONE, FIRST, CHANNEL_1);
if (first_born == 0) {
    ...
}
```

```
} else if ((second_born = _task_create(PROCESSOR_TWO, SECOND,  
    BACKUP_CHANNEL)) == 0) {  
    _task_destroy(first_born);  
} else {  
    ...  
}
```

2.1.263 `_task_disable_fp`, `_task_enable_fp`

`_task_disable_fp()` Disables floating-point context switching for the active task if the task is a floating-point task.
`_task_enable_fp()` Enables floating-point context switching for the active task.

Prototype

```
source\kernel\task.c
void _task_disable_fp(void)

void _task_enable_fp(void)
```

Traits

Changes context information that MQX stores

Description

Function	When MQX performs a context switch, floating-point registers are saved and restored?
<code>_task_disable_fp()</code>	No
<code>_task_enable_fp()</code>	Yes

Example

Task is about to do some floating-point work, so change the type of context switch.

```
_task_enable_fp();
/* Start floating-point math. */
...
/* Floating-point math is complete. */
_task_disable_fp();
```

2.1.264 `_task_errno`

Gets the task error code for the active task.

Prototype

```
source\include\mqx.h  
#define _task_errno  (*_task_get_error_ptr())
```

See Also

[_task_get_error](#), [_task_get_error_ptr](#)

[_task_set_error](#)

Description

MQX provides the variable for POSIX compatibility.

`_task_errno` gives the same value as `_task_get_error()`.

Example

Print the task error code of the active task.

```
void *event_ptr;  
_mqx_uint task_wait_count;  
...  
if (_event_open("global", &event_ptr) == MQX_OK) {  
    ...  
    if (_event_get_wait_count(event_ptr) == MAX_MQX_UINT) {  
        printf("\nTask error code is 0x%lx", _task_errno);  
    }  
}
```

2.1.265 `_task_get_creator`

Gets the task ID of the task that created the calling task.

Prototype

```
source\kernel\task.c  
_task_id _task_get_creator(void)
```

Parameters

None

Returns

Task ID of the parent task

See Also

[_task_get_processor](#)

[_task_get_id](#)

2.1.266 `_task_get_environment`, `_task_set_environment`

<code>_task_get_environment()</code>	Gets a pointer to the application-specific environment data for the task.
<code>_task_set_environment()</code>	Sets the address of the application-specific environment data for the task.

Prototype

```
source\kernel\task.c
void *_task_get_environment(
    _task_id task_id)

void *_task_set_environment(
    _task_id task_id,
    void      *environment_ptr)
```

Parameters

task_id [IN] — Task ID of the task whose environment data is to be set or obtained
environment_ptr [IN] — Pointer to the environment data

Returns

- (Get) Environment data (success)
- (Set) Previous environment data (success)
- NULL (failure)

Traits

On failure, calls `_task_set_error()` to set the task error code to `MQX_INVALID_TASK_ID`

See Also

[_task_get_parameter ..., _task_set_parameter ...](#)
[_task_set_error](#)

Example

Check the environment data for the active task.

```
if (_task_get_environment(_task_get_id())) {
    /* Environment data has been set; don't reset it. */
} else {
    _task_set_environment(_task_get_id(), context_ptr);
}
```


2.1.267 `_task_get_error`, `_task_get_error_ptr`

`_task_get_error()` Gets the task error code
`_task_get_error_ptr()` Gets a pointer to the task error code.

Prototype

```
source\kernel\task.c
_mqx_uint  _task_get_error(void)

_mqx_uint *_task_get_error_ptr(void)
```

Parameters

None

Returns

- `_task_get_error()` — Task error code for the active task
- `_task_get_error_ptr()` — Pointer to the task error code

See Also

[_task_set_error](#)

[_task_errno](#)

Description

CAUTION

If a task writes to the pointer that `_task_get_error_ptr()` returns, the task error code is changed to the value, overwriting any previous error code. To avoid overwriting a previous error code, a task should use `_task_set_error()`.

Example

Get the task error code and reset it if required.

```
if (_task_get_error() == MSGQ_QUEUE_FULL){
    _task_set_error(MQX_OK);
}
```

2.1.268 `_task_get_exception_handler`, `_task_set_exception_handler`

`_task_get_exception_handler()` Gets a pointer to the task exception handler.
`_task_set_exception_handler()` Sets the address of the task exception handler.

Prototype

```
source\kernel\task.c
TASK_EXCEPTION_FPTR _task_get_exception_handler(
    _task_id task_id)

TASK_EXCEPTION_FPTR _task_set_exception_handler(
    _task_id task_id,
    TASK_EXCEPTION_FPTR handler_address)
```

Parameters

task_id [IN] — Task ID of the task whose exception handler is to be set or obtained
handler_address [IN] — Pointer to the task exception handler

Returns

- `_task_get_exception_handler()` — Pointer to the task exception handler for the task (might be NULL) (success)
- `_task_set_exception_handler()` — Pointer to the previous task exception handler (might be NULL) (success)
- NULL (failure: *task_id* is not valid)

Traits

On failure, calls `_task_set_error()` to set the task error code to **MQX_INVALID_TASK_ID**

See also

[_task_get_exit_handler](#), [_task_set_exit_handler](#)

[_int_exception_isr](#)

[_task_set_error](#)

2.1.269 `_task_get_exit_handler`, `_task_set_exit_handler`

`_task_get_exit_handler()` Gets a pointer to the task exit handler for the task.
`_task_set_exit_handler()` Sets the address of the task exit handler for the task.

Prototype

```
source\kernel\task.c
TASK_EXIT_FPTR _task_get_exit_handler(
    _task_id task_id)(void)

TASK_EXIT_FPTR _task_set_exit_handler(
    _task_id task_id,
    TASK_EXIT_FPTR exit_handler_address)
```

Parameters

task_id [IN] — Task ID of the task whose exit handler is to be set or obtained
exit_handler_address [IN] — Pointer to the exit handler for the task

Returns

- `_task_get_exit_handler()` — Pointer to the exit handler (might be NULL) (success)
- `_task_set_exit_handler()` — Pointer to the previous exit handler (might be NULL) (success)
- NULL (failure: *task_id* is not valid)

Traits

On failure, calls `_task_set_error()` to set the task error code to **MQX_INVALID_TASK_ID**

See Also

[_mqx_exit](#)
[_task_get_exception_handler](#), [_task_set_exception_handler](#)
[_task_abort](#)
[_task_set_error](#)

Description

MQX calls a task's task exit handler if either of these conditions is true:

- task is terminated with `_task_abort()`
- task returns from its function body (for example, if it calls `_mqx_exit()`)

Example

See `_task_abort()`.

2.1.270 `_task_get_id`

Gets the task ID of the active task.

Prototype

```
source\kernel\task.c  
_task_id _task_get_id(void)
```

Returns

Task ID of the active task

See also

[_task_get_creator](#)

[_task_get_processor](#)

[_task_get_id_from_name](#)

Example

See `_task_ready()`.

2.1.271 `_task_get_id_from_name`

Gets the task ID that is associated with the task name.

Prototype

```
source\kernel\task.c
_task_id _task_get_id_from_name(
    char *name_ptr)
```

Parameters

name_ptr [IN] — Pointer to the name to find in the task template list

Returns

- Task ID that is associated with the first match of *name_ptr* (success)
- MQX_NULL_TASK_ID (failure: name is not in the task template list)

See Also

[_task_get_creator](#)

[_task_get_processor](#)

[_task_get_id](#)

[TASK_TEMPLATE_STRUCT](#)

Example

Check whether a particular task has been created and, if it has not, create it.

```
task_id = _task_get_id_from_name("TestTask");
if (task_id == MQX_NULL_TASK_ID) {
    /* Create the task: */
    _task_create(0, _task_get_template_index("TestTask"), 0);
}
```

2.1.272 `_task_get_index_from_id`

Gets the task template index for the task ID.

Prototype

```
source\kernel\task.c  
_mqx_uint _task_get_index_from_id(  
    _task_id task_id)
```

Parameters

task_id [IN] — Value to set the task parameter to

Returns

- task template index (success)
- 0 (failure: task ID was not found)

See Also

[_task_get_template_index](#)

2.1.273 `_task_get_parameter ...`, `_task_set_parameter ...`

<code>_task_get_parameter()</code>	Gets the task creation parameter of the active task.
<code>_task_get_parameter_for()</code>	Gets the task creation parameter of the specified task
<code>_task_set_parameter()</code>	Sets the task creation parameter of the active task.
<code>_task_set_parameter_for()</code>	Sets the task creation parameter of the specified task.

Prototype

```
source\kernel\task.c
uint32_t _task_get_parameter(void)

uint32_t _task_get_parameter_for(
    task_id task_id)

uint32_t _task_set_parameter(
    uint32_t new_value)

uint32_t _task_set_parameter_for(
    uint32_t new_value,
    task_id task_id)
```

Parameters

new_value [IN] — Value to set the task parameter to
task_id [IN] — Task ID of the task to get or set

Returns

- `_task_get_parameter()`, `_task_get_parameter_for()` — Creation parameter (might be NULL)
- `_task_set_parameter()`, `_task_set_parameter_for()` — Previous creation parameter (might be NULL)

See Also

[_task_create](#), [_task_create_blocked](#), [_task_create_at](#)

Description

If a deeply nested function needs the task creation parameter, it can get the parameter with `_task_get_parameter()` or `_task_get_parameter_for()` rather than have the task's main body pass the parameter to it.

2.1.274 `_task_get_priority`, `_task_set_priority`

`_task_get_priority()` Gets the priority of the task.
`_task_set_priority()` Sets the priority of the task.

Prototype

```
source\kernel\task.c
_mqx_uint _task_get_priority(
    _task_id      task_id,
    _mqx_uint      *priority_ptr)

_mqx_uint _task_set_priority(
    _task_id      task_id,
    _mqx_uint      new_priority,
    _mqx_uint      *old_priority_ptr)
```

Parameters

task_id [IN] — One of the following:
 task ID of the task for which to set or get info
MQX_NULL_TASK_ID (use the calling task)
priority_ptr [OUT] — Pointer to the priority
new_priority [IN] — New priority
old_priority_ptr [OUT] — Pointer to the previous priority

Returns

- MQX_OK
- Errors

Error	Description
MQX_INVALID_PARAMETER	<i>new_priority</i> is numerically greater than the lowest-allowable priority of an application task. Valid just for _task_set_priority() function.
MQX_INVALID_TASK_ID	<i>task_id</i> does not represent a currently valid task.

Traits

Might dispatch a task

See Also

[_task_get_creator](#)

[_task_get_processor](#)

[_sem_create](#)

[_sem_create_fast](#)[_sem_wait ...](#)[_mutatr_get_sched_protocol, _mutatr_set_sched_protocol](#)[_mutex_lock](#)

Description

MQX might boost the priority of a task that waits for a semaphore or locks a mutex. If MQX has boosted the priority of the task that is specified by *task_id*, **_task_set_priority()** will raise but not lower the task's priority.

If the task is in this state:	Priority change takes place:
Blocked	When task is ready
Ready	Immediately

Example

Raise the priority of the current task.

```

_task_get_priority(_task_get_id(), &priority);
if (priority > 0) {
    priority--;
    if (_task_set_priority(_task_get_id(), priority, &temp) = MQX_OK)
        ...
}
```

2.1.275 `_task_get_processor`

Gets the processor number of the task's home processor.

Prototype

```
source\kernel\task.c
_processor_number _task_get_processor(
    _task_id task_id)
```

Parameters

task_id [IN] — Task ID of the task for which to get info

Returns

Processor number of the processor where the task resides

See Also

[_task_get_id](#)

[MQX_INITIALIZATION_STRUCT](#)

Description

The function returns the processor-number portion of *task_id*. It cannot check the validity of *task_id* because MQX on one processor is unaware of which tasks might reside on another processor.

Example

Determine whether two tasks are on the same processor.

```
_task_id task_a;
_task_id task_b;

if (_task_get_processor(task_a) == _task_get_processor(task_b)) {
    /* Proceed */
    ...
}
```

2.1.276 `_task_get_td`

Gets a pointer to the task descriptor for the task ID.

Prototype

```
source\kernel\task.c  
void *_task_get_td(  
    _task_id task_id)
```

Parameters

task_id [IN] — One of:
task ID for a task on this processor
MQX_NULL_TASK_ID (use the current task)

Returns

- Pointer to the task descriptor for *task_id* (success)
- NULL (failure: *task_id* is not valid for this processor)

See also

[_task_ready](#)

Example

See `_task_ready()`.

2.1.277 `_task_get_template_index`

Gets the task template index that is associated with the task name.

Prototype

```
source\kernel\task.c
_mqx_uint _task_get_template_index(
    char *name_ptr)
```

Parameters

name_ptr [IN] — Pointer to the name to find in the task template list

Returns

- Task template index that is associated with the first match of *name_ptr* (success)
- MQX_NULL_TASK_ID (failure: name is not in the task template list)

See Also

[_task_get_id_from_name](#)

[_task_get_index_from_id](#)

[TASK_TEMPLATE_STRUCT](#)

Example

See `_task_get_id_from_name()`.

2.1.278 `_task_get_template_ptr`

Gets the pointer to the task template for the task ID.

Prototype

```
source\kernel\task.c  
TASK_TEMPLATE_STRUCT_PTR _task_get_template_ptr(  
    _task_id task_id)
```

Parameters

task_id [IN] — Task ID for the task for which to get info

Returns

Pointer to the task's task template. NULL if an invalid `task_id` is presented.

See Also

[_task_get_template_index](#)

[_task_get_index_from_id](#)

2.1.279 `_task_ready`

Makes the task ready to run by putting it in its ready queue.

Prototype

```
source\kernel\task.c
void _task_ready(
    void *td_ptr)
```

Parameters

td_ptr [IN] — Pointer to the task descriptor of the task (on this processor) to be made ready

Task error codes

Task Error Code	Description
MQX_INVALID_TASK_ID	<i>task_id</i> is not valid for this processor.
MQX_INVALID_TASK_STATE	Task is already in its ready queue.

Traits

- If the newly readied task is higher priority than the calling task, MQX makes the newly readied task active
- Might set the task error code (see task error codes)

See Also

[_task_block](#)

[_time_dequeue](#)

[_taskq_resume](#)

Description

The function is the only way to make ready a task that called `_task_block()`.

Example

The following two functions implement a fast, cooperative scheduling mechanism, which takes the place of task queues.

```
#include mqx_prv.h

#define WAIT_BLOCKED 0xF1

Restart(_task_id tid) {
    TD_STRUCT_PTR td_ptr = _task_get_td(tid);
    _int_disable();
    if ((td_ptr != NULL) && (td_ptr->STATE == WAIT_BLOCKED)) {
        _task_ready(td_ptr);
    }
    _int_enable();
}
```

```
Wait() {  
    TD_STRUCT_PTR td_ptr = _task_get_td(_task_get_id());  
  
    _int_disable();  
    td_ptr->STATE = WAIT_BLOCKED;  
    _task_block();  
    _int_enable();  
}
```

2.1.280 `_task_restart`

Restarts the task.

Prototype

```
source\kernel\task.c
_mqx_uint _task_restart(
    _task_id      task_id,
    uint32_t      *param_ptr,
    bool          blocked)
```

Parameters

task_id [IN] — Task ID of the task to restart

param_ptr [IN] — One of the following:

pointer to a new task creation parameter

NULL

blocked [IN] — Whether to restart the task in the blocked state

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_TASK_ID	<i>task_id</i> is invalid.

Traits

Cannot be called from an ISR

See Also

[_task_create](#), [_task_create_blocked](#), [_task_create_at](#)

Description

The function closes all queues that the task has open, releases all the task's resources, and frees all memory that is associated with the task's resources.

The function restarts the task with the same task descriptor, task ID, and task stack.

2.1.281 `_task_set_error`

Sets the task error code.

Prototype

```
source\kernel\task.c
_mqx_uint _task_set_error(
    _mx_uint error_code)
```

Parameters

error_code [IN] — Task error code

Returns

Previous task error code

See Also

[_task_check_stack](#)

[_task_get_error, _task_get_error_ptr](#)

[_task_errno](#)

Description

MQX uses the function to indicate an error. MQX never sets the task error code to `MQX_OK`; that is, MQX does not reset the task error code. It is the responsibility of the application to reset the task error code.

As a result, when an application calls `_task_get_error()`, it gets the first error that MQX detected since the last time the application reset the task error code.

If the current task error code is:	Function changes the task error code:
<code>MQX_OK</code>	To <i>error_code</i>
Not <code>MQX_OK</code>	To <i>error_code</i> if <i>error_code</i> is <code>MQX_OK</code>

If the function is called from an ISR, the function sets the interrupt error code.

Example

Reset the task error code and check whether it was set.

```
_mx_uint error;

error = _task_set_error(MQX_OK);
if (error != MQX_OK) {
    /* Handle the error. */
}
```

2.1.282 `_task_start_preemption`, `_task_stop_preemption`

`_task_start_preemption()` Enables preemption of the current task.
`_task_stop_preemption()` Disables preemption of the current task.

Prototype

```
source\kernel\task.c
void _task_start_preemption(void)

void _task_stop_preemption(void)
```

Parameters

None

Returns

None

Traits

- Changes the preemption ability of tasks
- Interrupts are still handled

See Also

[`_task_ready`](#)

[`_task_block`](#)

Description

The `_task_stop_preemption()` function disables interrupt-driven preemption of the calling task unless the task invokes the scheduler explicitly either by a blocking call (`_task_block()`), a non-blocking call (`_lwevent_set()`) or it calls `_task_start_preemption()`. When preemption is stopped, the context switch will not occur upon return from any ISR, even if a higher priority task becomes ready during the ISR execution. This includes the context switch at the end of a timeslice, therefore tasks calling the `_task_stop_preemption()` function may have their timeslice extended.

Example

Stop a higher-priority task from preempting this task during a critical period, but allow interrupts to be serviced.

```
...
_task_stop_preemption();
/* Perform the critical operation that cannot be preempted. */
...
task_start_preemption();
```

2.1.283 `_taskq_create`

Creates a task queue.

Prototype

```
source\kernel\taskq.c
void *_taskq_create(
    _mqx_uint policy)
```

Parameters

policy [IN] — Queuing policy; one of the following:

MQX_TASK_QUEUE_BY_PRIORITY
MQX_TASK_QUEUE_FIFO

Returns

- Pointer to the task queue (success)
- NULL (failure)

Task error codes

Task error code	Description
Error from <code>_mem_alloc_system()</code>	MQX cannot allocate memory for the task queue.
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_PARAMETER	<i>policy</i> is not one of the allowed policies.

Traits

- Cannot be called from an ISR
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_taskq_destroy](#)

[_taskq_resume](#)

[_taskq_suspend](#)

[_task_set_error](#)

Description

A task can use the task queue to suspend and resume tasks.

Example

```
void *task_queue;

void TaskA(void)
{
```

```
task_queue = _taskq_create(MQX_TASK_QUEUE_FIFO);

while (condition) {
    _taskq_suspend(task_queue);
    /* Do some work. */
}

_taskq_destroy(task_queue);
}
```

2.1.284 _taskq_destroy

Destroys the task queue.

Prototype

```
source\kernel\taskq.c
_mqx_uint _taskq_destroy(
    void *task_queue_ptr)
```

Parameters

- task_queue_ptr* [IN] — Pointer to the task queue to destroy; returned by **_taskq_create()**

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_PARAMETER	<i>task_queue_ptr</i> is <i>NULL</i> .
MQX_INVALID_TASK_QUEUE	<i>task_queue_ptr</i> does not point to a valid task queue.

Traits

- Might put tasks in their ready queues
- Cannot be called from an ISR

See Also

[_task_create](#), [_task_create_blocked](#), [_task_create_at](#)

[_taskq_resume](#)

[_taskq_suspend](#)

Description

The function removes all tasks from the task queue, puts them in their ready queues, and frees the task queue.

Example

See [_taskq_create\(\)](#).

2.1.285 `_taskq_get_value`

Gets the number of tasks that are in the task queue.

Prototype

```
source\kernel\taskq.c
_mqx_uint _taskq_get_value(
    void *task_queue_ptr)
```

Parameters

task_queue_ptr [IN] — Pointer to the task queue; returned by `_taskq_create()`

Returns

- Number of tasks on the task queue (success)
- `MAX_MQX_UINT` (failure)

Task Error Codes

MQX_INVALID_PARAMETER	<i>task_queue_ptr</i> is <code>NULL</code> .
MQX_INVALID_TASK_QUEUE	<i>task_queue_ptr</i> does not point to a valid task queue.

Traits

On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_taskq_create](#)

[_task_set_error](#)

2.1.286 _taskq_resume

Restarts the task that is suspended in the task queue.

Prototype

```
source\kernel\taskq.c
_mqx_uint _taskq_resume(
    void      *task_queue,
    bool      all_tasks)
```

Parameters

task_queue [IN] — Pointer to the task queue returned by **_taskq_create()**

all_tasks [IN] — One of the following:

FALSE (ready the first task)

TRUE (ready all tasks)

Returns

- MQX_OK
- Errors

Error	Description
MQX_INVALID_PARAMETER	<i>task_queue_ptr</i> is not valid.
MQX_INVALID_TASK_QUEUE	<i>task_queue_ptr</i> is <i>NULL</i> .
MQX_TASK_QUEUE_EMPTY	Task queue is empty.

Traits

Might put tasks in their ready queues

See Also

[_taskq_destroy](#)

[_taskq_create](#)

[_taskq_suspend](#)

Description

The function removes the task or tasks from the task queue and puts them in their ready queues. MQX schedules the tasks based on their priority, regardless of the scheduling policy of the task queue.

Example

```
extern void *task_queue;
void TaskB(void)
{
    bool condition;
    ...
}
```

```
if (condition) {  
    /* Schedule the first waiting task: */  
    _taskq_resume(task_queue, FALSE);  
}  
...  
}
```


2.1.287 _taskq_suspend

Suspends the active task and put it in the task queue.

Prototype

```
source\kernel\taskq.c
_mqx_uint _taskq_suspend(
    void *task_queue)
```

Parameters

task_queue [IN] — Pointer to the task queue returned by `_taskq_create()`

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_PARAMETER	<i>task_queue_ptr</i> is <i>NULL</i> .
MQX_INVALID_TASK_QUEUE	<i>task_queue_ptr</i> does not point to a valid task queue.

Traits

- Blocks the calling task
- Cannot be called from an ISR

See Also

[_taskq_destroy](#)

[_taskq_create](#)

[_taskq_resume](#)

[_taskq_get_value](#)

Description

The function blocks the calling task and puts the task's task descriptor in the task queue.

Example

See `_taskq_create()`.

2.1.288 `_taskq_suspend_task`

Suspends the ready task in the task queue.

Prototype

```
source\kernel\taskq.c
_mqx_uint _taskq_suspend_task(
    _task_id task_id,
    void *task_queue_ptr)
```

Parameters

task_id [IN] — Task ID of the task to suspend

task_queue_ptr [IN] — Pointer to the task queue; returned by `_taskq_create()`

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_INVALID_PARAMETER	<i>task_queue_ptr</i> is <i>NULL</i> .
MQX_INVALID_TASK_ID	<i>task_id</i> is not a valid task descriptor.
MQX_INVALID_TASK_QUEUE	<i>task_queue_ptr</i> does not point to a valid task queue.
MQX_INVALID_TASK_STATE	Task is not in the ready state.

Traits

- Blocks the specified task
- Cannot be called from an ISR

See Also

[_taskq_destroy](#)

[_taskq_create](#)

[_taskq_resume](#)

[_taskq_get_value](#)

Description

The function blocks the specified task and puts the task's task descriptor in the task queue.

Example

```
void *task_queue;

void TaskA(void)
{
    task_queue = _taskq_create(0);

    while (condition) {
        _taskq_suspend_task(_task_get_creator(), task_queue);
        /* Do some work. */
    }

    _taskq_destroy(task_queue);
}
```

2.1.289 _taskq_test

Tests the task queues.

Prototype

```
source\kernel\taskq.c
_mqx_uint _taskq_test(
    void *task_queue_error_ptr,
    void *td_error_ptr)
```

Parameters

task_queue_error_ptr [OUT] — Pointer to the task queue with an error (*NULL* if no error is found)

td_error_ptr [OUT] — Pointer to the task descriptor with an error (*NULL* if no error is found)

Returns

- MQX_OK
- Errors

Error	Description
MQX_CANNOT_CALL_FUNCTION_FROM_ISR	Function cannot be called from an ISR.
MQX_CORRUPT_QUEUE	A task on a task queue is not valid.
MQX_INVALID_TASK_QUEUE	A task queue is not valid.

Traits

- Cannot be called from an ISR
- Disables and enables interrupts

See Also

[_taskq_destroy](#)

[_taskq_create](#)

[_taskq_resume](#)

[_taskq_get_value](#)

2.1.290 `_ticks_to_time`

Converts tick format to second/millisecond format

Prototype

```
source\kernel\time.c
bool _ticks_to_time(
    MQX_TICK_STRUCT_PTR  tick_time_ptr,
    TIME_STRUCT_PTR      time_ptr)
```

Parameters

tick_time_ptr [IN] — Pointer to a time structure

time_ptr [OUT] — Pointer to the corresponding normalized second/millisecond time structure

Returns

- TRUE (success)
- FALSE (failure: *tick_time_ptr* or *time_ptr* is NULL)

See Also

[_time_to_ticks](#)

[MQX_TICK_STRUCT](#)

[TIME_STRUCT](#)

Description

The function verifies that the fields in the input structure are within the following ranges.

Field	Minimum	Maximum
TICKS	0	(2 ⁶⁴) - 1
HW_TICKS	0	(2 ³²) - 1

2.1.291 `_time_add ...`

Add time in these units to tick time:	
<code>_time_add_day_to_ticks()</code>	Days
<code>_time_add_hour_to_ticks()</code>	Hours
<code>_time_add_min_to_ticks()</code>	Minutes
<code>_time_add_sec_to_ticks()</code>	Seconds
<code>_time_add_msec_to_ticks()</code>	Milliseconds
<code>_time_add_usec_to_ticks()</code>	Microseconds
<code>_time_add_nsec_to_ticks()</code>	Nanoseconds
<code>_time_add_psec_to_ticks()</code>	Picoseconds

Prototype

```

source\kernel\time.c
MQX_TICK_STRUCT_PTR _time_add_day_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             days)

MQX_TICK_STRUCT_PTR _time_add_hour_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             hours)

MQX_TICK_STRUCT_PTR _time_add_min_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             mins)

MQX_TICK_STRUCT_PTR _time_add_sec_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             secs)

MQX_TICK_STRUCT_PTR _time_add_msec_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             msecs)

MQX_TICK_STRUCT_PTR _time_add_usec_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             usecs)

MQX_TICK_STRUCT_PTR _time_add_nsec_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             nsecs)

MQX_TICK_STRUCT_PTR _time_add_psec_to_ticks(
    MQX_TICK_STRUCT_PTR tick_ptr,
    mqx_uint             psecs)

```

Parameters

tick_ptr [IN] — Tick time to add to

days [IN] — Days to add

hours [IN] — Hours to add
mins [IN] — Minutes to add
secs [IN] — Seconds to add
msecs [IN] — Milliseconds to add
usecs [IN] — Microseconds to add
nsecs [IN] — Nanoseconds to add
psecs [IN] — Picoseconds to add

Returns

Tick time

See Also

[_mqx_zero_tick_struct](#)

Description

The functions can also be used in conjunction with the global constant `_mqx_zero_tick_struct` to convert units to tick time.

Example

Convert 265 days to ticks.

```

_mqx_uint      days;
MQX_TICK_STRUCT ticks;

...

days = 365;
ticks = _mqx_zero_tick_struct;
_time_add_day_to_ticks(&ticks, days);

```

2.1.292 `_time_delay` ...

Suspend the active task:	
<code>_time_delay()</code>	For the number of milliseconds
<code>_time_delay_for()</code>	For the number of ticks (in tick time)
<code>_time_delay_ticks()</code>	For the number of ticks
<code>_time_delay_until()</code>	Until the specified time (in tick time)

Prototype

```
source\kernel\time.c
void _time_delay(
    uint32_t milliseconds)

void _time_delay_for(
    MQX_TICK_STRUCT_PTR tick_time_delay_ptr)

void _time_delay_ticks(
    _mqx_uint tick_delay)

void _time_delay_until(
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

milliseconds [IN] — Minimum number of milliseconds to suspend the task

tick_time_delay_ptr [IN] — Pointer to the minimum number of ticks to suspend the task

tick_delay [IN] — Minimum number of ticks to suspend the task

tick_time_ptr [IN] — Pointer to the time (in tick time) until which to suspend the task

Returns

None

Traits

Blocks the calling task

If the requested delay equals zero, then only `_sched_yield()` function is called.

See Also

[_time_dequeue](#)

Description

The functions put the active task in the timeout queue for the specified time.

Before the time expires, any task can remove the task from the timeout queue by calling `_time_dequeue()`.

Example

See `_time_dequeue()`.

2.1.293 `_time_dequeue`

Removes the task (specified by task ID) from the timeout queue.

Prototype

```
source\kernel\time.c
void _time_dequeue(
    _task_id  tid)
```

Parameters

tid [IN] — Task ID of the task to be removed from the timeout queue

Returns

None

Traits

Removes the task from the timeout queue, but does not put it in the task's ready queue

See Also

[_task_ready](#)

[_time_delay ...](#)

[_time_dequeue_td](#)

Description

The function removes from the timeout queue a task that has put itself there for a period of time (`_time_delay()`).

If *tid* is invalid or represents a task that is on another processor, the function does nothing.

A task that calls the function must subsequently put the task in the task's ready queue with `_task_ready()`.

Example

Task A creates Task B and then waits for Task B to remove it from the timeout queue and ready it using its task descriptor. Task A then creates Task C and waits for Task C to remove it from the timeout queue and ready it using its task ID.

```
void taskB(uint32_t parameter)
{
    void *td_ptr;
    td_ptr = (void*)parameter;
    ...
    _time_dequeue_td(td_ptr);
    _task_ready(td_ptr);
    ...
}
void taskC(uint32_t parameter)
{
    ...
```

```
_time_dequeue((_task_id)parameter);
_task_ready(_task_get_td((_task_id)parameter);
...
}

void taskA(uint32_t parameter)
{
    ...
    _task_create(0, TASKB, (uint32_t)_task_get_td(_task_get_id()));
    _time_delay(100);
    ...
    _task_create(0, TASKC, (uint32_t)_task_get_id());
    _time_delay(100);
    ...
}
```

2.1.294 `_time_dequeue_td`

Removes the task (specified by task descriptor) from the timeout queue.

Prototype

```
source\kernel\time.c  
void _time_dequeue_td(  
    void *td)
```

Parameters

td [IN] — Pointer to the task descriptor of the task to be removed from the timeout queue

Returns

None

Traits

Removes the task from the timeout queue; does not put it in the task's ready queue

See Also

[_task_ready](#)

[_time_delay ...](#)

[_time_dequeue](#)

Description

See `_time_dequeue()`.

Example

See `_time_dequeue()`.

2.1.295 `_time_diff`, `_time_diff_ticks`

For `_time_diff_units` functions, see `_time_diff_ ...`

Get the difference between two:	
<code>_time_diff()</code>	Second/millisecond times
<code>_time_diff_ticks()</code>	Tick times

Prototype

```
source\kernel\time.c
void _time_diff(
    TIME_STRUCT_PTR start_time_ptr,
    TIME_STRUCT_PTR end_time_ptr,
    TIME_STRUCT_PTR diff_time_ptr)

_mqx_uint _time_diff_ticks(
    MQX_TICK_STRUCT_PTR tick_end_time_ptr,
    MQX_TICK_STRUCT_PTR tick_start_time_ptr,
    MQX_TICK_STRUCT_PTR tick_diff_time_ptr)
```

Parameters

- `start_time_ptr [IN]` — Pointer to the normalized start time in second/millisecond time
- `end_time_ptr [IN]` — Pointer to the normalized end time, which must be greater than the start time
- `diff_time_ptr [OUT]` — Pointer to the time difference (the time is normalized)
- `tick_start_time_ptr [IN]` — Pointer to the normalized start time in tick time
- `tick_end_time_ptr [IN]` — Pointer to the normalized end time, which must be greater than the start time
- `tick_diff_time_ptr [OUT]` — Pointer to the time difference (the time is normalized)

Returns

For `_time_diff_ticks()`:

- `MQX_OK`
- `MQX_INVALID_PARAMETER` (one or more pointers are NULL)

See Also

Other functions in the `_time_diff_ ...` family

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

[MQX_TICK_STRUCT](#)

[TIME_STRUCT](#)

Example

Determine how long it takes to send 100 messages.

```
TIME_STRUCT    start_time, end_time, diff_time;
...
_time_get(&start_time);

/* Send 100 messages. */

_time_get(&end_time);
_time_diff(&start_time, &end_time, &diff_time);

printf("Time to send 100 messages: %ld sec %ld millisec\n",
       diff_time.SECONDS, diff_time.MILLISECONDS);
```

2.1.296 `_time_diff_` ...

Get the difference in this unit between two tick times:	
<code>_time_diff_days()</code>	Days
<code>_time_diff_hours()</code>	Hours
<code>_time_diff_minutes()</code>	Minutes
<code>_time_diff_seconds()</code>	Seconds
<code>_time_diff_milliseconds()</code>	Milliseconds
<code>_time_diff_microseconds()</code>	Microseconds
<code>_time_diff_nanoseconds()</code>	Nanoseconds
<code>_time_diff_picoseconds()</code>	Picoseconds
<code>_time_diff_ticks()</code>	See <code>_time_diff()</code> , <code>_time_diff_ticks()</code>

Prototype

```
source\kernel\time.c
int32_t _time_diff_days(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)

int32_t _time_diff_hours(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)

int32_t _time_diff_minutes(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)

int32_t _time_diff_seconds(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)

int32_t _time_diff_milliseconds(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)

int32_t _time_diff_microseconds(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)

int32_t _time_diff_nanoseconds(
    MQX_TICK_STRUCT_PTR end_tick_ptr,
    MQX_TICK_STRUCT_PTR start_tick_ptr,
    bool *overflow_ptr)
```

```
int32_t _time_diff_picoseconds(
    MQX_TICK_STRUCT_PTR  end_tick_ptr,
    MQX_TICK_STRUCT_PTR  start_tick_ptr,
    bool                  *overflow_ptr)
```

Parameters

end_tick_ptr [IN] — Pointer to the ending tick time, which must be greater than the starting tick time

start_tick_ptr [IN] — Pointer to the starting tick time

overflow_ptr [OUT] — *TRUE* if overflow occurs (see description)

Returns

Difference in days, hours, minutes, seconds, or so on

See Also

[_mqx_zero_tick_struct](#)

[_time_diff, _time_diff_ticks](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

[MQX_TICK_STRUCT](#)

Description

If the calculation overflows **int32_t**, the function sets the boolean at *overflow_ptr* to *TRUE*. If this happens, use the **_time_diff** function for a larger unit. For example, if **_time_diff_hours()** sets the overflow, use **_time_diff_days()**.

The functions can also be used in conjunction with the global constant *_mqx_zero_tick_struct* to convert tick time to units.

Example

```
bool    overflow = FALSE;
int32_t nsecs;
MQX_TICK_STRUCT ticks;

...

nsecs = _time_diff_nanoseconds(&ticks, &_mqx_zero_tick_struct,
    &overflow);
```


2.1.297 `_time_from_date`

Gets second/millisecond time format from date format.

Prototype

```
source\kernel\time.c
bool _time_from_date(
    DATE_STRUCT_PTR  date_ptr,
    TIME_STRUCT_PTR  ms_time_ptr)
```

Parameters

date_ptr [IN] — Pointer to a date structure

ms_time_ptr [OUT] — Pointer to a normalized second/millisecond time structure

Returns

- TRUE (success)
- FALSE (failure: see description)

See Also

[_time_get, _time_get_ticks](#)

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_set, _time_set_ticks](#)

[_time_to_date](#)

[DATE_STRUCT](#)

[TIME_STRUCT](#)

Description

The function verifies that the fields in the input structure are within the following ranges.

Field	Minimum	Maximum
YEAR	1970	2099
MONTH	1	12
DAY	1	31 (depending on the month)
HOUR	0	23 (since midnight)
MINUTE	0	59
SECOND	0	59
MILLISEC	0	999

The function converts the fields in the input structure to the fields in the output structure, taking into account leap years.

The time is since 0:00:00.00, January 1, 1970.

The function returns *FALSE* if either:

- *date_ptr* or *time_ptr* are *NULL*

- fields in *date_ptr* are out of range

Example

Change the time to 10:00:00.00, February 8, 1999.

```
DATE_STRUCT  date;
TIME_STRUCT  time;
...
date.YEAR    = 1999;
date.MONTH   = 2;
date.DAY     = 8;
date.HOUR    = 10;
date.SECOND  = 0;
date.MILLISEC = 0;

_time_from_date(&date, &time);
_time_set(&time);
```

2.1.298 `_time_get`, `_time_get_ticks`

Get the absolute time in:	
<code>_time_get()</code>	Second/millisecond time
<code>_time_get_ticks()</code>	Tick time

Prototype

```
source\kernel\time.c
void _time_get(
    TIME_STRUCT_PTR    ms_time_ptr)

void _time_get_ticks(
    MQX_TICK_STRUCT_PTR    tick_time_ptr)
```

Parameters

ms_time_ptr [OUT] — Where to store the normalized absolute time in second/millisecond time
tick_time_ptr [OUT] — Where to store the absolute time in tick time

Returns

None

See Also

[_time_get_elapsed](#), [_time_get_elapsed_ticks](#)

[_time_set](#), [_time_set_ticks](#)

[MQX_TICK_STRUCT](#)

[TIME_STRUCT](#)

Description

If the application changed the absolute time with `_time_set()` (or `_time_set_ticks()`), `_time_get()` (or `_time_get_ticks()`) returns the time that was set plus the number of seconds and milliseconds (or ticks) since the time was set.

If the application has not changed the absolute time with `_time_set()` (or `_time_set_ticks()`), `_time_get()` (or `_time_get_ticks()`) returns the same as `_time_get_elapsed()` (or `_time_get_elapsed_ticks()`), which is the number of seconds and milliseconds (or ticks) since MQX started.

Example

See `_time_diff()`.

2.1.299 `_time_get_elapsed`, `_time_get_elapsed_ticks`

Get the time in this format since MQX started:	
<code>_time_get_elapsed()</code>	Second/millisecond time
<code>_time_get_elapsed_ticks()</code>	Tick time

Prototype

```
source\kernel\time.c
void _time_get_elapsed(
    TIME_STRUCT_PTR  ms_time_ptr)

void _time_get_elapsed_ticks(
    MQX_TICK_STRUCT_PTR  tick_time_ptr)
```

Parameters

ms_time_ptr [OUT] — Where to store the elapsed normalized second/millisecond
timetick_time_ptr [OUT] — Where to store the elapsed tick time

Returns

None

See Also

[_time_get](#), [_time_get_ticks](#)

[_time_set](#), [_time_set_ticks](#)

[TIME_STRUCT](#)

[MQX_TICK_STRUCT](#)

Description

The function always returns elapsed time; it is not affected by `_time_set()` or `_time_set_ticks()`.

2.1.300 `_time_get_hwticks`

Gets the number of hardware ticks since the last tick.

Prototype

```
source\kernel\time.c  
uint32_t _time_get_hwticks(void)
```

Parameters

None

Returns

Number of hardware ticks since the last tick

See Also

[_time_get_hwticks_per_tick](#), [_time_set_hwticks_per_tick](#)

2.1.301 `_time_get_hwticks_per_tick`, `_time_set_hwticks_per_tick`

<code>_time_get_hwticks_per_tick()</code>	Gets the number of hardware ticks per tick.
<code>_time_set_hwticks_per_tick()</code>	Sets the number of hardware ticks per tick.

Prototype

```
source\kernel\time.c
uint32_t _time_get_hwticks_per_tick(void)

void _time_set_hwticks_per_tick(
    uint32_t new_ticks)
```

Parameters

new_ticks [OUT] — New number of hardware ticks per tick

Returns

`_time_get_hwticks()`: Number of hardware ticks per tick

See Also

[_time_get_hwticks](#)

2.1.302 `_time_get_microseconds`

Gets the calculated number of microseconds since the last periodic timer interrupt.

Prototype

```
source\bsp\platform\get_usec.c  
uint16_t _time_get_microseconds(void)
```

Parameters

None

Returns

- Number of microseconds since the last periodic timer interrupt
- 0 (BSP does not support the feature)

Traits

Resolution depends on the periodic timer device

See Also

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

2.1.303 `_time_get_nanoseconds`

Gets the calculated number of nanoseconds since the last periodic timer interrupt.

Prototype

```
source\bsp\platform\get_nsec.c  
uint32_t _time_get_nanoseconds(void)
```

Parameters

None

Returns

- Number of nanoseconds since the last periodic timer interrupt
- 0 (BSP does not support the feature)

Traits

Resolution depends on the periodic timer device

See Also

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

2.1.304 `_time_get_resolution`, `_time_set_resolution`

`_time_get_resolution()` Gets the resolution of the periodic timer interrupt.
`_time_set_resolution()` Sets the resolution of the periodic timer interrupt.

Prototype

```
source\kernel\time.c
_mqx_uint _time_get_resolution(void)

_mqx_uint _time_set_resolution(
    _mx_uint resolution)
```

Parameters

resolution [IN] — Periodic timer resolution (in milliseconds) that MQX is to use

Returns

- `_time_get_resolution()`:
Resolution of the periodic timer interrupt in milliseconds
- `_time_set_resolution()`:
 - `MQX_OK`
 - `MQX_INVALID_PARAMETER` (input resolution is equal to 0 or greater than 1000 milliseconds)

See Also

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

[TIME_STRUCT](#)

Description

On each clock interrupt, MQX increments time by the resolution.

CAUTION

If the resolution does not agree with the interrupt period that was programmed at the hardware level, some timing functions will give incorrect results.

2.1.305 `_time_get_ticks_per_sec`, `_time_set_ticks_per_sec`

`_time_get_ticks_per_sec()` Gets the timer frequency (in ticks per second) that MQX uses.

`_time_set_ticks_per_sec()` Sets the timer frequency (in ticks per second) that MQX uses.

Prototype

```
source\kernel\time.c
_mqx_uint _time_get_ticks_per_sec(void)

void _time_set_ticks_per_sec(
    _mx_uint ticks_per_sec)
```

Parameters

ticks_per_sec [IN] — New timer frequency in ticks per second

Returns

- `_time_get_ticks_per_sec()`:
Period of clock interrupt in ticks per second
- `_time_set_ticks_per_sec()`:
None

CAUTION

If the timer frequency does not agree with the interrupt period that was programmed at the hardware level, some timing functions will give incorrect results.

2.1.306 `_time_init_ticks`

Initializes a tick time structure with the number of ticks.

Prototype

```
source\kernel\time.c
_mqx_uint _time_init_ticks(
    MQX_TICK_STRUCT_PTR tick_time_ptr,
    _mqx_uint ticks)
```

Parameters

tick_time_ptr [OUT] — Pointer to the tick time structure to initialize

ticks [IN] — Number of ticks with which to initialize the structure

Returns

- TRUE (success)
- FALSE (failure: input year is earlier than 1970 or output year is later than 2481)

See Also

[_time_set, _time_set_ticks](#)

[MQX_TICK_STRUCT](#)

2.1.307 `_time_notify_kernel`

The BSP periodic timer ISR calls the function when a periodic timer interrupt occurs.

Prototype

```
source\kernel\time.c  
void _time_notify_kernel(void)
```

Parameters

None

Returns

None

Traits

See description

See Also

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

TIME_STRUCT

Description

The BSP installs an ISR for the periodic timer interrupt. The ISR calls `_time_notify_kernel()`, which does the following:

- increments kernel time
- if the active task is a time slice task whose time slice has expired, puts it at the end of the task's ready queue
- if the timeout has expired for tasks on the timeout queue, puts them in their ready queues

If the BSP does not have periodic timer interrupts, MQX components that use time will not operate.

2.1.308 `_time_set`, `_time_set_ticks`

Set the absolute time in:	
<code>_time_set()</code>	Second/millisecond time
<code>_time_set_ticks()</code>	Tick time

Prototype

```
source\kernel\time.c
void _time_set(
    TIME_STRUCT_PTR  ms_time_ptr)

void _time_set_ticks(
    MQX_TICK_STRUCT_PTR  tick_time_ptr)
```

Parameters

ms_time_ptr [IN] — Pointer to a structure that contains the new normalized time in second/millisecond time

tick_time_ptr [IN] — Pointer to the structure that contains the new time in tick time

Returns

None

See Also

[_time_get](#), [_time_get_ticks](#)

[_time_get_elapsed](#), [_time_get_elapsed_ticks](#)

[_time_to_date](#)

[_time_init_ticks](#)

[_time_to_ticks](#)

[_time_from_date](#)

TIME_STRUCT

MQX_TICK_TIMEPrototype

Description

The function affects `_time_get()` (and `_time_get_ticks()`), but does not affect time `_time_get_elapsed()` (or `_time_get_elapsed_ticks()`).

Example

See `_time_from_date()`.

2.1.309 `_time_set_timer_vector`

Sets the periodic timer interrupt vector number that MQX uses.

Prototype

```
source\kernel\time.c  
void _time_set_timer_vector(  
    _mqx_uint  vector)
```

Parameters

vector [IN] — Periodic timer interrupt vector to use

Returns

None

See Also

[_time_get](#), [_time_get_ticks](#)

[_time_get_resolution](#), [_time_set_resolution](#)

Description

The BSP should call the function during initialization.

2.1.310 `_time_to_date`

Converts time format to date format.

Prototype

```
source\kernel\time.c
bool _time_to_date(
    TIME_STRUCT_PTR  time_ptr,
    DATE_STRUCT_PTR  date_ptr)
```

Parameters

time_ptr [IN] — Pointer to a normalized second/millisecond time structure
date_ptr [OUT] — Pointer to the corresponding date structure

Returns

- TRUE (success)
- FALSE (failure: see description)

See Also

[_time_get, _time_get_ticks](#)

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_set, _time_set_ticks](#)

[_time_from_date](#)

[DATE_STRUCT](#)

[TIME_STRUCT](#)

Description

The function verifies that the fields in the input structure are within the following ranges.

Field	Minimum	Maximum
SECONDS	0	MAXIMUM_SECONDS_IN_TIME (4,102,444,800)
MILLISECONDS	0	999

The function converts the fields in the input structure to the fields in the output structure, taking into account leap years.

The time is since 0:00:00.00, January 1, 1970.

The function returns *FALSE* if either:

- *date_ptr* or *time_ptr* is *NULL*
- fields in *time_ptr* are out of range

2.1.311 `_time_to_ticks`

Converts second/millisecond time format to tick time format.

Prototype

```
source\kernel\time.c
bool _time_to_ticks(
    TIME_STRUCT_PTR    time_ptr,
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

time_ptr [IN] — Pointer to a normalized second/millisecond time structure
tick_time_ptr [OUT] — Pointer to the corresponding tick time structure

Returns

- TRUE (success)
- FALSE (failure: *time_ptr* or *tick_time_ptr* is NULL)

See Also

[_ticks_to_time](#)
[MQX_TICK_STRUCT](#)
[TIME_STRUCT](#)

Description

The function verifies that the fields in the input structure are within the following ranges.

Field	Minimum	Maximum
SECONDS	0	MAXIMUM_SECONDS_IN_TIME
MILLISECONDS	0	(4,102,444,800) 999

The function converts the fields in the input structure to the fields in the output structure, taking into account leap years.

2.1.312 mktime

Converts tm struct time format to second time format

Prototype

```
source\kernel\time.c  
time_t mktime(struct tm* tm_ptr)
```

Parameters

tm_ptr[IN] — Pointer to broken-down time format (tm struct).

Returns

- time value converted from tm struct (SUCCESS)
- 0 (FAILURE: tm_ptr is NULL or overflow occurs)

See Also

[gmtime_r](#)

[timegm](#)

[localtime_r](#)

[time_t](#)

TM STRUCT

Description

The mktime() function converts a broken-down time structure, expressed as local time, to calendar time representation. The function could normalize tm_wday and tm_yday fields in case these members are outside their valid value.

2.1.313 gmtime_r

Converts calendar time format to broken-down time representation

Prototype

```
source\kernel\time.c  
struct tm *gmtime_r(  
    const time_t *timep,  
    struct tm *result)
```

Parameters

timep[IN] — Pointer to a calendar time.

result[OUT] — Pointer to the corresponding tm structure format.

Returns

- Pointer to user-supplied struct (SUCCESS)
- NULL (FAIL)

See Also

[mktime](#)

[timegm](#)

[localtime_r](#)

[time_t](#)

TM STRUCT

Description

The gmtime_r () function converts the calendar time timep to broken-down time representation, expressed in UTC. The function returns NULL in case the input parameter is overflow. The result is stored in user-supplied struct.

2.1.314 timegm

Converts the broken-down time format to calendar time representation.

Prototype

```
source\kernel\time.c
time_t timegm(struct tm *tm_ptr)Parameters
tm_ptr[IN] – Pointer to a broken-down time format (tm structure).
```

Returns

- The calendar time value (SUCCESS)
- 0 (FAIL)

See Also

[mktime](#)

[gmtime_r](#)

[localtime_r](#)

[time_t](#)

TM STRUCT

Description

The timegm() function is the inverse of gmtime. It converts the broken-down time representation, expressed in UTC, to a calendar time format.

2.1.315 localtime_r

Converts the calendar time representation to broken-down time format.

Prototype

```
source\kernel\time.c
struct tm *localtime_r(
    const time_t *timep,
    struct tm     *result)
```

Parameters

timep[IN] — Pointer to a calendar time.

Result[OUT] — Pointer to a broken-down time (tm structure).

Returns

- pointer to user-supplied struct (SUCCESS)
- NULL (FAIL)

See Also

[mktime](#)

[timegm](#)

[localtime_r](#)

[time_t](#)

[TM STRUCT](#)

Description

The `localtime_r()` function converts the calendar time format to broken-down time representation, expressed relative to the user's specified timezone. The result is stored in a user-supplied structure.

2.1.316 `_timer_cancel`

Cancels an outstanding timer request.

Prototype

```
source\kernel\timer.c
#include <timer.h>
_mqx_uint _timer_cancel(
    _timer_id id)
```

Parameters

id [IN] — ID of the timer to be cancelled, from calling a function from the **`_timer_start`** family of functions

Returns

- `MQX_OK`
- Errors

Error	Description
<code>MQX_COMPONENT_DOES_NOT_EXIST</code>	Timer component is not created.
<code>MQX_INVALID_COMPONENT_BASE</code>	Timer component data is no longer valid.
<code>MQX_INVALID_PARAMETER</code>	<i>id</i> is not valid.
<code>MQX_CANNOT_CALL_FUNCTION_FROM_ISR</code>	Function cannot be called from an ISR.

See Also

[_timer_start_oneshot_after ...](#)

[_timer_start_oneshot_at ...](#)

[_timer_start_periodic_at ...](#)

[_timer_start_periodic_every ...](#)

Example

See `_timer_create_component()`.

2.1.317 `_timer_create_component`

Creates the timer component.

Prototype

```
source\kernel\timer.c
#include <timer.h>
_mqx_uint  _timer_create_component(
_mqx_uint  timer_task_priority,
_mqx_uint  timer_task_stack_size)
```

Parameters

timer_task_priority [IN] — Priority of Timer Task

timer_task_stack_size [IN] — Stack size (in single-addressable units) for Timer Task

Returns

- `MQX_OK` (success: see description)
- `MQX_OUT_OF_MEMORY` — MQX cannot allocate memory for Timer Task or for timer component data.
- `MQX_CANNOT_CALL_FUNCTION_FROM_ISR` — Function cannot be called from an ISR.

Traits

Creates Timer Task

See Also

[_timer_start_oneshot_after ...](#)

[_timer_start_oneshot_at ...](#)

[_timer_start_periodic_at ...](#)

[_timer_start_periodic_every ...](#)

[_timer_cancel](#)

Description

If the timer component is not explicitly created, MQX creates it with default values the first time that a task calls one of the functions from the `_timer_start` family.

The default values are:

- `TIMER_DEFAULT_TASK_PRIORITY`
- `TIMER_DEFAULT_STACK_SIZE`

The function returns `MQX_OK` if either:

- timer component is created
- timer component was previously created and the configuration is not changed

Example

Create the timer component, start a periodic timer that sets an event every 20 milliseconds, and later cancel the timer.

```
void timer_set_event
(
    _timer_id  timer_id,
    void       *event_ptr,
    uint32_t   seconds,
    uint32_t   milliseconds
)

{

    if (_event_set(event_ptr, 0x01) != MQX_OK) {
        printf("\nSet Event failed");
        _mqx_exit(1);
    }
}

Void TaskA(uint32_t parameter)
{
    _timer_id  timer;
    ...
    if (_timer_create_component(TIMER_TASK_PRIORITY,
        TIMER_TASK_STACK_SIZE)
        != MQX_OK){
        _mqx_exit(1);
    }

    if (_event_create("timer") == MQX_OK) {
        if (_event_open("timer", &event_ptr) == MQX_OK) {
            timer = _timer_start_periodic_every(timer_set_event,
                event_ptr,
                TIMER_KERNEL_TIME_MODE, 20L);
            if (timer == TIMER_NULL_ID) {
                printf("\n_timer_start_periodic_every() failed.");
                _mqx_exit(1L);
            }
            for (i = 0; i < 10; i++) {
                if (_event_wait_all(event_ptr, 0x01L, 0L) == MQX_OK) {
                    printf("\nEvent 0x01 was set");
                    if (_event_clear(event_ptr, 0x01L) != MQX_OK) {
                        _mqx_exit(1L);
                    }
                } else {
                    _mqx_exit(1L);
                }
            }
        }
    }
}
```

```
        }  
    }  
    _timer_cancel(timer);  
    ...  
}
```


2.1.318 _timer_start_oneshot_after ...

Start a timer that expires after the number of:	
<code>_timer_start_oneshot_after()</code>	Milliseconds
<code>_timer_start_oneshot_after_ticks()</code>	Ticks (in tick time)

Prototype

```
source\kernel\timer.c
#include <timer.h>
_timer_id _timer_start_oneshot_after(
    TIMER_NOTIFICATION_TIME_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    uint32_t milliseconds)

_timer_id _timer_start_oneshot_after_ticks(
    TIMER_NOTIFICATION_TICK_FPTR notification_function),
    void *notification_data_ptr,
    _mqx_uint mode,
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

notification_function [IN] — Notification function that MQX calls when the timer expires

notification_data_ptr [IN] — Data that MQX passes to the notification function

mode [IN] — Time to use when calculating the time to expire; one of the following:

TIMER_ELAPSED_TIME_

MODE (use `_time_get_elapsed()` or `_time_get_elapsed_ticks()`, which are not affected by `_time_set()` or `_time_set_ticks()`)

TIMER_KERNEL_TIME_

MODE (use `_time_get()` or `_time_get_ticks()`)

milliseconds [IN] — Milliseconds to wait before MQX calls the notification function and cancels the timer

tick_time_ptr [IN] — Ticks (in tick time) to wait before MQX calls the notification function and cancels the timer

Returns

- Timer ID (success)
- **TIMER_NULL_ID** (failure)

Task Error Codes

Task Error Code	Description
MQX_INVALID_COMPONENT_BASE	Timer component data is no longer valid.
MQX_INVALID_PARAMETER	One of the following: <ul style="list-style-type: none"> • mode is not one of the allowed modes • notification_function is NULL • milliseconds is 0 • tick_time_ptr is NULL
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for the timer data.

Traits

- Creates the timer component with default values if it was not previously created
- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_task_set_error](#)

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

[_timer_cancel](#)

[_timer_start_oneshot_at ...](#)

[_timer_start_periodic_at ...](#)

[_timer_start_periodic_every ...](#)

[_timer_create_component](#)

Description

The function calculates the expiry time based on *milliseconds* or (*tick_time_ptr*) and *mode*.

You might need to increase the Timer Task stack size to accommodate the notification function (see `_timer_create_component()`).

2.1.319 _timer_start_oneshot_at ...

Start a timer that expires once at the specified time in:	
<code>_timer_start_oneshot_at()</code>	Second/millisecond time
<code>_timer_start_oneshot_at_ticks()</code>	Tick time

Prototype

```
source\kernel\timer.c
#include <timer.h>
_timer_id _timer_start_oneshot_at(
    TIMER_NOTIFICATION_TIME_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    TIME_STRUCT_PTR ms_time_ptr)

#include <timer.h>
_timer_id _timer_start_oneshot_at_ticks(
    TIMER_NOTIFICATION_TICK_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

notification_function [IN] — Pointer to the notification function that MQX calls when the timer expires

notification_data_ptr [IN] — Pointer to the data that MQX passes to the notification function

mode [IN] — Time to use when calculating the time to expire; one of the following:

TIMER_ELAPSED_TIME_

MODE (use `_time_get_elapsed()` or `_time_get_elapsed_ticks()`, which are not affected by `_time_set()` or `_time_set_ticks()`)

TIMER_KERNEL_TIME_

MODE (use `_time_get()` or `_time_get_ticks()`)

ms_time_ptr [IN] — Pointer to the normalized second/millisecond time at which MQX calls the notification function and cancels the timer

tick_time_ptr [IN] — Pointer to the tick time at which MQX calls the notification function and cancels the timer

Returns

- Timer ID (success)
- **TIMER_NULL_ID** (failure)

Traits

- Creates the timer component with default values if it was not previously created

- On failure, calls `_task_set_error()` to set the task error code (see task error codes)

See Also

[_timer_cancel](#)

[_timer_start_one-shot_after ...](#)

[_timer_start_periodic_at ...](#)

[_timer_start_periodic_every ...](#)

[_task_set_error](#)

[_timer_create_component](#)

Description

When the timer expires, MQX calls *notification_function* with *timer_id*, *notification_data_ptr*, and the current time.

You might need to increase the Timer Task stack size to accommodate the notification function (see [_timer_create_component\(\)](#)).

Task error codes

Task Error Code	Description
MQX_INVALID_COMPONENT_BASE	Timer component data is no longer valid.
MQX_INVALID_PARAMETER	One of the following: <ul style="list-style-type: none"> • mode is not one of the allowed modes • notification_function is NULL • time_ptr is NULL
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for the timer data.

2.1.320 _timer_start_periodic_at ...

	Start a periodic timer at the specified time in:
<code>_timer_start_periodic_at()</code>	Second/millisecond time
<code>_timer_start_periodic_at_ticks()</code>	Tick time

Prototype

```
source\kernel\timer.c
#include <timer.h>
_timer_id _timer_start_periodic_at(
    TIMER_NOTIFICATION_TIME_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    TIME_STRUCT_PTR ms_time_start_ptr,
    uint32_t ms_wait)

#include <timer.h>
_timer_id _timer_start_periodic_at_ticks(
    TIMER_NOTIFICATION_TICK_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    MQX_TICK_STRUCT_PTR tick_time_start_ptr,
    MQX_TICK_STRUCT_PTR tick_time_wait_ptr)
```

Parameters

notification_function [IN] — Pointer to the notification function that MQX calls when the timer expires

notification_data_ptr [IN] — Pointer to the data that MQX passes to the notification function

mode [IN] — Time to use when calculating the time to expire; one of the following:

TIMER_ELAPSED_TIME_MODE (use `_time_get_elapsed()` or `_time_get_elapsed_ticks()`, which are not affected by `_time_set()` or `_time_set_ticks()`)

TIMER_KERNEL_TIME_MODE (use `_time_get()` or `_time_get_ticks()`)

ms_time_start_ptr [IN] — Pointer to the normalized second/millisecond time at which MQX starts calling the notification function

ms_wait [IN] — Milliseconds that MQX waits between subsequent calls to the notification function

tick_time_start_ptr [IN] — Pointer to the tick time at which MQX starts calling the notification function

tick_time_wait_ptr [IN] — Ticks (in tick time) that MQX waits between subsequent calls to the notification function

Returns

- Timer ID (success)
- **TIMER_NULL_ID** (failure)

Traits

- Creates the timer component with default values if it was not previously created
- On failure, calls **_task_set_error()** to set the task error code as described for **_timer_start_oneshot_at()**

See Also

[_timer_cancel](#)

[_timer_start_oneshot_after ...](#)

[_timer_start_oneshot_at ...](#)

[_timer_start_periodic_every ...](#)

[_time_get, _time_get_ticks](#)

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_task_set_error](#)

[_timer_create_component](#)

Description

You might need to increase the Timer Task stack size to accommodate the notification function (see **_timer_create_component()**).

2.1.321 _timer_start_periodic_every ...

	Start a periodic timer every number of:
<code>_timer_start_periodic_every()</code>	Milliseconds
<code>_timer_start_periodic_every_ticks()</code>	Ticks (in tick time)

Prototype

```
source\kernel\timer.c
#include <timer.h>
_timer_id _timer_start_periodic_every(
    TIMER_NOTIFICATION_TIME_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    uint32_t ms_wait)

#include <timer.h>
_timer_id _timer_start_periodic_every_ticks(
    TIMER_NOTIFICATION_TICK_FPTR notification_function,
    void *notification_data_ptr,
    _mqx_uint mode,
    MQX_TICK_STRUCT_PTR tick_time_wait_ptr)
```

Parameters

notification_function [IN] — Pointer to the notification function that MQX calls when the timer expires

notification_data_ptr [IN] — Pointer to the data that MQX passes to the notification function

mode [IN] — Time to use when calculating the time to expire; one of the following:

TIMER_ELAPSED_TIME_

MODE (use `_time_get_elapsed()` or `_time_get_elapsed_ticks()`, which are not affected by `_time_set()` or `_time_set_ticks()`)

TIMER_KERNEL_TIME_

MODE (use `_time_get()` or `_time_get_ticks()`)

ms_wait [IN] — Milliseconds that MQX waits before it first calls the notification function and between subsequent calls to the notification function

tick_time_wait_ptr [IN] — Ticks (in tick time) that MQX waits before it first calls the notification function and between subsequent calls to the notification function

Returns

- Timer ID (success)
- **TIMER_NULL_ID** (failure)

Traits

- Creates the timer component with default values if it was not previously created

- On failure, calls `_task_set_error()` to set the task error code as described for `_timer_start_oneshot_after()`

See Also

[_timer_cancel](#)

[_timer_start_oneshot_after ...](#)

[_timer_start_oneshot_at ...](#)

[_timer_start_periodic_at ...](#)

[_time_get, _time_get_ticks](#)

[_time_get_elapsed, _time_get_elapsed_ticks](#)

[_task_set_error](#)

[_timer_create_component](#)

Description

When the timer expires, MQX calls *notification_function* with *timer_id*, notifier data, and the current time.

You might need to increase the Timer Task stack size to accommodate the notification function (see `_timer_create_component()`).

Example

See `_timer_create_component()`.

2.1.322 _timer_test

Tests the timer component.

Prototype

```
source\kernel\timer.c
#include <timer.h>
_mqx_uint _timer_test(
    void *timer_error_ptr)
```

Parameters

timer_error_ptr [IN] — Pointer to the first timer entry that has an error

Error	Description
MQX_CORRUPT_QUEUE	Queue of timers is not valid.
MQX_INVALID_COMPONENT_HANDLE	One of the timer entries in the timer queue is not valid (<i>timer_error_ptr</i>).

Returns

- MQX_OK
- See errors

See Also

[_timer_start_oneshot_after ...](#)

[_timer_start_oneshot_at ...](#)

[_timer_start_periodic_at ...](#)

[_timer_start_periodic_every ...](#)

[_timer_cancel](#)

2.1.323 [_usr_lwevent_clear](#)

This function is an equivalent to the [_lwevent_clear](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_clear(
    LWEVENT_STRUCT_PTR event_group_ptr,
    _mqx_uint           bit_mask)
```

Parameters

event_group_ptr [IN, RO] — Pointer to the event group

bit_mask [IN] — Each set bit represents an event bit to clear

See Also

[_usr_lwevent_create](#)

[_usr_lwevent_destroy](#)

[_usr_lwevent_set](#), [_usr_lwevent_set_auto_clear](#)

[_usr_lwevent_wait_...](#)

[_usr_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

Description

See [_lwevent_clear\(\)](#).

2.1.324 `_usr_lwevent_create`

This function is an equivalent to the [_lwevent_create](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_create(
    LWEVENT_STRUCT_PTR lwevent_group_ptr,
    _mqx_uint flags)
```

Parameters

lwevent_group_ptr [IN, RO] — Pointer to the lightweight event group to initialize

flags [IN] — Creation flag; one of the following:

LWEVENT_AUTO_CLEAR - all bits in the lightweight event group are made autoclearing

0 - lightweight event bits are not set as autoclearing by default

note: the autoclearing bits can be changed any time later by calling

[_usr_lwevent_set_auto_clear](#).

See Also

[_usr_lwevent_destroy](#)

[_usr_lwevent_set](#), [_usr_lwevent_set_auto_clear](#)

[_usr_lwevent_clear](#)

[_usr_lwevent_wait_ ...](#)

[_usr_lwevent_get_signalled](#)

LWEVENT_STRUCT

Description:

See [_lwevent_create\(\)](#).

2.1.325 `_usr_lwevent_destroy`

This function is an equivalent to the `_lwevent_destroy` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_destroy(
    LWEVENT_STRUCT_PTR lwevent_group_ptr)
```

Parameters

lwevent_group_ptr [IN, RO] — Pointer to the event group to deinitialize

See Also

[_usr_lwevent_create](#)

[_usr_lwevent_set, _usr_lwevent_set_auto_clear](#)

[_usr_lwevent_clear](#)

[_usr_lwevent_wait_ ...](#)

[_usr_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

Description

See [_lwevent_destroy\(\)](#).

2.1.326 `_usr_lwevent_get_signalled`

This function is an equivalent to the `_lwevent_get_signalled` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_get_signalled(void)
```

Parameters

None

See Also

[_usr_lwevent_create](#)

[_usr_lwevent_destroy](#)

[_usr_lwevent_set, _usr_lwevent_set_auto_clear](#)

[_usr_lwevent_clear](#)

[_usr_lwevent_wait_ ...](#)

[LWEVENT_STRUCT](#)

Description

See [_lwevent_get_signalled\(\)](#).

2.1.327 `_usr_lwevent_set`

This function is an equivalent to the `_lwevent_set` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_set(
    LWEVENT_STRUCT_PTR lwevent_group_ptr,
    _mqx_uint flags)
```

Parameters

lwevent_group_ptr [IN, RO] — Pointer to the lightweight event group to set bits in

flags [IN] — Each bit represents an event bit to be set

See Also

[_usr_lwevent_create](#)

[_usr_lwevent_destroy](#)

[_usr_lwevent_set_auto_clear](#)

[_usr_lwevent_clear](#)

[_usr_lwevent_wait_ ...](#)

[_usr_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

Description:

See `_lwevent_set()`.

2.1.328 `_usr_lwevent_set_auto_clear`

This function is an equivalent to the [_lwevent_set_auto_clear](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_set_auto_clear(
    LWEVENT_STRUCT_PTR  lwevent_group_ptr,
    _mqx_uint            auto_mask)
```

Parameters

lwevent_group_ptr [IN, RO] — Pointer to the lightweight event group to set bits in
auto_mask [IN] — Mask of events, which become auto-clear (if corresponding bit of mask is set) or manual-clear (if corresponding bit of mask is clear)

See Also

[_usr_lwevent_create](#)

[_usr_lwevent_destroy](#)

[_usr_lwevent_set](#)

[_usr_lwevent_clear](#)

[_usr_lwevent_wait_ ...](#)

[_usr_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

Description:

See [_lwevent_set_auto_clear\(\)](#).

2.1.329 `_usr_lwevent_wait_ ...`

This function is an equivalent to the `_lwevent_wait_ ...` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

	Wait for the specified lightweight event bits to be set in the lightweight event group:
<code>_usr_lwevent_wait_for()</code>	For the number of ticks (in tick time)
<code>_usr_lwevent_wait_ticks()</code>	For the number of ticks
<code>_usr_lwevent_wait_until()</code>	Until the specified time (in tick time)

Prototype

```
source\kernel\lwevent.c
#include <lwevent.h>
_mqx_uint _usr_lwevent_wait_for(
    LWEVENT_STRUCT_PTR    event_ptr,
    _mx_uint               bit_mask,
    bool                   all,
    MQX_TICK_STRUCT_PTR    tick_ptr)

_mqx_uint _usr_lwevent_wait_ticks(
    LWEVENT_STRUCT_PTR    event_ptr,
    _mx_uint               bit_mask,
    bool                   all,
    _mx_uint               timeout_in_ticks)

_mqx_uint _usr_lwevent_wait_until(
    LWEVENT_STRUCT_PTR    event_ptr,
    _mx_uint               bit_mask,
    bool                   all,
    MQX_TICK_STRUCT_PTR    tick_ptr)
```

Parameters

event_ptr [IN, RO] — Pointer to the lightweight event

bit_mask [IN] — Each set bit represents an event bit to wait for

all — One of the following:

TRUE (wait for all bits in *bit_mask* to be set)

FALSE (wait for any bit in *bit_mask* to be set)

tick_ptr [IN] — One of the following:

pointer to the maximum number of ticks to wait

NULL (unlimited wait)

timeout_in_ticks [IN] — One of the following:

maximum number of ticks to wait

0 (unlimited wait)

See Also

[_usr_lwevent_create](#)

[_usr_lwevent_destroy](#)

[_usr_lwevent_set](#), [_usr_lwevent_set_auto_clear](#)

[_usr_lwevent_clear](#)

[_usr_lwevent_get_signalled](#)

[LWEVENT_STRUCT](#)

[MQX_TICK_STRUCT](#)

Description:

See [_lwevent_wait_ ...\(\)](#).

2.1.330 `_usr_lwmem_alloc`

This function is an equivalent to the [_lwmem_alloc ...](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmem.c  
void *_usr_lwmem_alloc(  
    _mem_size size)
```

Parameter

size [IN] — Number of single-addressable units to allocate

See Also

[_usr_lwmem_alloc_from](#)

[_usr_lwmem_create_pool](#)

[_usr_lwmem_free](#)

Description

See [_lwmem_alloc ...\(\)](#).

2.1.331 `_usr_lwmem_alloc_from`

This function is an equivalent to the `_lwmem_alloc_from` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmem.c
void *_usr_lwmem_alloc_from(
    _lwmem_pool_id  pool_id
    _mem_size       size)
```

Parameters

pool_id [IN, RW] — Lightweight-memory pool from which to allocate the lightweight-memory block (pool created with `_usr_lwmem_create_pool` or ordinary lightweight memory pool for which the user-mode access has been enabled by calling `_watchdog_create_component`)

size [IN] — Number of single-addressable units to allocate

See Also

[`_usr_lwmem_alloc`](#)

[`_usr_lwmem_create_pool`](#)

[`_usr_lwmem_free`](#)

Description

See `_lwmem_alloc_*_from()`.

2.1.332 `_usr_lwmem_create_pool`

This function is an equivalent to the [_lwmem_create_pool](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmem.c
_lwmem_pool_id _usr_lwmem_create_pool(
    LWMEM_POOL_STRUCT_PTR mem_pool_ptr,
    void *start,
    _mem_size size)
```

Parameters

mem_pool_ptr [IN, RW] — Pointer to the definition of the pool
start [IN] — Start of the memory for the pool
size [IN] — Number of single-addressable units in the pool

See Also

[_usr_lwmem_alloc](#)

[_usr_lwmem_alloc_from](#)

[_usr_lwmem_free](#)

Description

See [_lwmem_create_pool\(\)](#).

2.1.333 [_usr_lwmem_free](#)

This function is an equivalent to the [_lwmem_free](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmem.c
_mqx_uint _usr_lwmem_free(
    void *mem_ptr)
```

Parameters

mem_ptr [IN, RW] — Pointer to the block to free

See Also

[_usr_lwmem_alloc](#)

[_usr_lwmem_alloc_from](#)

[_usr_lwmem_create_pool](#)

Description

See [_lwmem_free\(\)](#).

2.1.334 `_usr_lwmsgq_init`

This function is an equivalent to the [_lwmsgq_deinit](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _usr_lwmsgq_init(
void *location,
_mqx_uint num_messages,
_mqx_uint msg_size)
```

Parameters

location [IN] — Pointer to memory to create a message queue.

num_message [IN] — Number of messages in the queue.

msg_size [IN] — Specifies message size as a multiplier factor of `_mqx_max_type` items.

See also

[_usr_lwmsgq_receive](#)

[_usr_lwmsgq_send](#)

Description

See [_lwmsgq_deinit\(\)](#).

2.1.335 `_usr_lwmsgq_receive`

This function is an equivalent to the [_lwmsgq_receive](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _usr_lwmsgq_receive(
void *handle,
_mqx_max_type_ptr message,
_mqx_uint flags,
_mqx_uint ticks,
MQX_TICK_STRUCT_PTR tick_ptr)
```

Parameters

- handle* [IN] — Pointer to the message queue created by `_lwmsgq_init`
- message* [OUT] — Received message
- flags* [IN] — LWMSGQ_RECEIVE_BLOCK_ON_EMPTY (block the reading task if msgq is empty), LWMSGQ_TIMEOUT_UNTIL (perform a timeout using the tick structure as the absolute time), LWMSGQ_TIMEOUT_FOR (perform a timeout using the tick structure as the relative time)
- ticks* [IN] — The maximum number of ticks to wait or NULL (unlimited wait).
- tick_ptr* [IN] — Pointer to the tick structure to use.

See also

[_usr_lwmsgq_init](#)

[_usr_lwmsgq_send](#)

Description

See [_lwmsgq_receive\(\)](#).

2.1.336 `_usr_lwmsgq_send`

This function is an equivalent to the [_lwmsgq_send](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmsgq.c
#include <lwmsgq.h>
#include <lwmsgq_prv.h>
_mqx_uint _usr_lwmsgq_send(
void *handle,
_mqx_max_type_ptr message,
_mqx_uint flags)
```

Parameters

handle [IN] — Pointer to the message queue created by `_lwmsgq_init`

message [IN] — Pointer to the message to send.

flags [IN] — LWMSGQ_SEND_BLOCK_ON_FULL — Block the task if queue is full.

LWMSGQ_SEND_BLOCK_ON_SEND — Block the task after the message is sent.

See also

[_usr_lwmsgq_init](#)

[_usr_lwmsgq_receive](#)

Description

See [_lwmsgq_send\(\)](#).

2.1.337 `_usr_lwsem_create`

This function is an equivalent to the [_lwsem_create](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwmem.c
_mqx_uint _usr_lwsem_create(
    LWSEM_STRUCT_PTR lwsem_ptr,
    _mqx_int         initial_count)
```

Parameters

lwsem_ptr [IN, RO] — Pointer to the lightweight semaphore to create
initial_count [IN] — Initial semaphore counter

See Also

[_usr_lwsem_destroy](#)

[_usr_lwsem_post](#)

[_usr_lwsem_wait ...](#)

Description

See [_lwsem_create\(\)](#).

2.1.338 [_usr_lwsem_destroy](#)

This function is an equivalent to the [_lwsem_destroy](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwsem.c
_mqx_uint _usr_lwsem_destroy(
    LWSEM_STRUCT_PTR  lwsem_ptr)
```

Parameters

lwsem_ptr [IN, RO] — Pointer to the created lightweight semaphore

See Also

[_usr_lwsem_create](#)

Description

See [_lwsem_destroy\(\)](#).

2.1.339 [_usr_lwsem_poll](#)

This function is an equivalent to the [_lwsem_poll](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwsem.c  
bool _usr_lwsem_poll(  
    LWSEM_STRUCT_PTR  lwsem_ptr)
```

Parameters

lwsem_ptr [IN, RO] — Pointer to the created lightweight semaphore

See Also

[_usr_lwsem_create](#)

[_usr_lwsem_wait ...](#) family

Description

See [_lwsem_poll\(\)](#).

2.1.340 `_usr_lwsem_post`

This function is an equivalent to the [_lwsem_post](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\lwsem.c
_mqx_uint _usr_lwsem_post(
    LWSEM_STRUCT_PTR  lwsem_ptr)
```

Parameters

lwsem_ptr [IN, RO] — Pointer to the created lightweight semaphore

See Also

[_usr_lwsem_create](#)

[_usr_lwsem_wait ...](#)

Description

See [_lwsem_post\(\)](#).

2.1.341 `_usr_lwsem_wait ...`

These functions are equivalents to `_lwsem_wait ...` API calls but they can be executed from within the User task or other code running in the CPU User mode. Parameters passed to these functions by pointer are required to meet the memory protection requirements as described in the parameter list below.

	Wait (in FIFO order) for the lightweight semaphore:
<code>_usr_lwsem_wait()</code>	Until it is available
<code>_usr_lwsem_wait_for()</code>	For the number of ticks (in tick time)
<code>_usr_lwsem_wait_ticks()</code>	For the number of ticks
<code>_usr_lwsem_wait_until()</code>	Until the specified time (in tick time)

Prototype

```
source\kernel\lwsem.c
#include <lwsem.h>
_mqx_uint _usr_lwsem_wait(
    LWSEM_STRUCT_PTR sem_ptr)

_mqx_uint _usr_lwsem_wait_for(
    LWSEM_STRUCT_PTR sem_ptr,
    MQX_TICK_STRUCT_PTR tick_time_timeout_ptr)

_mqx_uint _usr_lwsem_wait_ticks(
    LWSEM_STRUCT_PTR sem_ptr,
    _mqx_uint tick_timeout)

_mqx_uint _usr_lwsem_wait_until(
    LWSEM_STRUCT_PTR sem_ptr,
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

sem_ptr [IN, RO] — Pointer to the lightweight semaphore

tick_time_timeout_ptr [IN, RW] — One of the following:

pointer to the maximum number of ticks to wait

NULL (unlimited wait)

tick_timeout [IN] — One of the following:

maximum number of ticks to wait

0 (unlimited wait)

tick_time_ptr [IN, RW] — One of the following:

pointer to the time (in tick time) until which to wait

NULL (unlimited wait)

See Also

[_usr_lwsem_create](#)

[_usr_lwsem_post](#)

[LWSEM_STRUCT](#)

[MQX_TICK_STRUCT](#)

Description

See [_lwsem_wait ...\(\)](#).

2.1.342 `_usr_task_abort`

This function is an equivalent to the [_task_abort](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\task.c
_mqx_uint _usr_task_abort(
    _task_id task_id)
```

Parameters

task_id [IN] — One of the following:

task ID of the task to be destroyed

MQX_NULL_TASK_ID (abort the calling task)

See Also

[_usr_task_destroy](#)

Description

See [_task_abort\(\)](#).

2.1.343 `_usr_task_create`

This function is an equivalent to the `_task_create` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\task.c
_task_id _usr_task_create(
    _processor_number processor_number,
    _mqx_uint         template_index,
    uint32_t           parameter)
```

Parameters

processor_number [IN] — One of the following:

processor number of the processor where the task is to be created
0 (create on the local processor)

template_index [IN] — One of the following:

index of the task template in the processor's task template list to use for the child task
0 (use the task template that *create_parameter* defines)

parameter [IN]

template_index is not 0 — pointer to the parameter that MQX passes to the child task
template_index is 0 — pointer to the task template

See Also

[_usr_task_abort](#)

[_usr_task_destroy](#)

[_usr_task_ready](#)

[_usr_task_set_error](#)

[MQX_INITIALIZATION_STRUCT](#)

[TASK_TEMPLATE_STRUCT](#)

Description

See [_task_create](#), [_task_create_blocked](#), [_task_create_at](#).

2.1.344 `_usr_task_destroy`

This function is an equivalent to the [_task_destroy](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\task.c  
_mqx_uint _usr_task_destroy(  
    _task_id task_id)
```

Parameters

task_id [IN] — One of the following:

task ID of the task to be destroyed

MQX_NULL_TASK_ID (destroy the calling task)

See Also

[_usr_task_create](#)

[_usr_task_abort](#)

Description

See [_task_destroy\(\)](#).

2.1.345 [_usr_task_get_td](#)

This function is an equivalent to the [_task_get_td](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\task.c  
void *_usr_task_get_td(  
    _task_id task_id)
```

Parameters

task_id [IN] — One of:
task ID for a task on this processor
MQX_NULL_TASK_ID (use the current task)

See also

[_usr_task_ready](#)

Description

See [_task_get_td\(\)](#).

2.1.346 `_usr_task_ready`

This function is an equivalent to the `_task_ready` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\task.c  
void _usr_task_ready(  
    void *td_ptr)
```

Parameters

td_ptr [IN] — Pointer to the task descriptor of the task (on this processor) to be made ready

Description

See `_task_ready`.

2.1.347 `_usr_task_set_error`

This function is an equivalent to the [_task_set_error](#) API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\task.c
_mqx_uint _usr_task_set_error(
    _mqx_uint error_code)
```

Parameters

error_code [IN] — Task error code

Description

See [_task_set_error\(\)](#).

2.1.348 `_usr_time_delay ...`

These functions are equivalents to [_time_delay ...](#) API calls but they can be executed from within the User task or other code running in the CPU User mode. Parameters passed to these functions by pointer are required to meet the memory protection requirements as described in the parameter list below.

Suspend the active task:	
<code>_usr_time_delay()</code>	For the number of milliseconds
<code>_usr_time_delay_ticks()</code>	For the number of ticks

Prototype

```
source\kernel\time.c
void _usr_time_delay(
    uint32_t ms_delay)

void _usr_time_delay_ticks(
    _mqx_uint tick_delay)
```

Parameters

ms_delay [IN] — Minimum number of milliseconds to suspend the task

tick_delay [IN] — Minimum number of ticks to suspend the task

See Also

[_usr_time_get_elapsed_ticks](#)

Description

See [_time_delay ...\(\)](#).

2.1.349 `_usr_time_get_elapsed_ticks`

This function is an equivalent to the `_time_get_elapsed_ticks` API call but it can be executed from within the User task or other code running in the CPU User mode. Parameters passed to this function by pointer are required to meet the memory protection requirements as described in the parameter list below.

Prototype

```
source\kernel\time.c  
void _usr_time_get_elapsed_ticks(  
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

timetick_time_ptr [OUT, RW] — Where to store the elapsed tick time

See Also

[_usr_time_delay ...](#)

[MQX_TICK_STRUCT](#)

Description

See [_time_get_elapsed](#), [_time_get_elapsed_ticks\(\)](#).

2.1.350 `_watchdog_create_component`

Creates the watchdog component.

Prototype

```
source\kernel\watchdog.c
#include <watchdog.h>
_mqx_uint _watchdog_create_component(
    _mx_uint      timer_interrupt_vector,
    WATCHDOG_ERROR_FPTR expiry_function)
```

Parameters

timer_interrupt_vector [IN] — Periodic timer interrupt vector number

expiry_function [IN] — Function that MQX calls when a watchdog expires

Returns

- MQX_OK (success: see description)
- Errors (failure)

Errors	Description
MQX_OUT_OF_MEMORY	MQX cannot allocate memory for watchdog component data.
WATCHDOG_INVALID_ERROR_FUNCTION	<i>expiry_function</i> is <i>NULL</i> .
WATCHDOG_INVALID_INTERRUPT_VECTOR	MQX cannot install the periodic timer interrupt vector.

See Also

[_watchdog_start](#), [_watchdog_start_ticks](#)

[_watchdog_stop](#)

Description

An application must explicitly create the watchdog component before tasks can use watchdogs.

The function returns **MQX_OK** if either:

- watchdog component is created
- watchdog component was previously created and the configuration is not changed

Example

```
_mx_uint result;
extern void task_watchdog_error(TD_STRUCT_PTR td_ptr);
...
/* Create watchdog component. */
```

```
result = _watchdog_create_component(TIMER_INTERRUPT_VECTOR,
    task_watchdog_error);
if (result != MQX_OK) {
    /* An error occurred. */
}
```


2.1.351 `_watchdog_start`, `_watchdog_start_ticks`

Starts or restart the watchdog.

Prototype

```
source\kernel\watchdog.c
#include <watchdog.h>
bool _watchdog_start(
    uint32_t ms_time)

bool _watchdog_start_ticks(
    MQX_TICK_STRUCT_PTR tick_time_ptr)
```

Parameters

ms_time [IN] — Milliseconds until the watchdog expires

tick_time_ptr [IN] — Pointer to the number of ticks until the watchdog expires

Returns

- TRUE (success)
- FALSE (failure: see description)

See also

[_time_to_ticks](#)

[_usr_lwevent_clear](#)

[_watchdog_stop](#)

[MQX_TICK_STRUCT](#)

Description

The function returns *FALSE* if either of these conditions is true:

- watchdog component was not previously created
- watchdog component data is no longer valid

Example

```
while (1) {
    _watchdog_stop();
    msg_ptr = _msgq_receive(MSGQ_ANY_QUEUE, 0);
    /* Start the watchdog to expire in 2 seconds, in case we
    ** don't finish in that time.
    */
    _watchdog_start(2000);
    ...
    /* Do the work. */
    ...
}
```

2.1.352 `_watchdog_stop`

Stops the watchdog.

Prototype

```
source\kernel\watchdog.c  
#include <watchdog.h>  
bool _watchdog_stop(void)
```

Parameters

None

Returns

- TRUE (success)
- FALSE (failure: see description)

See also

[_usr_lwevent_clear](#)

[_watchdog_start](#), [_watchdog_start_ticks](#)

Description

The function returns *FALSE* if any of these conditions is true:

- watchdog component was not previously created
- watchdog component data is no longer valid
- watchdog was not started

Example

See `_usr_lwevent_clear()`.

2.1.353 `_watchdog_test`

Tests the watchdog component data.

Prototype

```
source\kernel\watchdog.c
#include <watchdog.h>
_mqx_uint _watchdog_test(
    void *watchdog_error_ptr,
    void *watchdog_table_error_ptr)
```

Parameters

watchdog_error_ptr [OUT] — Pointer to the watchdog component base that has an error (*NULL* if no errors are found)

watchdog_table_error_ptr [OUT] — Pointer to the watchdog table that has an error (always *NULL*)

Returns

- `MQX_OK` (see description)
- `MQX_INVALID_COMPONENT_BASE` (an error was found)

See Also

[_usr_lwevent_clear](#)

[_watchdog_start, _watchdog_start_ticks](#)

[_watchdog_stop](#)

Description

The function returns **MQX_OK** if either:

- it did not find an error in watchdog component data
- watchdog component was not previously created

Example

```
void *watchdog_error;
void *watchdog_table_error;
...
if (_watchdog_test(&watchdog_error, &watchdog_table_error) != MQX_OK) {
    /* Watchdog component is corrupted. */
}
```

2.1.354 MSG_MUST_CONVERT_DATA_ENDIAN

Determines whether the data portion of the message needs to be converted to the other endian format.

Prototype

```
source\include\message.h  
bool MSG_MUST_CONVERT_DATA_ENDIAN(  
    unsigned char  endian_format)
```

Parameters

endian_format [IN] — Endian format of the message

Returns

- TRUE
- FALSE

See Also

[_mem_swap_endian](#)

[_msg_swap_endian_data](#)

[MSG_MUST_CONVERT_HDR_ENDIAN](#)

[MESSAGE_HEADER_STRUCT](#)

Example

See `_msg_swap_endian_data()`.

2.1.355 MSG_MUST_CONVERT_HDR_ENDIAN

Determines whether the header portion of the message needs to be converted to the other endian format.

Prototype

```
source\include\message.h  
bool MSG_MUST_CONVERT_HDR_ENDIAN(  
    unsigned char  endian_format)
```

Parameters

endian_format [IN] — Endian format of the message

Returns

- TRUE
- FALSE

See Also

[_mem_swap_endian](#)

[_msg_swap_endian_header](#)

[_msg_swap_endian_data](#)

[MSG_MUST_CONVERT_DATA_ENDIAN](#)

[MESSAGE_HEADER_STRUCT](#)

Example

See `_msg_swap_endian_header()`.

Chapter 3 MQX Data Types

3.1 Data Types Overview

Table 3-1. Data Types for Compiler Portability

Data type	Size	Description
<code>_mqx_int</code>	See note 1	See note 1
<code>_mqx_uint</code>	See note 1	See note 1
<code>_mqx_max_type</code>		Largest type available (e.g., on a 32-bit processor, <code>_mqx_max_type</code> is defined as <code>uint32_t</code>)
<code>_mqx_max_type_ptr</code>	See note 3	Pointer to <code>_mqx_max_type</code>
<code>_mem_size</code>	See note 2	See note 2
<code>_mem_size_ptr</code>	See note 3	Pointer to <code>_mem_size</code>
<code>_psp_code_addr</code>	Large enough to hold the address of a code location	
<code>_psp_code_addr_ptr</code>	See note 3	Pointer to <code>_psp_code_addr</code>
<code>_psp_data_addr</code>	Large enough to hold the address of a data location	
<code>_psp_data_addr_ptr</code>	See note 3	Pointer to <code>_psp_data_addr</code>
<code>_file_size</code>	<code>uint32_t</code>	Number of bytes in a file
<code>_file_offset</code>	<code>int32_t</code>	Maximum offset (in bytes) in a file
<code>ieee_single</code>	32 bits	Single-precision IEEE floating-point number
<code>ieee_double</code>	32 or 64 bits depending on the compiler	Double-precision IEEE floating-point number

¹ `_mqx_int`, `_mqx_uint`: MQX determines the size of `_mqx_int` and `_mqx_uint` from the natural size of the processor. They are defined in `psptypes.h` for the PSP. For example, on a 16-bit processor, `_mqx_uint` (`_mqx_int`) is defined as `uint16_t` (`int16_t`). On a 32-bit processor, `_mqx_uint` (`_mqx_int`) is defined as `uint32_t` (`int32_t`).

- ² **_mem_size**: MQX equates **_mem_size** to the type that can hold the maximum data address for the processor. It is defined in *psptypes.h* for the PSP.
- ³ ***_ptr** are large enough to hold a data address (**_mem_size**).

Table 3-2. MQX Simple Data Types

Name	Data type	Defined in
—	_CODE_PTR_	<i>psptypes.h</i> for the PSP
_lwmem_pool_id	void*	lwmem.h
_mem_pool_id	void*	mqx.h
_msg_size	uint16_t	message.h
_partition_id	void*	part.h
_pool_id	void*	message.h
_processor_number	uint16_t	mqx.h
_queue_id	uint16_t or uint32_t	message.h
_queue_number	uint16_t or uint32_t	message.h
_task_id	uint32_t	mqx.h
_timer_id	_mqx_uint	timer.h

Starting with MQX 4.1.0, legacy MQX custom integer types were replaced by the Standard C99 set (int_32 -> int32_t, boolean -> bool, etc). The *psptypes_legacy.h* header file is provided with the set of backward compatible type definitions to make the transition to the new types easier.

3.2 MQX Complex Data Types in Alphabetical Order

3.2.1 DATE_STRUCT

Date structure for time.

Prototype

```
#include <mqx.h>
typedef
{
    int16_t YEAR;
    int16_t MONTH;
    int16_t DAY;
    int16_t HOUR;
    int16_t MINUTE;
    int16_t SECOND;
    int16_t MILLISEC;
    int_16 WDAY;
    int_16 YDAY;
} DATE_STRUCT, * DATE_STRUCT_PTR;
```

See Also

[_time_from_date](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

[_time_to_date](#)

TIME_STRUCT

Field	Range	
	From	To
YEAR	1970	2099
MONTH	1	12
DAY	1	28, 29, 30, 31 (depending on the month)
HOUR	0	23
MINUTE	0	59
SECOND	0	59
MILLISEC	0	999
WDAY	0	6
YDAY	0	365

CAUTION

If you violate the ranges, undefined behavior results.

Example

See `_time_from_date()`.

3.2.2 IPC_PCB_INIT_STRUCT

Initialization structure for IPCs over PCB devices.

Prototype

```
#include <mqx.h>
#include <ipc.h>
#include <ipc_pcb.h>
typedef struct ipc_pcb_init_struct {
    char          *IO_PCB_DEVICE_NAME;
    IPC_PCB_DEVINSTALL_FPTR DEVICE_INSTALL;
    void          *DEVICE_INSTALL_PARAMETER;
    uint16_t      IN_MESSAGES_MAX_SIZE;
    uint16_t      IN_MESSAGES_TO_ALLOCATE;
    uint16_t      IN_MESSAGES_TO_GROW;
    uint16_t      IN_MESSAGES_MAX_ALLOCATE;
    uint16_t      OUT_PCBS_INITIAL;
    uint16_t      OUT_PCBS_TO_GROW;
    uint16_t      OUT_PCBS_MAX;
} IPC_PCB_INIT_STRUCT, * IPC_PCB_INIT_STRUCT_PTR;
```

See Also

[_ipc_pcb_init](#)

Fields

Field	Description
IO_PCB_DEVICE_NAME	String name of the PCB device driver to be opened by the IPC.
DEVICE_INSTALL	Function to call to install the PCB device (if required)
DEVICE_INSTALL_PARAMETER	Parameter to pass to the installation function.
IN_MESSAGES_MAX_SIZE	Maximum size of all messages arriving at the IPC.
IN_MESSAGES_TO_ALLOCATE	Initial number of input messages to allocate.
IN_MESSAGES_TO_GROW	Number of input messages to add to the pool when messages are all in use.
IN_MESSAGES_MAX_ALLOCATE	Maximum number of messages in the input message pool.
OUT_PCBS_INITIAL	Initial number of PCBs in the output PCB pool.
OUT_PCBS_TO_GROW	Number of PCBs to add to the output PCB pool when all the PCBs are in use.
OUT_PCBS_MAX	Maximum number of PCBs in the output PCB pool.

3.2.3 IPC_PROTOCOL_INIT_STRUCT

IPC initialization information.

Prototype

```
source\ipc\ipc.h
typedef struct ipc_protocol_init_struct
{
    IPC_INIT_FPTR  IPC_PROTOCOL_INIT;
    void           *IPC_PROTOCOL_INIT_DATA;
    char           *IPC_NAME;
    _queue_number  IPC_OUT_QUEUE;
} IPC_PROTOCOL_INIT_STRUCT, * IPC_PROTOCOL_INIT_STRUCT_PTR;
```

See Also

[IPC_ROUTING_STRUCT](#)

[IPC_INIT_STRUCT](#)

Description

The *_ipc_init_table[]* (an array of entries of type **IPC_PROTOCOL_INIT_STRUCT**) defines the communication paths between processors (IPCs). The table is terminated by a zero-filled entry.

Fields

Field	Description
IPC_PROTOCOL_INIT	Function that initializes the IPC. The function depends on the IPC.
IPC_PROTOCOL_INIT_DATA	Pointer to the initialization data that is specific to the IPC protocol. The format of the data depends on the IPC.
IPC_NAME	String name that identifies the IPC.
IPC_OUT_QUEUE	Queue number of the output queue to which MQX routes messages that are to be sent to the remote processor. The queue number must match a queue number that is in the IPC routing table.

3.2.4 IPC_ROUTING_STRUCT

Entry in the IPC routing table for interprocessor communication.

Prototype

```
source\ipc\ipc.h
typedef struct ipc_routing_struct
{
    _processor_number    MIN_PROC_NUMBER;
    _processor_number    MAX_PROC_NUMBER;
    _queue_number        QUEUE;
} IPC_ROUTING_STRUCT, * IPC_ROUTING_STRUCT_PTR;
```

See Also

[IPC_PROTOCOL_INIT_STRUCT](#)

[IPC_INIT_STRUCT](#)

Description

Defines an entry in the table *_ipc_routing_table[]*, which has an entry for each remote processor that the processor communicates with. The table is terminated with a zero-filled entry.

Fields

Field	Description
MIN_PROC_NUMBER MAX_PROC_NUMBER	Range of processors that can be accessed from the communication path. In most cases, the values are equal, indicating that the end of the communication is occupied by one processor. In some cases, the processor at the end of the path is connected to other processors, in which case the processor might also act as a gateway.
QUEUE	Queue number of the IPC output queue.

3.2.5 IPC_INIT_STRUCT

IPC initialization structure that is passed to the `_ipc_task` function as a creation parameter.

Prototype

```
source\ipc\ipc.h
typedef struct ipc_init_struct
{
    const IPC_ROUTING_STRUCT *    ROUTING_LIST_PTR;
    const IPC_PROTOCOL_INIT_STRUCT *  PROTOCOL_LIST_PTR;
} IPC_INIT_STRUCT, * IPC_INIT_STRUCT_PTR;
```

See Also

[IPC_PROTOCOL_INIT_STRUCT](#)

[IPC_ROUTING_STRUCT](#)

Description

This structure allows both user defined IPC routing table and IPC initialization table to be passed to the `_ipc_task`.

Fields

Field	Description
ROUTING_LIST_PTR	Pointer to the IPC routing table.
PROTOCOL_LIST_PTR	Pointer to the IPC initialization table.

3.2.6 LOG_ENTRY_STRUCT

Header of an entry in a user log.

Prototype

```
#include <log.h>
typedef struct log_entry_header_struct
{
    _mqx_uint    SIZE;
    _mqx_uint    SEQUENCE_NUMBER;
    uint32_t     SECONDS;
    uint16_t     MILLISECONDS;
    uint16_t     MICROSECONDS;
} LOG_ENTRY_STRUCT, * LOG_ENTRY_STRUCT_PTR;
```

See Also

[_log_read](#)

[_log_write](#)

Description

The length of the entry depends on the **SIZE** field.

Fields

Field	Description
SIZE	Number of long words in the entry.
SEQUENCE_NUMBER	Sequence number for the entry.
SECONDS MILLISECONDS MICROSECONDS	Time at which MQX wrote the entry.

3.2.7 LWEVENT_STRUCT

Lightweight event group.

Prototype

```
#include <lwevent.h>
typedef struct lwevent_struct
{
    QUEUE_ELEMENT_STRUCT  LINK;
    QUEUE_STRUCT          WAITING_TASKS;
    _mqx_uint             VALID;
    _mqx_uint             VALUE;
    _mqx_uint             FLAGS;
    _mqx_uint             AUTO;
} LWEVENT_STRUCT, * LWEVENT_STRUCT_PTR;
```

See Also

[_lwevent_clear](#)

[_lwevent_create](#)

[_lwevent_destroy](#)

[_lwevent_set](#)

[_lwevent_set_auto_clear](#)

[_lwevent_wait_ ...](#)

Fields

Field	Description
LINK	Queue data structures.
WAITING_TASKS	Queue of tasks waiting for event bits to be set.
VALID	Validation stamp.
VALUE	Current bit value of the lightweight event group.
FLAGS	Flags associated with the lightweight event group; currently only LWEVENT_AUTO_CLEAR.
AUTO	Mask specifying lightweight event bits that are configured as auto-clear.

3.2.8 LWLOG_ENTRY_STRUCT

Entry in kernel log or a lightweight log.

Prototype

```
#include <lwlog.h>
typedef struct lwlog_entry_struct
{
    _mqx_uint      SEQUENCE_NUMBER;
    #if MQX_LWLOG_TIME_STAMP_IN_TICKS == 0
        uint32_t      SECONDS;
        uint32_t      MILLISECONDS;
        uint32_t      MICROSECONDS;
    #else
        MQX_TICK_STRUCT TIMESTAMP;
    #endif
    _mqx_max_type   DATA[LWLOG_MAXIMUM_DATA_ENTRIES];
    struct lwlog_entry_struct
        *NEXT_PTR;
} LWLOG_ENTRY_STRUCT, * LWLOG_ENTRY_STRUCT_PTR;
```

See Also

[_lwlog_read](#)

[_lwlog_write](#)

Fields

Field	Description
SEQUENCE_NUMBER	The sequence number for the entry.
SECONDS MILLISECONDS MICROSECONDS	The time at which the entry was written if MQX is not configured at compile time to timestamp in ticks.
TIMESTAMP	The time in tick time at which the entry was written if MQX is configured at compile time to timestamp in ticks.
DATA	Data for the entry.
NEXT_PTR	Pointer to the next lightweight-log entry.

3.2.9 LWSEM_STRUCT

Lightweight semaphore.

Prototype

```
#include <mqx.h>
typedef struct lwsem_struct
{
    struct lwsem_struct      *NEXT;
    struct lwsem_struct      *PREV;
    QUEUE_STRUCT             TD_QUEUE;
    _mqx_uint                VALID;
    _mqx_int                 VALUE;
} LWSEM_STRUCT, * LWSEM_STRUCT_PTR;
```

See Also

[_lwsem_create](#)

Fields

Field	Description
NEXT	Pointer to the next lightweight semaphore in the list of lightweight semaphores.
PREV	Pointer to the previous lightweight semaphore in the list of lightweight semaphores.
TD_QUEUE	Manages the queue of tasks that are waiting for the lightweight semaphore. The NEXT and PREV fields in the task descriptors link the tasks.
VALID	When MQX creates the lightweight semaphore, it initializes the field. When MQX destroys the lightweight semaphore, it clears the field.
VALUE	Count of the semaphore. MQX decrements the field when a task waits for the semaphore. If the field is not 0, the task gets the semaphore. If the field is 0, MQX puts the task in the lightweight semaphore queue until the count is a non-zero value.

3.2.10 LWTIMER_PERIOD_STRUCT

Lightweight timer queue.

Prototype

```
typedef struct lwtimer_period_struct
{
    QUEUE_ELEMENT_STRUCT  LINK;
    _mqx_uint              PERIOD;
    _mqx_uint              EXPIRY;
    _mqx_uint              WAIT;
    QUEUE_STRUCT           TIMERS;
    LWTIMER_STRUCT_PTR     TIMER_PTR;
    _mqx_uint              VALID;
} LWTIMER_PERIOD_STRUCT, * LWTIMER_PERIOD_STRUCT_PTR;
```

See Also

[LWTIMER_STRUCT](#)

Description

The structure controls any number of lightweight timers that expire at the same periodic rate as defined by the structure.

Fields

Field	Description
LINK	Queue of lightweight timers.
PERIOD	Period (in ticks) of the timer queue; a multiple of BSP_ALARM_RESOLUTION.
EXPIRY	Number of ticks that have elapsed in the period.
WAIT	Number of ticks to wait before starting to process the queue.
TIMERS	Queue of timers to expire at the periodic rate.
TIMER_PTR	Pointer to the last timer that was processed.
VALID	When the timer queue is created, MQX initializes the field. When the queue is cancelled, MQX clears the field.

3.2.11 LWTIMER_STRUCT

Lightweight timer.

Prototype

```
typedef struct lwtimer_struct
{
    QUEUE_ELEMENT_STRUCT  LINK;
    _mqx_uint              RELATIVE_TICKS;
    _mqx_uint              VALID;
    LWTIMER_ISR_FPTR       TIMER_FUNCTION;
    void                   *PARAMETER;
    void                   *PERIOD_PTR;
} LWTIMER_STRUCT, * LWTIMER_STRUCT_PTR;
```

See Also

[LWTIMER_PERIOD_STRUCT](#)

Description

With lightweight timers, a timer function is called at a periodic interval.

Fields

Field	Description
LINK	Queue data structures.
RELATIVE_TICKS	Relative number of ticks until the timer is to expire.
VALID	When the timer is added to the timer queue, MQX initializes the field. When the timer or the timer queue that the timer is in is cancelled, MQX clears the field.
TIMER_FUNCTION	Function that is called when the timer expires.
PARAMETER	Parameter that is passed to the timer function.
PERIOD_PTR	Pointer to the lightweight timer queue to which the timer is attached.

3.2.12 MESSAGE_HEADER_STRUCT

Message header.

Prototype

```
#include <message.h>
typedef struct message_header_struct
{
    _msg_size      SIZE;
#ifdef MQX_USE_32BIT_MESSAGE_QIDS
    uint16_t       PAD;
#endif
    _queue_id      TARGET_QID;
    _queue_id      SOURCE_QID;
    unsigned char   CONTROL;
#ifdef MQX_USE_32BIT_MESSAGE_QIDS
    unsigned char   RESERVED[3];
#else
    unsigned char   RESERVED;
#endif
} MESSAGE_HEADER_STRUCT, * MESSAGE_HEADER_STRUCT_PTR;
```

See Also

[_msg_alloc](#)

[_msg_alloc_system](#)

[_msg_free](#)

[_msgq_poll](#)

[_msgq_receive ...](#)

[_msgq_send](#)

Description

All messages must start with a message header.

Fields

Field	Description
SIZE	Number of single-addressable units in the message, including the header. The maximum value is MAX_MESSAGE_SIZE. The application sets the field.
TARGET_QID	Queue ID of the queue to which MQX is to send the message. The application sets the field.
SOURCE_QID	Queue ID of a message queue that is associated with the sending task. When messages are allocated, this field is initialized to MSGQ_NULL_QUEUE_ID. If the sending task does not have a message queue associated with it, MQX does not use this field.
CONTROL	Indicates the following for the message: endian format priority urgency
RESERVED	Not used

Example

See `_msgq_send()`.

3.2.13 MQX_INITIALIZATION_STRUCT

MQX initialization structure for each processor.

Prototype

```
#include <mqx.h>
typedef struct MQX_initialization_struct
{
    _mqx_uint    PROCESSOR_NUMBER;
    void         *START_OF_KERNEL_MEMORY;
    void         *END_OF_KERNEL_MEMORY;
    _mqx_uint    INTERRUPT_STACK_SIZE
    TASK_TEMPLATE_STRUCT_PTR
                TASK_TEMPLATE_LIST;
    _mqx_uint    MQX_HARDWARE_INTERRUPT_LEVEL_MAX;
    _mqx_uint    MAX_MSGPOOLS;
    _mqx_uint    MQX_MSGQS;
    char         *IO_CHANNEL;
    char         *IO_OPEN_MODE;
    _mqx_uint    RESERVED[2];
} MQX_INITIALIZATION_STRUCT, * MQX_INITIALIZATION_STRUCT_PTR;
```

See Also

[_mqx](#)

[_task_create, _task_create_blocked, _task_create_at](#)

[_task_get_processor](#)

TASK_TEMPLATE_STRUCT

Description

When an application starts MQX on each processor, it calls **_mqx()** with the MQX initialization structure.

Fields

Field	Description
PROCESSOR_NUMBER	Application-unique processor number of the processor. Minimum is 1, maximum is 255. (Processor number 0 is reserved and is used by tasks to indicate their local processor.)
START_OF_KERNEL_MEMORY	Lowest address from which MQX allocates dynamic memory and task stacks.
END_OF_KERNEL_MEMORY	Highest address from which MQX allocates dynamic memory and task stacks. It is the application's responsibility to allocate enough memory for all tasks.
INTERRUPT_STACK_SIZE	Maximum number of single-addressable units used by all ISR stacks.
TASK_TEMPLATE_LIST	Pointer to the task template list for the processor. The default name for the list is <i>MQX_template_list</i> [].
MQX_HARDWARE_INTERRUPT_LEVEL_MAX	Hardware priority at which MQX runs (for processors with multiple interrupt priority levels). All tasks and interrupts run at lower priority.
MAX_MSGPOOLS	Maximum number of message pools.
MQX_MSGQS	Maximum number of message queues. Minimum is MSGQ_FIRST_USER_QUEUE, maximum is 255.
IO_CHANNEL	Pointer to the string that indicates which device to use as the default. The function <code>_io_fopen()</code> uses the string for default I/O.
IO_OPEN_MODE	Parameter that MQX passes to the device initialization function when it opens the device.
RESERVED	Reserved for future enhancements to MQX; each element of the array must be initialized to 0.

Example

Typical MQX initialization structure.

```
MQX_INITIALIZATION_STRUCT MQX_init_struct =
{
    /* PROCESSOR_NUMBER */          /* 1,
    /* START_OF_KERNEL_MEMORY */    /* (void*)(0x40000),
    /* END_OF_KERNEL_MEMORY */      /* (void*)(0x2effff),
    /* INTERRUPT_STACK_SIZE */      /* 500,
    /* TASK_TEMPLATE_LIST */        /* (void*)template_list,
    /* MQX_HARDWARE_INTERRUPT_LEVEL_MAX */ /* 6,
    /* MAX_MSGPOOLS */              /* 60,
    /* MQX_MSGQS */                 /* 255,
    /* IO_CHANNEL */                 /* BSP_DEFAULT_IO_CHANNEL,
    /* IO_OPEN_MODE */              /* BSP_DEFAULT_IO_OPEN_MODE
};
```


3.2.14 MQX_TICK_STRUCT

MQX internally keeps time in ticks.

Prototype

```
typedef struct mqx_tick_struct
{
    _mqx_uint  TICKS[MQX_NUM_TICK_FIELDS];
    uint32_t   HW_TICKS;
} MQX_TICK_STRUCT, * MQX_TICK_STRUCT_PTR;
See also
```

All functions that end with **_ticks**

Fields

Field	Description
TICKS[]	Ticks since MQX started. The field is a minimum of 64 bits; the exact size depends on the PSP.
HW_TICKS	Hardware ticks (timer counter increments) between ticks. The field increases the accuracy over counting the time simply in ticks.

3.2.15 MUTEX_ATTR_STRUCT

Mutex attributes, which are used to initialize a mutex.

Prototype

```
#include <mutex.h>
typedef struct mutex_attr_struct
{
    _mqx_uint    SCHED_PROTOCOL;
    _mqx_uint    VALID;
    _mqx_uint    PRIORITY_CEILING;
    _mqx_uint    COUNT;
    _mqx_uint    WAIT_PROTOCOL;
} MUTEX_ATTR_STRUCT, * MUTEX_ATTR_STRUCT_PTR;
```

See Also

[_mutatr_destroy](#)

[_mutatr_init](#)

Fields

Field	Description
SCHED_PROTOCOL	Scheduling protocol; one of the following: <ul style="list-style-type: none"> • MUTEX_NO_PRIO_INHERIT • MUTEX_PRIO_INHERIT • MUTEX_PRIO_PROTECT • MUTEX_PRIO_INHERIT MUTEX_PRIO_PROTECT
VALID	When a task calls <code>_mutatr_init()</code> , MQX sets the field to <code>MUTEX_VALID</code> (defined in <i>mutex.h</i>) and does not change it. If the field changes, MQX considers the attributes invalid. The function <code>_mutatr_init()</code> sets the field to <code>TRUE</code> ; <code>_mutatr_destroy()</code> sets it to <code>FALSE</code> .
PRIORITY_CEILING	Priority of the mutex; applicable only if the scheduling protocol is priority protect.
COUNT	Number of spins to use if the waiting protocol is limited spin.
WAIT_PROTOCOL	Waiting protocol; one of the following: <ul style="list-style-type: none"> • MUTEX_SPIN_ONLY • MUTEX_LIMITED_SPIN • MUTEX_QUEUEING • MUTEX_PRIORITY_QUEUEING

3.2.16 MUTEX_STRUCT

A mutex.

Prototype

```
#include <mutex.h>
typedef struct mutex_struct
{
    void            *NEXT;
    void            *PREV;
    _mqx_uint        POLICY;
    _mqx_uint        VALID;
    _mqx_uint        PRIORITY;
    _mqx_uint        COUNT;
    uint16_t         DELAYED_DESTROY;
    unsigned char    LOCK;
    unsigned char    FILLER;
    QUEUE_STRUCT     WAITING_TASKS;
    void            *OWNER_TD;
    _mqx_uint        BOOSTED;
} MUTEX_STRUCT;
```

See Also

[_mutex_destroy](#)

[_mutex_init](#)

MUTEX_ATTR_STRUCT

Fields

Field	Description
NEXT PREV	Queue of mutexes. MQX stores the start and end of the queue in MUTEXES of the MUTEX_COMPONENT_STRUCT.
PROTOCOLS	Waiting protocol (most significant word) and scheduling protocol (least significant word) for the mutex.
VALID	When a task calls <code>_mutex_init()</code> , MQX sets the field to <code>MUTEX_VALID</code> (defined in <i>mutex.h</i>) and does not change it. If the field changes, MQX considers the mutex invalid.
PRIORITY_CEILING	Priority of the mutex. If the scheduling protocol is priority protect, MQX grants the mutex only to tasks with at least this priority.
COUNT	Maximum number of spins. The field is used only if the waiting protocol is limited spin.
DELAYED_DESTROY	<i>TRUE</i> if the mutex is being destroyed.
LOCK	Most significant bit is set when the mutex is locked.
FILLER	Not used.

WAITING_TASKS	Queue of tasks that are waiting to lock the mutex. If PRIORITY_INHERITANCE is set, the queue is in priority order; otherwise, it is in FIFO order.
OWNER_TD	Task descriptor of the task that has locked the mutex.
BOOSTED	Number of times that MQX has boosted the priority of the task that has locked the mutex.

3.2.17 QUEUE_ELEMENT_STRUCT

Header for a queue element.

Prototype

```
#include <mqx.h>
typedef struct queue_element_struct
{
    struct queue_element_struct    *NEXT;
    struct queue_element_struct    *PREV;
} QUEUE_ELEMENT_STRUCT, * QUEUE_ELEMENT_STRUCT_PTR;
```

See Also

[_queue_dequeue](#)

[_queue_enqueue](#)

[_queue_init](#)

[QUEUE_STRUCT](#)

Description

Each element in a queue (**QUEUE_STRUCT**) must start with the structure.

Fields

Field	Description
NEXT	Pointer to the next element in the queue.
PREV	Pointer to the previous element in the queue.

3.2.18 QUEUE_STRUCT

Queue of any type of element that has a header of type **QUEUE_ELEMENT_STRUCT**.

Prototype

```
#include <mqx.h>
typedef struct queue_struct
{
    struct queue_element_struct    *NEXT;
    struct queue_element_struct    *PREV;
    uint16_t                       SIZE;
    uint16_t                       MAX;
} QUEUE_STRUCT, * QUEUE_STRUCT_PTR;
```

See Also

[_queue_init](#)

QUEUE_ELEMENT_STRUCT

Fields

Field	Description
NEXT	Pointer to the next element in the queue. If there are no elements in the queue, the field is a pointer to the structure itself.
PREV	Pointer to the last element in the queue. If there are no elements in the queue, the field is a pointer to the structure itself.
SIZE	Number of elements in the queue.
MAX	Maximum number of elements that the queue can hold. If the field is 0, the number is unlimited.

3.2.19 TASK_TEMPLATE_STRUCT

Task template that MQX uses to create instances of a task.

Prototype

```
#include <mqx.h>
typedef struct task_template_struct
{
    _mqx_uint    TASK_TEMPLATE_INDEX;
    TASK_FPTR    TASK_ADDRESS;
    _mem_size    TASK_STACKSIZE;
    _mqx_uint    TASK_PRIORITY;
    char _PTR    TASK_NAME;
    _mqx_uint    TASK_ATTRIBUTES;
    uint32_t     CREATION_PARAMETER;
    _mqx_uint    DEFAULT_TIME_SLICE;
} TASK_TEMPLATE_STRUCT, * TASK_TEMPLATE_STRUCT_PTR;
```

See Also

[_mqx](#)

[_task_create](#), [_task_create_blocked](#), [_task_create_at](#)

MQX_INITIALIZATION_STRUCT

Description

The task template list is an array of these structures, terminated by a zero-filled element. The MQX initialization structure contains a pointer to the list.

Fields

Field	Description
TASK_TEMPLATE_INDEX	Application-unique number that identifies the task template. The minimum value is 1, maximum is MAX_MQX_UINT. The field is ignored if you call <code>_task_create()</code> or <code>_task_create_blocked()</code> or <code>_task_create_at()</code> with a template index equal to 0 and a creation parameter set to a pointer to a task template.
TASK_ADDRESS	Pointer to the root function for the task. When MQX creates the task, the task begins running at this address.
TASK_STACKSIZE	Number of single-addressable units of stack space that the task needs.
TASK_PRIORITY	Software priority of the task. Priorities start at 0, which is the highest priority; 1, 2, 3, and so on, are progressively lower priorities.
TASK_NAME	Pointer to a name for tasks that MQX creates from the template.
TASK_ATTRIBUTES	Attributes of tasks that MQX creates from the template; any combination of:
NULL	When MQX starts, it does not create an instance of the task. MQX uses FIFO scheduling for the task. MQX does not save floating-point registers as part of the task's context.
MQX_AUTO_START_TASK	When MQX starts, it creates one instance of the task.
MQX_DSP_TASK	MQX saves the DSP coprocessor registers as part of the task's context. If the DSP registers are separate from the normal registers, MQX manages their context independently during task switching. MQX saves or restores the registers only when a new DSP task is scheduled to run.
MQX_FLOATING_POINT_TASK	MQX saves floating-point registers as part of the task's context.
MQX_TIME_SLICE_TASK	MQX uses round robin scheduling for the task (the default is FIFO scheduling).
CREATION_PARAMETER	Passed to tasks that MQX creates from the template.
DEFAULT_TIME_SLICE	If the task uses round robin scheduling and the field is non-zero, MQX uses the value as the task's time slice value. If the task uses round robin scheduling and the field is 0, MQX uses the default time slice value.

Example

```
#include<mqx.h>
...
extern void taskA();

TASK_TEMPLATE_STRUCT task_list[] =
{
    {FIRST_TASK, taskA, 0x2000, MAIN_PRIOR,
      "taskA", MQX_AUTO_START_TASK, (uint32_t)MY_QUEUE, 0},
    {0,          0,          0,          0,          0,          0,          0},
};
```

3.2.20 TIME_STRUCT

Time in millisecond format.

Prototype

```
#include <mqx.h>
typedef struct time_struct
{
    uint32_t SECONDS;
    uint32_t MILLISECONDS;
} TIME_STRUCT, * TIME_STRUCT_PTR;
```

See also

[_time_from_date](#)

[_time_get, _time_get_ticks](#)

[_time_set, _time_set_ticks](#)

[_time_to_date](#)

[DATE_STRUCT](#)

Fields

Field	Description
SECONDS	Number of seconds.
MILLISECONDS	Number of milliseconds.

3.2.21 time_t

Time in second format, representing the number of seconds elapsed since 00:00:00, Jan 1, 1970 UTC.

Prototype

```
#include <mqx.h>
/*-----*/
/* time_t */
/*!
 *
 */
#ifndef __time_t_defined
typedef uint_32    time_t;
#define __time_t_defined
#endif
```

See also

mktime

gmtime_r

localtime_r

timegm

TM STRUCT

3.2.22 TM STRUCT

Time in second format, representing the number of seconds elapsed since 00:00:00, Jan 1, 1970 UTC.

Prototype

```
#include <mqx.h>
struct tm {
    int_32    tm_sec;
    int_32    tm_min;
    int_32    tm_hour;
    int_32    tm_mday;
    int_32    tm_mon;
    int_32    tm_year;
    int_32    tm_wday;
    int_32    tm_yday;
    int_32    tm_isdst;
};
```

See also

[mktime](#)

[gmtime_r](#)

[localtime_r](#)

[timegm](#)

[time_t](#)

Fields

Field	Description
tm_sec	The number of seconds after the minute, normally in the range 0 to 59, but can be up to 60 to allow for leap seconds.
tm_min	The number of minutes after the hour, in the range 0 to 59.
tm_hour	The number of hours past midnight, in the range 0 to 23.
tm_mday	The day of the month, in the range 1 to 31.
tm_mon	The number of months since January, in the range 0 to 11.
tm_year	The number of years since 1900.
tm_wday	The number of days since Sunday, in the range 0 to 6.
tm_yday	The number of days since January 1, in the range 0 to 365.
tm_isdst	A flag that indicates whether daylight saving time is in effect at the time described. The value is positive if daylight saving time is in effect, zero if it is not, and negative if the information is not available.