# 7

# Memory Requirements

## 7.1 Introduction

Memory is typically a limited resource in real-time embedded systems, therefore, **RTEMS** can be configured to utilize the minimum amount of memory while meeting all of the applications requirements. Worksheets are provided which allow the **RTEMS** application developer to determine the amount of **RTEMS** code and RAM workspace which is required by the particular configuration. Also provided are the minimum code space, maximum code space, and the constant data space required by **RTEMS**.

## 7.2 Data Space Requirements

**RTEMS** requires a small amount of memory for its private variables. This data area must be in RAM and is separate from the **RTEMS RAM Workspace**. The following table illustrates the data space required for all configurations of **RTEMS**:

| Description | Size |
|---|---|
| Data Space | 706 |

## 7.3 Minimum and Maximum Code Space Requirements

A maximum configuration of **RTEMS** includes the core and all managers, including the multiprocessing manager. Conversely, a minimum configuration of **RTEMS** includes only the core and the following managers: initialization, task,

interrupt and fatal error. The following table illustrates the code space required by these configurations of **RTEMS**:

| Configuration | Size |
|---|---|
| **Minimum** | **14,316** |
| **Maximum** | **31,204** |

## 7.4 RTEMS Code Space Worksheet

The **RTEMS Code Space Worksheet** is a tool provided to aid the **RTEMS** application designer to accurately calculate the memory required by the **RTEMS** run-time environment. **RTEMS** allows the custom configuration of the executive by optionally excluding managers which are not required by a particular application. This worksheet provides the included and excluded size of each manager in tabular form allowing for the quick calculation of any custom configuration of **RTEMS**. The **RTEMS Code Space Worksheet** is provided on the next page.

## 7.5 RTEMS RAM Workspace Worksheet

The **RTEMS RAM Workspace Worksheet** is a tool provided to aid the **RTEMS** application designer to accurately calculate the minimum memory block to be reserved for RTEMS use. This worksheet provides equations for calculating the amount of memory required based upon the number of objects configured, whether for single or multiple processor versions of the executive. This information is presented in tabular form, along with the fixed system requirements, allowing for quick calculation of any application defined configuration of **RTEMS**. The **RTEMS RAM Workspace Worksheet** is provided on the page following the **RTEMS Code Space Worksheet.**

## RTEMS Code Space Worksheet

| Component | Included | Not Included | Size |
|---|---|---|---|
| Core | 9,628 | n/a | |
| Initialization | 1,016 | n/a | |
| Task | 3,012 | n/a | |
| Interrupt | 142 | n/a | |
| Clock | 316 | n/a | |
| Timer | 934 | 44 | |
| Semaphore | 1,348 | 50 | |
| Message | 1,878 | 80 | |
| Event | 760 | 18 | |
| Signal | 300 | 12 | |
| Partition | 956 | 32 | |
| Region | 1,376 | 38 | |
| Dual Ported Memory | 572 | 32 | |
| I/O | 472 | 44 | |
| Fatal Error | 68 | n/a | |
| Rate Monotonic | 1,164 | 40 | |
| Multiprocessing | 6,520 | 40 | |
| **Total Code Space Requirements** | | | |

## RTEMS RAM Workspace Worksheet

| Description | Equation | Bytes Required |
|---|---|---|
| maximum_tasks | * 332 = | |
| maximum_timers | * 56 = | |
| maximum_semaphores | * 100 = | |
| maximum_message_queues | * 104 = | |
| maximum_messages | * 24 = | |
| maximum_regions | * 132 = | |
| maximum_partitions | * 52 = | |
| maximum_ports | * 32 = | |
| maximum_periods | * 32 = | |
| maximum_extensions | * 60 = | |
| Floating Point Tasks | * 332 = | |
| Task Stacks | = | |
| Total Single Processor Requirements | | |

| Description | Equation | Bytes Required |
|---|---|---|
| maximum_nodes | * 48 = | |
| maximum_global_objects | * 16 = | |
| maximum_proxies | * 112 = | |
| Total Multiprocessing Requirements | | |

| | |
|---|---|
| Fixed System Requirements | 5,344 |
| Total Single Processor Requirements | |
| Total Multiprocessing Requirements | |
| Minimum Bytes for RTEMS Workspace | |