| Document Title | Requirements on Time Service |
|---|---|
| **Document Category** | Requirement specification (RS) |
| **Document UID** | 623 |
| **Document Status** | published |
| **Part of AUTOSAR Standard** | Classic Platform |
| **Part of Standard Release** | R26-11 |

| Document Change History | | | |
|---|---|---|---|
| **Date** | **Release** | **Changed by** | **Description** |
| 2026-11-26 | R26-11 | AUTOSAR Release Management | • No content changes |
| 2025-11-27 | R25-11 | AUTOSAR Release Management | • No content changes |
| 2024-11-27 | R24-11 | AUTOSAR Release Management | • No content changes |
| 2023-11-23 | R23-11 | AUTOSAR Release Management | • Editorial changes |
| 2022-11-24 | R22-11 | AUTOSAR Release Management | • No content changes |
| 2021-11-25 | R21-11 | AUTOSAR Release Management | • No content changes |
| 2020-11-30 | R20-11 | AUTOSAR Release Management | • No content changes |
| 2019-11-28 | R19-11 | AUTOSAR Release Management | • No content changes<br>• Changed Document Status from Final to published |
| 2018-10-31 | 4.4.0 | AUTOSAR Release Management | • Editorial changes |
| 2017-12-08 | 4.3.1 | AUTOSAR Release Management | • Editorial changes |

△

| | | | |
|---|---|---|---|
| 2016-11-30 | 4.3.0 | AUTOSAR Release Management | • Add section 5 Requirements Tracing |
| 2015-07-31 | 4.2.2 | AUTOSAR Release Management | • Editorial changes |
| 2014-10-31 | 4.2.1 | AUTOSAR Release Management | • New RS_BRF_feature linked to all requirements |
| 2013-10-31 | 4.1.2 | AUTOSAR Release Management | • Editorial changes |
| 2013-03-15 | 4.1.1 | AUTOSAR Administration | • Initial release |

**Disclaimer**

This work (specification and/or software implementation) and the material contained in it, as released by AUTOSAR, is for the purpose of information only. AUTOSAR and the companies that have contributed to it shall not be liable for any use of the work.

The material contained in this work is protected by copyright and other types of intellectual property rights. The commercial exploitation of the material contained in this work requires a license to such intellectual property rights.

This work may be utilized or reproduced without any modification, in any form or by any means, for informational purposes only. For any other purpose, no part of the work may be utilized or reproduced, in any form or by any means, without permission in writing from the publisher.

The work has been developed for automotive applications only. It has neither been developed, nor tested for non-automotive applications.

The word AUTOSAR and the AUTOSAR logo are registered trademarks.

# Table of Contents

1 Scope of Document 5

2 Conventions to be used 6

3 Acronyms and abbreviations 7

4 Requirements Specification 8
- 4.1 Functional Overview . . . 8
- 4.2 Functional Requirements . . . 8
  - 4.2.1 General . . . 8
  - 4.2.2 Configuration . . . 9
  - 4.2.3 Initialization . . . 10
  - 4.2.4 Normal Operation . . . 10

5 References 13

A Change history of AUTOSAR traceable items 14
- A.1 Traceable item history of this document according to AUTOSAR Release R26-11 . . . 14
  - A.1.1 Added Requirements in R26-11 . . . 14
  - A.1.2 Changed Requirements in R26-11 . . . 14
  - A.1.3 Deleted Requirements in R26-11 . . . 14
- A.2 Traceable item history of this document according to AUTOSAR Release R25-11 . . . 14
  - A.2.1 Added Requirements in R25-11 . . . 14
  - A.2.2 Changed Requirements in R25-11 . . . 14
  - A.2.3 Deleted Requirements in R25-11 . . . 14
- A.3 Traceable item history of this document according to AUTOSAR Release R24-11 . . . 15
  - A.3.1 Added Requirements in R24-11 . . . 15
  - A.3.2 Changed Requirements in R24-11 . . . 15
  - A.3.3 Deleted Requirements in R24-11 . . . 15
- A.4 Traceable item history of this document according to AUTOSAR Release R23-11 . . . 15
  - A.4.1 Added Requirements in R23-11 . . . 15
  - A.4.2 Changed Requirements in R23-11 . . . 15
  - A.4.3 Deleted Requirements in R23-11 . . . 16
- A.5 Traceable item history of this document according to AUTOSAR Release R22-11 . . . 16
  - A.5.1 Added Requirements in R22-11 . . . 16
  - A.5.2 Changed Requirements in R22-11 . . . 16
  - A.5.3 Deleted Requirements in R22-11 . . . 16

# 1 Scope of Document

This specification defines requirements of the BSW module Time Service.

### Constraints

First scope for specification of requirements on basic software modules is systems which are not safety relevant. For implementation of the basic software modules in safety relevant systems, it shall be checked if additional requirements are necessary.

# 2 Conventions to be used

The representation of requirements in AUTOSAR documents follows the table specified in [TPS_STDT_00078], see [1, Standardization Template].

The verbal forms for the expression of obligation specified in [TPS_STDT_00053] shall be used to indicate requirements, see [1, Standardization Template].

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as follows.

Note that the requirement level of the document in which they are used modifies the force of these words.

- MUST: This word, or the adjective “LEGALLY REQUIRED”, means that the definition is an absolute requirement of the specification due to legal issues.
- MUST NOT: This phrase, or the phrase “MUST NOT”, means that the definition is an absolute prohibition of the specification due to legal issues.
- SHALL: This phrase, or the adjective “REQUIRED”, means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective “RECOMMENDED”, means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase “NOT RECOMMENDED”, means that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
- MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item.

An implementation, which does not include a particular option, SHALL be prepared to interoperate with another implementation, which does include the option, though perhaps with reduced functionality. In the same vein an implementation, which does include a particular option, SHALL be prepared to interoperate with another implementation, which does not include the option (except, of course, for the feature the option provides).

# 3 Acronyms and abbreviations

The glossary below includes acronyms and abbreviations relevant to Time Service that are not included in the AUTOSAR Glossary [2].

| Abbreviation / Acronym: | Description: |
|---|---|
| GPT Predef Timer | A GPT Predef Timer is a free running up counter provided by the GPT driver. Which GPT Predef Timer(s) are available depends on hardware (clock, hardware timers, prescaler, width of timer register, ...) and configuration. A GPT Predef Timer has predefined physical time unit and range. |
| Time Service Predef Timer | A Time Service Predef Timer is a free running up counter with predefined physical time unit and range. The hardware timer functionality is based on the corresponding GPT Predef Timer. For each Predef Timer a set of API services is provided by the Time Service module. The user can instantiate any timers (only limited by available memory) and can use the instances completely independently of each other. |
| Timer instance | A timer instance is a data object of an API data type. |
| Reference time | The reference time is a time value stored for each timer instance. |

**Table 3.1: Acronyms and abbreviations used in the scope of this Document**

# 4 Requirements Specification

This chapter describes all requirements driving the work to define the Time Service.

## 4.1 Functional Overview

The Time Service module is part of the Services Layer. The module provides services for time based functionality. Use cases are:

- Time measurement
- Time based state machine
- Timeout supervision
- Busy waiting

Several "timer types" - so called "Time Service Predef Timers" - are available, if supported by hardware and enabled by configuration.

Each Predef Timer has a predefined tick duration (physical time unit) and a predefined number of bits (physical range). By this, compatibility of time based functionality is ensured for all platforms which support the required Time Service Predef Timers.

The Time Service Predef Timers are based on so-called "GPT Predef Timers", which are free running hardware timers, provided by the GPT driver.

All services are called by user ("polling mode"). Notifications are not supported.

The Time Service module does **not** use and distribute all features of the GPT driver. The Time Service module is **not** the top of a "Timer Stack".

## 4.2 Functional Requirements

### 4.2.1 General

**[SRS_Tm_00001] Different types of Predef Timers shall be supported by the Time Service module** ⌈

| | |
|---|---|
| ***Description:*** | The following types of Predef Timers shall be supported by the Time Service module:<br>• Timer 1$\mu$s16bit<br>• Timer 1$\mu$s24bit<br>• Timer 1$\mu$s32bit<br>• Timer 100$\mu$s32bit |

▽

△

| | |
|---|---|
| ***Rationale:*** | 1$\mu$s: high resolution timer.<br>16bit timer: To support 16bit hardware timers.<br>24bit timer: To support 24bit hardware timers.<br>32bit timer: To support 32bit hardware timers.<br>100$\mu$s32bit timer: covers automotive use cases (time span 4.9 days) |
| ***Use Case:*** | Time measurement, time based state machine, timeout supervision, busy waiting |
| ***Dependencies:*** | [SRS_BSW_00343] Specification and configuration of time |
| ***Supporting Material:*** | – |

⌋

**[SRS_Tm_00002] The GPT Predef Timers shall be used as time base for the Predef Timers of the Time Service module** ⌈

| | |
|---|---|
| ***Description:*** | The GPT Predef Timers shall be used as time base for the Predef Timers of the Time Service module. |
| ***Rationale:*** | The Time Service module has to use a driver module for hardware access |
| ***Use Case:*** | Read current timer value |
| ***Dependencies:*** | – |
| ***Supporting Material:*** | – |

⌋

### 4.2.2 Configuration

**[SRS_Tm_00003] The Time Service module shall make it possible to configure which Predef Timers are enabled** ⌈

| | |
|---|---|
| ***Description:*** | The Time Service module shall make it possible to configure which Predef Timers are enabled.<br>For each enabled Predef Timer a set of API services shall be available:<br>• Reset timer<br>• Get time span<br>• Shift timer<br>• Synchronize timer<br>• Busy waiting, only for 1$\mu$s timers |
| ***Rationale:*** | To disable Predef Timers if not needed or related GPT Predef Timers not available. |
| ***Use Case:*** | – |
| ***Dependencies:*** | – |

▽

△

| | |
|---|---|
| ***Supporting Material:*** | – |

⌋

### 4.2.3 Initialization

No content

### 4.2.4 Normal Operation

**[SRS_Tm_00004] The Time Service module shall provide a synchronous service to reset a timer instance** ⌈

| | |
|---|---|
| ***Description:*** | The Time Service module shall provide a synchronous service for each enabled Predef Timer, to reset a timer instance. By this service a reference time is set, which is needed for further services. The service shall have the following parameter:<br>• Pointer to a timer instance defined by the user |
| ***Rationale:*** | Basic functionality.<br>Due to performance reasons, this service is required for each Predef Timer. A pointer is used (instead of an identifier) for referencing a timer instance to avoid user dependent configuration of module Time Service. So, the service can be used flexibly just like a library service. |
| ***Use Case:*** | Time measurement, time based state machine, timeout supervision, busy waiting |
| ***Dependencies:*** | – |
| ***Supporting Material:*** | – |

⌋

**[SRS_Tm_00005] The Time Service module shall provide a synchronous service to get the time span** ⌈

| | |
|---|---|
| ***Description:*** | The Time Service module shall provide a synchronous service for each enabled Predefined Timer, to get the time span. The time span is the time difference between the reference time and the current point in time. The service shall have the following parameter:<br>• Pointer to a timer instance defined by the user |
| ***Rationale:*** | Basic functionality.<br>Due to performance reasons, this service is required for each Predef Timer. A pointer is used (instead of an identifier) for referencing a timer instance to avoid user dependent configuration of module Time Service. So, the service can be used flexibly just like a library service. |

▽

△

| | |
|---|---|
| ***Use Case:*** | Time measurement, time based state machine, timeout supervision, busy waiting |
| ***Dependencies:*** | – |
| ***Supporting Material:*** | – |

⌋

### [SRS_Tm_00006] The Time Service module shall provide a synchronous service to shift the reference time of a timer instance ⌈

| | |
|---|---|
| ***Description:*** | The Time Service module shall provide a synchronous service for each enabled Predef Timer, to shift the reference time of a timer instance. Shifting means to add a time value to the reference time to get a new reference time. The service shall have the following parameters:<br>• Pointer to a timer instance defined by the user<br>• Time value which has to be added to the reference time |
| ***Rationale:*** | Extended functionality.<br>Due to performance reasons, this service is required for each Predef Timer. A pointer is used (instead of an identifier) for referencing a timer instance to avoid user dependent configuration of module Time Service. So, the service can be used flexibly just like a library service. |
| ***Use Case:*** | Measurement of the cycle time of a runnable piece of software without loss of accuracy |
| ***Dependencies:*** | – |
| ***Supporting Material:*** | – |

⌋

### [SRS_Tm_00007] The Time Service module shall provide a synchronous service to synchronize two timer instances ⌈

| | |
|---|---|
| ***Description:*** | The Time Service module shall provide a synchronous service for each enabled Predef Timer, to synchronize two timer instances. Synchronization means to set the reference time of a timer instance "Destination" to the reference time of a timer instance "Source". The service shall have the following parameters:<br>• Pointer to a destination timer instance defined by the user<br>• Pointer to a source timer instance defined by the user |
| ***Rationale:*** | Extended functionality.<br>Due to performance reasons, this service is required for each Predef Timer. A pointer is used (instead of an identifier) for referencing a timer instance to avoid user dependent configuration of module Time Service. So, the service can be used flexibly just like a library service. |
| ***Use Case:*** | Measurement of different time stamps (e.g. first call of some tasks) related to the same reference time. |
| ***Dependencies:*** | – |

▽

△

| | |
|---|---|
| ***Supporting Material:*** | – |

⌋

**[SRS_Tm_00008] The Time Service module shall provide a synchronous service with tick duration 1$\mu$s to perform busy waiting by polling** ⌈

| | |
|---|---|
| ***Description:*** | The Time Service module shall provide a synchronous service for each enabled Predef Timer with tick duration 1$\mu$s to perform busy waiting (active waiting) by polling. The waiting time shall be restricted to 8 bits (255$\mu$s) to prevent long time blocking of code execution. The interrupts shall not be disabled, this means the real waiting time may be greater than the desired waiting time.<br>The service shall have the following parameter:<br>• Minimum waiting time |
| ***Rationale:*** | Extended functionality.<br>Due to performance reasons, this service is required for each 1$\mu$s Predef Timer. The service can be used flexibly just like a library service.<br>To reduce risk of bad implementation of busy waiting on user software level. To ensure correct waiting time independent of:<br>• CPU speed<br>• Pipeline effects<br>• Cache effects<br>• Access time to memory (bus width, wait states, ...)<br>• Compiler version, compiler options, compiler optimizations |
| ***Use Case:*** | Implementation of drivers (hardware dependant waiting times) |
| ***Dependencies:*** | – |
| ***Supporting Material:*** | – |

⌋

# 5 References

[1] Standardization Template
AUTOSAR_FO_TPS_StandardizationTemplate

[2] Glossary
AUTOSAR_FO_TR_Glossary

# A Change history of AUTOSAR traceable items

Please note that the lists in this chapter also include traceable items that have been removed from the specification in a later version. These items do not appear as hyperlinks in the document.

## A.1 Traceable item history of this document according to AUTOSAR Release R26-11

### A.1.1 Added Requirements in R26-11

none

### A.1.2 Changed Requirements in R26-11

none

### A.1.3 Deleted Requirements in R26-11

none

## A.2 Traceable item history of this document according to AUTOSAR Release R25-11

### A.2.1 Added Requirements in R25-11

none

### A.2.2 Changed Requirements in R25-11

none

### A.2.3 Deleted Requirements in R25-11

none

## A.3 Traceable item history of this document according to AUTOSAR Release R24-11

### A.3.1 Added Requirements in R24-11

none

### A.3.2 Changed Requirements in R24-11

none

### A.3.3 Deleted Requirements in R24-11

none

## A.4 Traceable item history of this document according to AUTOSAR Release R23-11

### A.4.1 Added Requirements in R23-11

| Number | Heading |
|---|---|
| [SRS_Tm_00001] | Different types of Predef Timers shall be supported by the Time Service module |
| [SRS_Tm_00002] | The GPT Predef Timers shall be used as time base for the Predef Timers of the Time Service module |
| [SRS_Tm_00003] | The Time Service module shall make it possible to configure which Predef Timers are enabled |
| [SRS_Tm_00004] | The Time Service module shall provide a synchronous service to reset a timer instance |
| [SRS_Tm_00005] | The Time Service module shall provide a synchronous service to get the time span |
| [SRS_Tm_00006] | The Time Service module shall provide a synchronous service to shift the reference time of a timer instance |
| [SRS_Tm_00007] | The Time Service module shall provide a synchronous service to synchronize two timer instances |
| [SRS_Tm_00008] | The Time Service module shall provide a synchronous service with tick duration 1$\mu$s to perform busy waiting by polling |

**Table A.1: Added Requirements in R23-11**

### A.4.2 Changed Requirements in R23-11

none

### A.4.3 Deleted Requirements in R23-11

none

## A.5 Traceable item history of this document according to AUTOSAR Release R22-11

### A.5.1 Added Requirements in R22-11

| Number | Heading |
|---|---|
| [SRS_Tm_00001] | Different types of Predef Timers shall be supported by the Time Service module |
| [SRS_Tm_00002] | The GPT Predef Timers shall be used as time base for the Predef Timers of the Time Service module |
| [SRS_Tm_00003] | The Time Service module shall make it possible to configure which Predef Timers are enabled |
| [SRS_Tm_00004] | The Time Service module shall provide a synchronous service to reset a timer instance |
| [SRS_Tm_00005] | The Time Service module shall provide a synchronous service to get the time span |
| [SRS_Tm_00006] | The Time Service module shall provide a synchronous service to shift the reference time of a timer instance |
| [SRS_Tm_00007] | The Time Service module shall provide a synchronous service to synchronize two timer instances |
| [SRS_Tm_00008] | The Time Service module shall provide a synchronous service with tick duration 1$\mu$s to perform busy waiting by polling |

**Table A.2: Added Requirements in R22-11**

### A.5.2 Changed Requirements in R22-11

none

### A.5.3 Deleted Requirements in R22-11

none