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AUTOSAR **Cyclic** Redundan**cy** **Check** User Manual

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1. Overview

본 문서는 CRC 사용을 위해 AUTOSAR 플랫폼 사용할 때, 사용자가 파라미터 설정 또는 시스템 설계를 할 때 주의하거나 참고할 사항을 제공한다. 자세한 사항은 Reference 문서를 참고한다.

설정관련 Category 의 해석은 다음과 같다.

- Changeable (C): User 에 의해서 설정 가능한 항목
- Fixed (F): User 에 의한 변경이 불가한 항목
- NotSupported (N): 사용되지 않는 항목

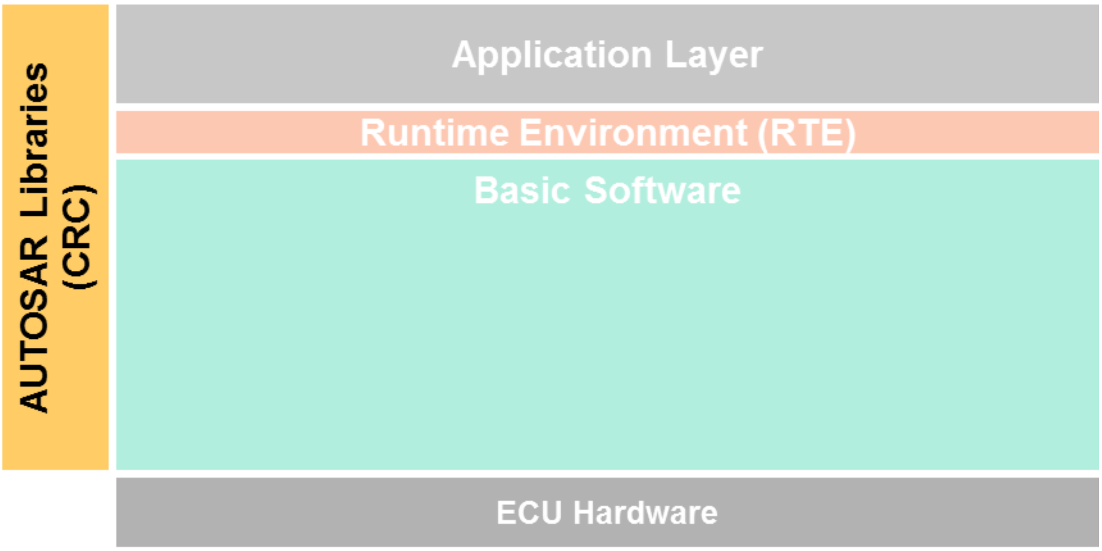
2. Reference

Sl. No.	Title	Version
1.	AUTOSAR_SWS_CRCLibrary.pdf	4.2.0
2.	AUTOSAR BSW Service API Guide.doc	1.0.0 or later

3. AUTOSAR System

3.1 Overview of Software Layers

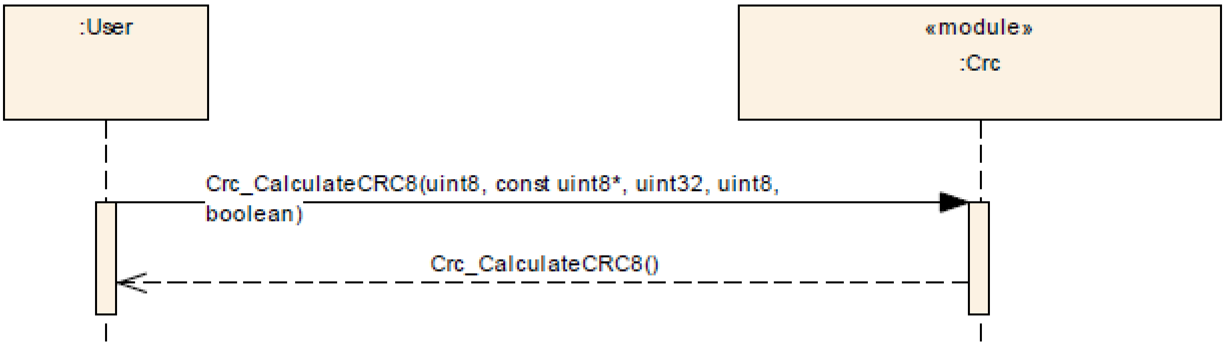
AUTOSAR 플랫폼의 CRC 관련 Layered Architecture 는 아래와 같다.



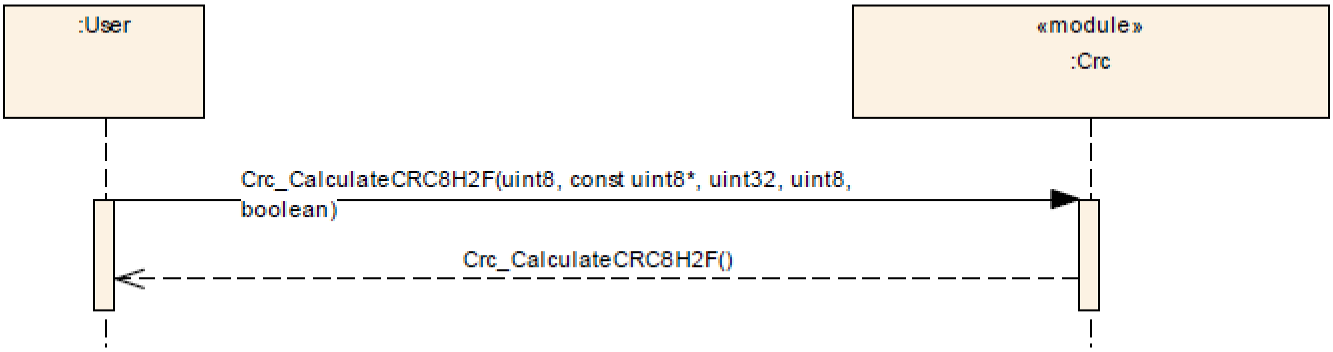
3.2 AUTOSAR CRC Library

3.2.1 Sequence Diagrams

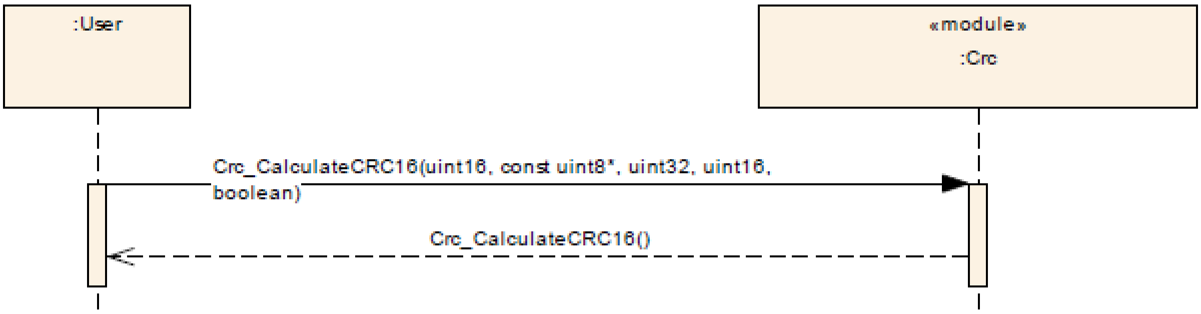
3.2.1.1 CRC_CalculateCRC8()


:User
«module»
:Crc
Crc_CalculateCRC8(uint8, const uint8*, uint32, uint8, boolean)
Crc_CalculateCRC8()

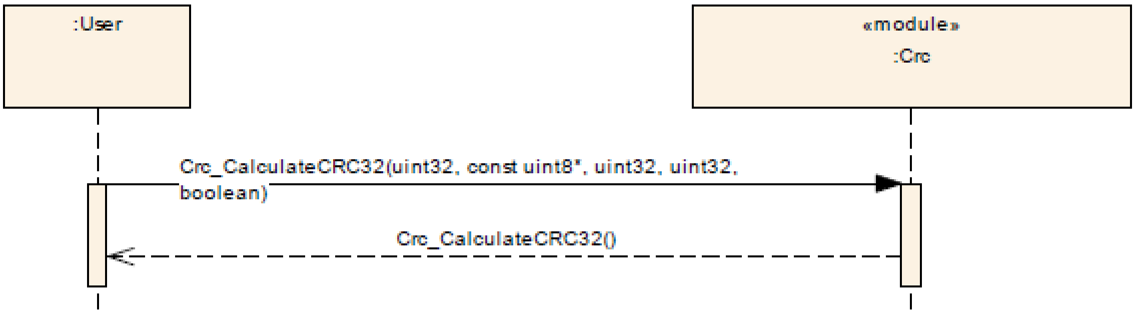
3.2.1.2 Crc_CalculateCRC8H2F ()


:User
«module»
:Crc
Crc_CalculateCRC8H2F(uint8, const uint8*, uint32, uint8, boolean)
Crc_CalculateCRC8H2F()

3.2.1.3 Crc_CalculateCRC16()


:User
«module»
:Crc
Crc_CalculateCRC16(uint16, const uint8*, uint32, uint16, boolean)
Crc_CalculateCRC16()

3.2.1.4 Crc_CalculateCRC32()


:User
«module»
:Crc
Crc_CalculateCRC32(uint32, const uint8*, uint32, uint32, boolean)
Crc_CalculateCRC32()

3.2.2 Architecture (Library)

3.2.2.1 Library can be called by BSW modules(that including the RTE), SW-Cs, libraries or integration code.

3.2.2.2 Library can be re-entrant.

3.2.2.3 Library does not require any initialization.

3.2.2.4 Library are synchronous (they do not have wait points)

4. Product Release Notes

4.1 Overview

이 Chapter 에서는, CRC Product 에 대한 release 관련 내용을 제공하는데 목적이 있으며, CRC product release version 에 대한, 제한사항 및 특이사항을 기술하고 있다.

4.2 Scope of the release

이 문서에 대한 모든 내용은, 다음의 CRC 모듈에 한정한다.

Module	Autosar version	SWS version	Module version
CRC	4.0.3	4.2.0	1.3.9

4.3 Module release notes

4.3.1 CRC

4.3.1.1 Change Log

- Version 1.3.9.0 (2022-08-20)
  - 신규 기능
    - N/A
  - 개선 사항
    - UNECE Rule 적용

원인	UNECE Cyber Security 법규 대응을 위한 보안 코딩 개선
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

- Version 1.3.8.0 (2021-12-31)
  - 신규 기능
    - N/A
  - 개선 사항
    - MISRA Rule 적용

원인	UNECE Cyber Security 법규 대응을 위한 보안 코딩 개선
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

- Version 1.3.7.0 (2021-01-20)

- 신규 기능
  - ■ N/A
- 개선 사항
  - ■ MISRA Rule 적용

원인	MISRA Rule 적용
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

➢ Version 1.3.6.0 (2020-12-31)

- 신규 기능
  - ■ N/A
- 개선 사항
  - ■ MISRA Rule 적용

원인	MISRA Rule 적용
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

- Version 1.3.5.0 (2019-10-17)
  - 신규 기능
    - N/A
  - 개선 사항
    - Source File Directory 구조 수정

원인	소스 코드 오픈
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

- Version 1.3.5 (2019-05-07)
  - 신규 기능
    - N/A
  - 개선 사항
    - MISRA 2012 적용

원인	MISRA Rule 2012 적용
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

- Version 1.3.4 (2016-06-27)
  - 신규 기능
    - N/A
  - 개선 사항
    - UserManual 수정

원인	UserManual 수정
동작 영향	없음
설정 영향	없음
ASW 조치 사항	없음

- Version 1.3.3 (2016-04-05)
  - DeliveryBox에 User Manual 추가

4.3.1.2 Limitations

4.3.1.2.1 설정항목중 CRC_16_HARDWARE, CRC_32_HARDWARE, CRC_8_HARDWARE, CRC_8H2F_HARDWARE 는 H/W 가 지원해야하는 것으로 현 CRC 모듈에서는 미지원 기능임.

4.3.1.3 Deviation

None

5. Configuration Guide

5.1 Crc 모듈

5.1.1 CrcGeneral Container

다음 설정을 참고한다.

Parameter Name	Value	Category
Crc16Mode	CRC_16_RUNTIME	C
Crc32Mode	CRC_32_RUNTIME	C
Crc8H2FMode	CRC_8H2F_RUNTIME	C
Crc8Mode	CRC_8_RUNTIME	C

6. Application Programming Interface (API)

6.1 Type Definitions

None

6.2 Macro Constants

None

6.3 Functions

6.3.1 Initialization/Deinitialization Related Api

None

6.3.2 Calcutation of 8bit CRC

Function Name	Crc_CalculateCRC8	
Syntax	FUNC(uint8, CRC_CODE) Crc_CalculateCRC8 (P2CONST(uint8, CRC_CONST, CRC_APPL_CONST)Crc_DataPtr, uint32 Crc_Length, uint8 Crc_StartValue8, boolean Crc_IsFirstCall)	
Service ID	0x01	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	Crc_DataPtr	Pointer to the start address of the data block to be calculated.
	Crc_Length	Length of the data block to calculated in bytes.
	Crc_StartValue8	Initial value when algorithm starts.

	Crc_IsFirstCall	TRUE: First call in a sequence or individual CRC calculation; start from initial value, ignore Crc_StartValue8. FALSE: Subsequent call in a call sequence; Crc_StartValue8 is interpreted to be the return value of the previous function call.
Parameters (Inout)	None	
Parameters (Out)	None	
Return Value	uint8	8 bit result of CRC calculation.
Description	Calculates CRC (8 bit) using CRC-SAE-J1850 standards by runtime based method. This service makes a CRC8 calculation on Crc_Length data bytes.	
Preconditions	None	
Configuration Dependency	This function shall be configurable with any one of the available CRC8 calculation methods by the configuration parameter : CRC_8_MODE	

6.3.3 Calculation of 8bit CRC with 0X2F polynomial

Function Name	Crc_CalculateCRC8H2F	
Syntax	FUNC(uint8, CRC_CODE) Crc_CalculateCRC8H2F (P2CONST(uint8, CRC_CONST, CRC_APPL_CONST)Crc_DataPtr, uint32 Crc_Length, uint8 Crc_StartValue8H2F, boolean Crc_IsFirstCall)	
Service ID	0x05	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	Crc_DataPtr	Pointer to the start address of the data block to be calculated.
	Crc_Length	Length of the data block to calculated in bytes.
	Crc_StartValue8H2F	Initial value when algorithm starts.
	Crc_IsFirstCall	TRUE: First call in a sequence or individual CRC calculation; start from initial value, ignore Crc_StartValue8H2F. FALSE: Subsequent call in a call sequence; Crc_StartValue8H2F is interpreted to be the return value of the previous function call.
Parameters (Inout)	None	
Parameters (Out)	None	
Return Value	uint8	8 bit result of CRC calculation.
Description	Calculates CRC (8 bit) using 0x2F polynomial by runtime based method. This service makes a CRC8 calculation with 0x2F polynomial on	

	Crc_Length data bytes.	
Preconditions	None	
Configuration Dependency	This function shall be configurable with any one of the available CRC8H2F calculation methods by the configuration parameter : CRC_8H2F_MODE	

6.3.4 Calculation of 16bit CRC

Function Name	Crc_CalculateCRC16	
Syntax	FUNC(uint16, CRC_CODE) Crc_CalculateCRC16 (P2CONST(uint8, CRC_CONST, CRC_APPL_CONST)Crc_DataPtr, uint32 Crc_Length, uint16 Crc_StartValue16, boolean Crc_IsFirstCall)	
Service ID	0x02	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	Crc_DataPtr	Pointer to the start address of the data block to be calculated.
	Crc_Length	Length of the data block to calculated in bytes.
	Crc_StartValue16	Initial value when algorithm starts.
	Crc_IsFirstCall	TRUE: First call in a sequence or individual CRC calculation; start from initial value, ignore Crc_StartValue16. FALSE: Subsequent call in a call sequence; Crc_StartValue16 is interpreted to be the return value of the previous function call.
Parameters (Inout)	None	
Parameters (Out)	None	
Return Value	uint16	16 bit result of CRC calculation.
Description	Calculates CRC (16 bit) using CRC-CCITT standards by runtime based method. This service makes a CRC16 calculation on Crc_Length data bytes.	
Preconditions	None	
Configuration Dependency	This function shall be configurable with any one of the available CRC16 calculation methods by the configuration parameter : CRC_16_MODE	

6.3.5 Calculation of 32bit CRC

Function Name	Crc_CalculateCRC32
Syntax	FUNC(uint32, CRC_CODE) Crc_CalculateCRC32 (P2CONST(uint8, CRC_CONST, CRC_APPL_CONST)Crc_DataPtr, uint32 Crc_Length, uint32 Crc_StartValue32, boolean Crc_IsFirstCall)
Service ID	0x03

Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	Crc_DataPtr	Pointer to the start address of the data block to be calculated
	Crc_Length	Length of the data block to calculated in bytes.
	Crc_StartValue32	Initial value when algorithm starts
	Crc_IsFirstCall	TRUE: First call in a sequence or individual CRC calculation; start from initial value, ignore Crc_StartValue32. FALSE: Subsequent call in a call sequence; Crc_StartValue32 is interpreted to be the return value of the previous function call.
Parameters (Inout)	None	
Parameters (Out)	None	
Return Value	uint32	32 bit result of CRC calculation.
Description	Calculates CRC (32 bit) using CRC-IEEE 802.3 standards by runtime based method. This service makes a CRC32 calculation on Crc_Length data bytes.	
Preconditions	None	
Configuration Dependency	This function shall be configurable with any one of the available CRC32 calculation methods by the configuration parameter : CRC_32_MODE	

6.3.6 GetVersion Information

Function Name	Crc_GetVersionInfo	
Syntax	FUNC(void, CRC_CODE) Crc_GetVersionInfo (P2VAR(Std_VersionInfoType, AUTOMATIC, CRC_APPL_DATA) Versioninfo)	
Service ID	0x04	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	None	
Parameters (Inout)	None	
Parameters (Out)	Versioninfo	Pointer represents where the version information of this module needs to be stored
Return Value	None	
Description	This function returns the version information of the module, which includes VendorId, ModuleId and Vendor Specific Version numbers. If Versioninfo is a NULL pointer then this service will simply return.	
Preconditions	None	
Configuration Dependency	None	

7. Generator

7.1 Generator Option

None

7.2 Generator Error Message

7.2.1 Crc

7.2.1.1 Error Messages

1) ERR201003: 'Component Name' Component is not present in the input file(s).
   - This error occurs, if 'Crc' component is not present in any of the input ECU Configuration Description File(s).

2) ERR201005: The parameter 'Parameter Name' in the container 'Container Name' should be configured.
   - This error occurs, if any of the mandatory configuration parameters mentioned below are not configured in ECU Configuration Description File.

Container Name	Parameter Name
BSW-IMPLEMENTATION	AR-RELEASE-VERSION
	VENDOR-ID
	SW-VERSION
BSW-MODULE-DESCRIPTION	MODULE-ID

3) ERR201006: The value configured for the parameter 'Parameter Name' in the container 'Container Name' should follow the pattern: <Pattern>
   - This error occurs, when the parameter 'Parameter Name' is not configured as per the pattern.

Parameter Name	Container Name	Pattern	Example
AR-RELEASE-VERSION	BSW-IMPLEMENTATION	<4.[0-9]+.[0-9]+>	4.0.3
SW-VERSION			

7.2.1.2 Warning Messages

None

7.2.1.3 Information Messages

1) INF201015: AUTOSAR Release version <value of the element AR-RELEASE-VERSION> configured for the parameter 'AR-RELEASE-VERSION' in provided MDT file is not correct. AUTOSAR Release version should be one of the following: 4.0.3.

- This information occurs, if the value of the element AR-RELEASE-VERSION present in the BSW Module Description template is configured other than 4.0.3.

2) INF201051: Value of the parameter 'Parameter Name' of the container 'CrcGeneral' is configured as 'Enumeration Literal', hence Generation Tool resets the value of the parameter to 'Reset Value'.
    - This information occurs, if the below mentioned parameters are configured as 'Enumeration Literal'.

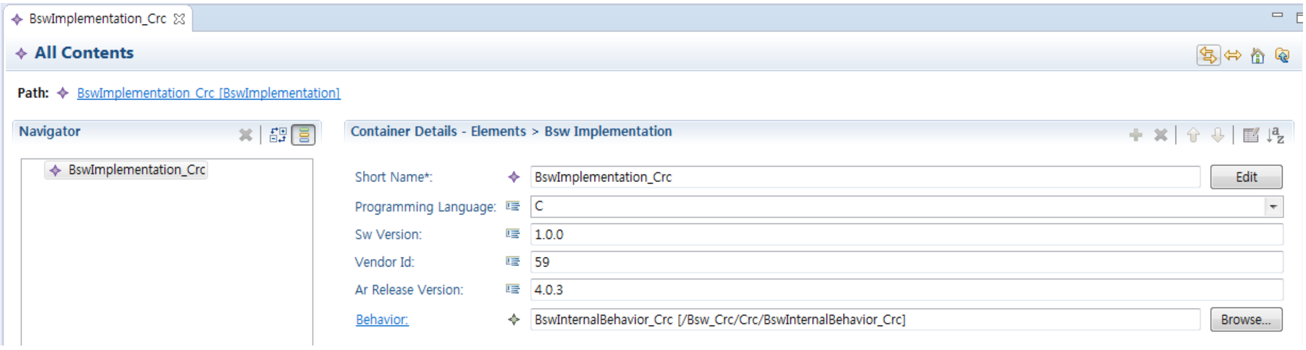
Parameter Name	Enumeration Literal	Reset Value
Crc16Mode	CRC_16_HARDWARE	CRC_16_RUNTIME
Crc32Mode	CRC_32_HARDWARE	CRC_32_RUNTIME
Crc8H2FMode	CRC_8H2F_HARDWARE	CRC_8H2F_RUNTIME
Crc8Mode	CRC_8_HARDWARE	CRC_8_RUNTIME

8. Appendix

8.1 Bswmd (Bsw Module Description)

8.1.1 Bsw 모듈 version 설정

각 모듈을 컴파일할 때, version 정보가 맞지 않으면 Compile 에서 Error 를 발생시킨다.
이때는 Bswmd 의 다음과 같이 BswImplementation Container 에서 version 정보를 수정해야 한다.



Path: BswImplementation_Crc [BswImplementation]

Container Details - Elements > Bsw Implementation

Short Name*: BswImplementation_Crc
Programming Language: C
Sw Version: 1.0.0
Vendor Id: 59
Ar Release Version: 4.0.3
Behavior: BswInternalBehavior_Crc [/Bsw_Crc/Crc/BswInternalBehavior_Crc]

8.2 Exclusive Areas

None

8.3 Example

8.3.1 calculation of CRC8

8.3.1.1 Data bytes 01h 02h 03h 04h 05h 06h 07h 08h: start value FFh:

```
Result = Crc_CalculateCRC8(&Array12345678[0], 8, 0xFF, TRUE);
```

8.3.2 calculation of CRC8H2F()

8.3.2.1 Data bytes 01h 02h 03h 04h 05h 06h 07h 08h: start value FFh:

```
Result = Crc_CalculateCRC8H2F(&Array12345678[0], 8, 0xFF, TRUE);
```

8.3.3 calculation of CRC16()

8.3.3.1 Data bytes 01h 02h 03h 04h 05h 06h 07h 08h: start value FFFFh:

```
Result = Crc_CalculateCRC16(&Array12345678[0], 8, 0xFFFF, TRUE);
```

8.3.4 calculation of CRC32()

8.3.4.1 Data bytes 01h 02h 03h 04h 05h 06h 07h 08h: start value FFFFFFFFh:

```
Result = Crc_CalculateCRC32(&Array12345678[0], 8, 0xFFFFFFFF, TRUE);
```