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1 Scope of this document

This document specifies requirements on Basic Software Modules of the following software layers:

- Service Layer

Those modules are of the following type:

- NVRAM Management
- Interfaces

The selection of modules is derived from the Basic Software Module List and the AUTOSAR Layered Software Architecture. The following modules are in scope:

- CRC

The requirements are structured in the following way:

- General requirements on Basic Software Modules (other document)
- General requirements which apply to all modules of the CRC Management
- Module specific requirements

Conformance to all requirements is mandatory for all implementations. “Configurable” also means, the requirement must be met, but such functionality can be disabled, if not needed in an ECU (BSW or SW-C).

Constraints

First scope for specification of requirements on basic software modules are systems which are not safety relevant. For this reason safety requirements are assigned to medium priority.

2 How to read this document

Each requirement has its unique identifier starting with the prefix “BSW” (for “Basic Software”). For any review annotations, remarks or questions, please refer to this unique ID rather than chapter or page numbers!

2.1 Conventions used

In requirements, the following specific semantics are used (taken from Request for Change RFC 2119 from the Internet Engineering Task Force IETF)

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 described in RFC 2119. Note that the requirement level of the document in which they are used modifies the force of these words.

- **MUST:** This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
- **MUST NOT:** This phrase, or the phrase „SHALL NOT“, means that the definition is an absolute prohibition of the specification.
- **SHOULD:** This word, or the adjective "RECOMMENDED", mean 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" mean 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, **MUST** 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, **MUST** be prepared to interoperate with another implementation, which does not include the option (except, of course, for the feature the option provides.)

2.2 Requirements structure

Each module specific chapter contains a short functional description of the Basic Software Module. Requirements of the same kind within each chapter are grouped under the following headlines (where applicable):

Functional Requirements:

- Configuration (which elements of the module need to be configurable)
- Initialization
- Normal Operation
- Shutdown Operation
- Fault Operation
- ...

Non-Functional Requirements:

- Timing Requirements
- Resource Usage
- Usability
- Output for other WPs (e.g. Description Templates, Tooling, ...)
- ...

3 Acronyms and abbreviations

<i>Acronym:</i>	<i>Description:</i>
CRC	Cyclic Redundancy Check

4 Requirement Specification

4.1 CRC Library

4.1.1 Functional Overview

The CRC Library provides functions for 8 bit, 16 bit and 32 bit CRC (cyclic redundancy check) calculations. The CRC library can be scaled in terms of

- Table based calculation (fast, but higher code size)
- Runtime calculation (slow, but smaller code size)
- Different standard CRC generator polynomials

Hardware supported CRC calculation may be supported in the future.

4.1.2 Functional Requirements

4.1.2.1 General

4.1.2.1.1 [BSW08524] Error detection

Initiator:	BMW
Date:	10.03.2005
Short Description:	Error detection
Type:	New
Importance:	High
Description:	The chosen polynomial shall detect the following errors: <ul style="list-style-type: none"> • single bit errors • two-bit errors • errors with an odd number of bits or at least three-bit error detection
Rationale:	An ordinary checksum would provide single bit error detection with less complexity in calculation. Detection of parity errors is easily implemented by using a simple parity bit. Therefore at least three-bit errors should be detected.
Use Case:	Detect errors/inconsistent data in NVRAM/RAM.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.1.2 [BSW08525] Support of standard polynomials

Initiator:	BMW
Date:	10.03.2005
Short Description:	Support of standard polynomials
Type:	New
Importance:	High
Description:	The CRC library shall support the following generator polynomials: <ul style="list-style-type: none"> • CRC 8-bit SAE-J1850 (0x1D) • CRC 16-bit CRC-CCITT (0x1021) • CRC 32-bit Ethernet IEEE-802 (0x04C11DB7)
Rationale:	These polynomials are considered to be standard.

Use Case:	CRC 8-bit : Detect errors/inconsistent data in Communication CRC16 and 32-bit : Detect errors/inconsistent data in NVRAM/RAM.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.2 Configuration

4.1.2.2.1 [BSW08518] CRC calculation method complexity

Initiator:	BMW
Date:	18.02.2005
Short Description:	CRC calculation method complexity
Type:	New
Importance:	High
Description:	The CRC Library shall provide different calculation methods (algorithm), optimizing either performance or memory usage (e.g. for runtime calculation).
Rationale:	Allow for optimization of code size or execution time depending on specific ECU requirements.
Use Case:	--
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.2.2 [BSW08526] CRC standard calculation methods

Initiator:	BMW
Date:	18.02.2005
Short Description:	CRC standard calculation methods
Type:	New
Importance:	High
Description:	The CRC Library shall support current standards of CRC calculation: <ul style="list-style-type: none"> - table based - runtime calculated - hardware based (may be supported in the future)
Rationale:	Allow for optimization of code size or execution time depending on specific ECU requirements.
Use Case:	--
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3 Non-Functional Requirements (Qualities)

4.1.3.1 General

4.1.3.1.1 [BSW08520] CRC routine reentrancy

Initiator:	BMW
Date:	18.02.2005

Short Description:	CRC routine reentrancy
Type:	New
Importance:	High
Description:	All CRC calculation routines shall be re-entrant.
Rationale:	Quasi-parallel access to the CRC routines shall be allowed from several clients within a multi tasking environment.
Use Case:	NVRAM-Manager, application and Flash Driver are using CRC routines in parallel.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.1.2 [BSW08521] CRC routine schedulability

Initiator:	BMW
Date:	18.02.2005
Short Description:	CRC routine schedulability
Type:	New
Importance:	High
Description:	All CRC routines shall allow step-by-step-wise calculation of a large data block that is passed by start address, length and start value.
Rationale:	CRC calculation of large data blocks without blocking the whole system.
Use Case:	<p>Example: The CRC calculation of a 4k ROM data block shall be performed. If the CRC routine would calculate the <i>WHOLE</i> block within one call, the watchdog would not be triggered anymore and cause a reset.</p> <p>Thus, the calculation has to be done in several steps (e.g. 16 byte wise).</p>
Dependencies:	General requirement: [BSW00313] Deadlock prevention
Conflicts:	--
Supporting Material:	--

5 References

5.1 Deliverables of AUTOSAR

[AUTOSAR_SW_ARCH] Layered Software Architecture
https://svn2.autosar.org/repos2/22_Releases
AUTOSAR_LayeredSoftwareArchitecture.pdf

[AUTOSAR_BASIC_SW] List of Basic Software Modules
https://svn2.autosar.org/repos2/22_Releases
AUTOSAR_BasicSoftwareModules.pdf