User's Manual

AUTOSAR MCAL R4.0.3
User's Manual

DIO Driver Component Ver.1.0.4

Generation Tool User's Manual

Target Device:
RH850/P1x-C

Renesas Electronics
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Abbreviations and Acronyms

Abbreviation / Acronym	Description
API	Application Programming Interface
AUTOSAR	AUTomotive Open System ARchitecture
BSWMDT	Basic Software Module Description Template
ECU	Electronic Control Unit
Id	Identifier
MCAL	Microcontroller Abstraction Layer
Dio/DIO	Digital Input Output
XML	eXtensible Mark-up Language
ARXML	AutosaR eXtensible Mark-up Language

Definitions

Terminology	Description
BSWMDT File	This file is the template for the Basic Software Module Description.
ECU Configuration Description File	Input file to MCAL Code Generator Tool. ECU Configuration Editor generates it.
Sl. No	Serial Number.

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Chapter 1 Introduction

The DIO Driver component provides the service for initializing the whole DIO structure of the microcontroller

The DIO Driver module comprises of two sections as Embedded Software and the MCAL Code Generator Tool to achieve scalability and configurability.

The document describes the DIO module specific inputs and outputs of the MCAL Code Generator Tool that is the common code generator engine used for the generation of the configuration code for all MCAL modules. MCAL Code Generator Tool is a command line tool that extracts information from ECU Configuration Description File and BSWMDT File and generates DIO Driver C Source and C Header files such as Dio_Cfg.h, Dio_Hardware.h, Dio_Cbk.h, Dio_Lcfg.c, Dio_PBcfg.c and Dio_Hardware.c

This document contains information on the options, input and output files of the MCAL Code Generator Tool. In addition, this manual covers a step-by-step procedure for the usage of MCAL Code Generator Tool.

1.1 Document Overview

This user manual is organized as given in the table below:

Table 1-1 Document Overview

Section	Contents
Section 1 (Introduction)	Introduces the document and explains how information is organized in this manual.
Section 2 (Reference)	Provides a list of documents referred while developing this document.
Section 3 (Code Generation Overview)	Provides the Code Generation Overview.
Section 4 (Input Files)	Provides information about ECU Configuration Description File.
Section 5 (Output Files)	Explains the output files that are generated by the MCAL Code Generator Tool.
Section 6 (Precautions)	Contains precautions to be taken during configuration of ECU Configuration Description File.
Section 7 (User Configuration Validation)	Describes about user configuration validation done by the MCAL Code Generator Tool.
Section 8 (Configuration Overview)	Provides Container Overview and details of parameters.
Section 9 (Messages)	Describes all the Error/Warning/Information messages of R4.0.3 which helps the user to understand the probable reason for the same.

Chapter 2 Reference

2.1 Reference Documents

The following table lists the documents referred to develop this document:

Table 2-1 Reference Documents

Sl. No.	Title	Version
1.	AUTOSAR_SWS_DIODriver.pdf	2.5.0
2.	MCAL_CodeGenerator_Tool_UserManual.pdf	1.7
3.	R20UT3828EJ0101-AUTOSAR.pdf	1.0.3

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Chapter 3 Code Generation Overview

Overview of Code Generation is shown below.

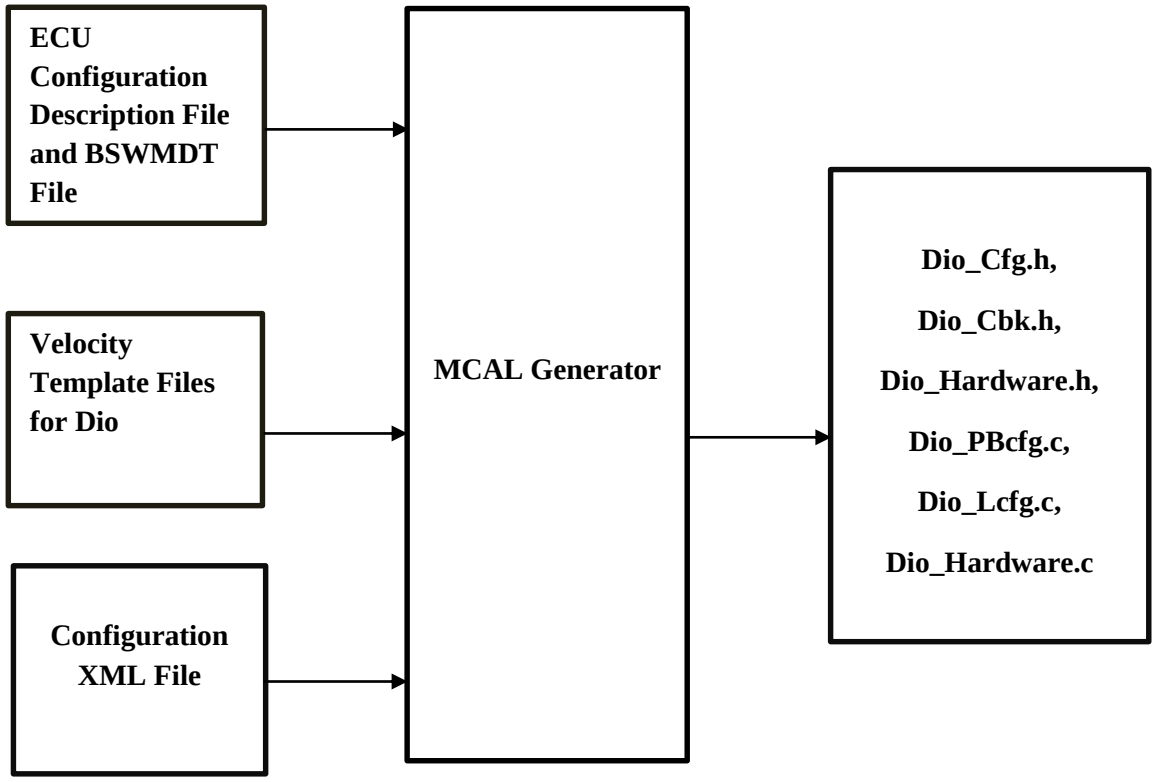

Figure 3-1 Overview of Code Generation

- ECU Configuration Description File (.arxml):
  This file will contain DIO Driver specific configuration information. This file shall be generated by AUTOSAR specified Configuration Editor.

- BSWMDT File (.arxml):
  MCAL Code Generator Tool uses “Common Published Information” from DIO module specific BSWMDT File. DIO module specific BSWMDT File should not be updated manually since it is “Static Configuration” file.

- Velocity template files:
  Dio_PBcfg_c, Dio_Cfg_h, Dio_Hardware_h, Dio_Cbk_h, Dio_Hardware_c, Dio_Lcfg_c, Dio_Validate and CommonHelper.
  The MCAL Code Generator Tool interprets them in order to provide user input validation and generate the final output file needed by the AUTOSAR configuration chain. They are the "logic" of the Code Generator

- Configuration XML File (.xml):
  This file is used to specify which velocity template to use and their location and the name of the output file generated.

For the error free input file, the MCAL Code Generator Tool generates the following output files: Dio_Cfg.h, Dio_Cbk.h, Dio_Hardware.h, Dio_PBcfg.c, Dio_Lcfg.c and Dio_Hardware.c and displays appropriate context sensitive error messages for wrong input and exits.

ECU Configuration Description File can be created or edited using ECU Configuration Editor.

Concept of execution for MCAL Code Generator Tool is as follows:

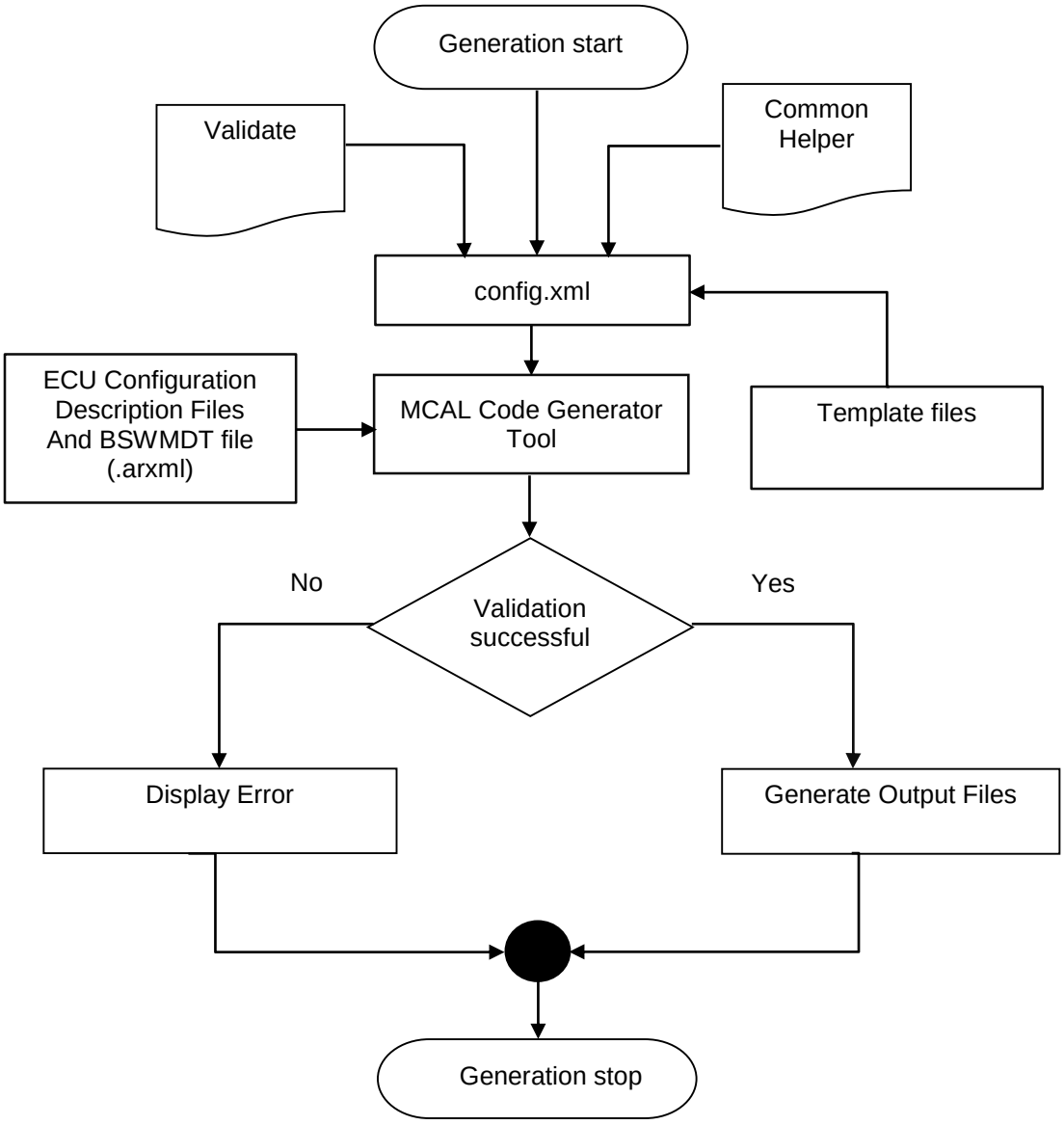

Figure 3-2 Flow Diagram of Code Generation

The module “Validate” will validate the configuration (contents of ECU Configuration Description File(s) as input). If there are incorrect values or incorrect dependencies, the MCAL Code Generator Tool will display error, warning and information messages. In case of errors, the MCAL Code Generator Tool will abort the execution.
Dio_Cfg_h / Dio_Cbk_h / Dio_PBcfg_c / Dio_Lcfg_c will generate compiler switch / structures necessary to the AUTOSAR Configuration chain and vendor specific parameters.
Dio_Hardware_h / Dio_Hardware_c will generate hardware related info (defines number of actual instances / channels used / structure to access to the I/O mapped peripheral).

Remark Please consult the general MCAL Code Generator Tool User Manual (MCAL_CodeGenerator_Tool_UserManual.pdf) and Getting Started MCAL Drivers X1x User Manual (R20UT3828EJ0101-AUTOSAR.pdf) for details about the tool command line options.

Chapter 4 Input Files

MCAL Code Generator Tool will accept the config.xml file, which has paths to the Velocity template files for generating Dio Driver files. MCAL Code Generator Tool need ECU Configuration Description File(s) and BSWMDT File as inputs to generate Dio Driver specific source files. Hence, ECU Configuration Description File should contain configuration of DIO Driver module. MCAL Code Generator Tool ignores any other AUTOSAR component configured in the ECU Configuration Description File. ECU Configuration Description File can be generated using configuration editor.

ECU Configuration Description File must comply with AUTOSAR standard ECU Configuration Description File format

Remark The detailed explanation about the parameters and containers are found in Parameter Definition File.

Chapter 5 Output Files

MCAL Code Generator Tool generates configuration details in C Header and C Source files (Dio_Cfg.h, Dio_Cbk.h, Dio_PBcfg.c, Dio_Lcfg.c, Dio_Hardware.h and Dio_Hardware.c).

The content of each output file is given in the table below:

Table 5-1 Output Files Description

Output File	Details
Dio_Cfg.h	This file contains the macro definitions for development error detects, version info API and channel group. This file contains DIO Channel Configuration Handles, DIO Port Configuration Handles and DIO Channel Group Configuration Handles.
Dio_PBcfg.c	This file contains Data Structures for DIO Port Group Configuration, DIO Port Channel Configuration and DIO Port Channel Group Configuration. This file also contains information on Number of ports and Channels configured.
Dio_Lcfg.c	This file contains Data Structure of DIO Port Channel Group Configuration.
Dio_Hardware.h	This file contains the definitions for addresses of the hardware registers used in the Dio Driver Module.
Dio_Hardware.c	This file contains the declarations for addresses of the hardware registers used in the Dio Driver Module.
Dio_Cbk.h	This file contains callback function prototype declarations to be used by application.

Remark Output files generated by MCAL Code Generator Tool should not be modified or edited manually

.

Chapter 6 Precautions

- ECU Configuration Description File and BSWMDT File must comply with AUTOSAR standard for R4.0.3 ECU Configuration Description File and BSWMDT File respectively.
- The input file must contain DIO Driver module.
- All the function names and the string values configured should follow C syntax for variables. It can only contain alphanumeric characters and "_". It should start with an alphabet.
- Configuration XML File should contain the file extension '.xml'.
- Configuration XML File: config.xml file should convey the velocity template file location and output file location
- If the output files generated by MCAL Code Generator Tool are modified externally, then they may not produce the expected results or may lead to error/warning/Information messages.
- Short Name for a container shall be unique within a name space.
- An error free ECU Configuration Description File generated from configuration editor has to be provided as input to the MCAL Code Generator Tool. Otherwise, MCAL Code Generator Tool may not produce the expected results or may lead to errors/warnings/information messages.
- The description file should always be generated using AUTOSAR specified configuration editor and it should not be edited manually.

Remark Refer the DIO Component User Manual (R20UT3639EJ0102-AUTOSAR.pdf) for deviations from AUTOSAR.

Chapter 7 User Configuration Validation

This section provides help to analyze the error, warning and information messages displayed during the execution of MCAL Code Generator Tool. It ensures conformance of input file with syntax and semantics. It also performs validation on the input file for correctness of the data.

For more details on list of Error/Warning/Information messages that are displayed as a result of input file(s) validation, refer Chapter 9 "*Messages*".

The MCAL Code Generator Tool displays error or warning or information when the user has configured incorrect inputs. The format of Error/Warning/Information message is as shown below.

<message_type>_<vendor_id>_<module_id>_<message_id>:<message_cont

ent>.

where,

- <message_type> : ERR/WARNING/INFO
- <vendor_id> : vendor Id = 59
- <module_id> : 120 - DIO Driver Module id (120) for user configuration checks.
- <Message_id> : 001-999
- <message_content>: Message content provides information about error or warning or information displayed when the user has configured incorrect inputs.

  File Name' and 'Path' need not be present for all Error/Warning/Information messages

  File Name: Name of the file in which the error has occurred

  Path: Absolute Path of the container in which the parameter that caused the message is present.

Chapter 8 Configuration Overview

8.1 Container Overview

The following figure represents container overview

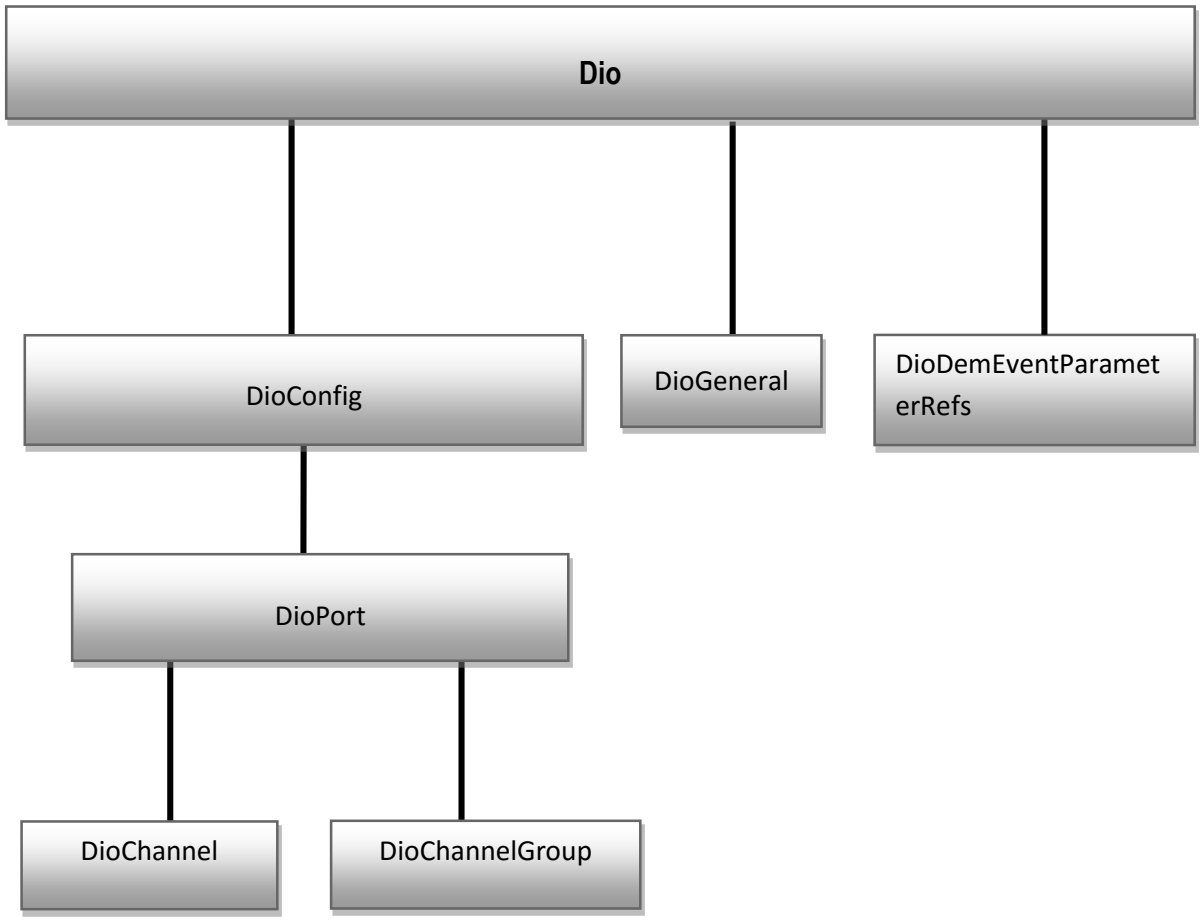

Figure 8-1 Configuration Overview

8.2 Pre-Compile Configurable Parameters

Table 8-1 Pre-Compile Configurable Parameters

Container Name	Parameter Name	Parameter Type	Parameter Range	Parameter Description
DioGeneral	DioDevErrorDetect	Boolean	TRUE / FALSE	This parameter switches the Development Error Detection and Notification ON or OFF.
	DioMaskedWritePortApi	Boolean	TRUE / FALSE	Adds / removes the service Dio_MaskedWritePort() from the code.
	DioFlipChannelApi	Boolean	TRUE / FALSE	This parameter adds / removes the service Dio_FlipChannel() from the code.
	DioVersionInfoApi	Boolean	TRUE / FALSE	Adds / removes the service Dio_GetVersionInfo() from the code.
	DioVersionCheckExternalModules	Boolean	TRUE / FALSE	Enable / disable AUTOSAR Version check for inter-module dependencies.
	DioCriticalSectionProtection	Boolean	TRUE / FALSE	This parameter specifies if the DIO driver CPU load can be reduced by disabling the enter/exit critical section functionality by adding a precompiled configuration parameter to the DIO driver.
	DioDeviceName	Enum	R7F701370A, R7F701371, R7F701372, R7F701373, R7F701374	This parameter contains the supported device name.
	DioWriteVerify	Enum	WV_INIT_RUNTIME WV_DISABLE	This parameter Enable/Disable Register write verification service.
	DioUseWriteVerifyErrorInterface	Boolean	TRUE / FALSE	This parameter allows the user to generate a user specific callback function for Register write verification service.
	DioWriteVerifyErrorInterface	String	STRING	A User can give a callback function name for register write verification in this parameter.

8.3 Post Build Time Configurable Parameters

Table 8-2 Post Build Time Configurable Parameters

Container Name	Parameter Name	Parameter Type	Parameter Range	Parameter Description
DioPort	DioPortId	Integer	This value will be assigned to the DIO port symbolic name. This parameter is not used for implementation.	Numeric identifier of the DIO port. Not all MCU ports may be used for DIO, thus there may be "gaps" in the list of all IDs.
	DioPortName	Enum	**For R7F701370A, R7F701371, R7F701372** PORTGROUP_0_BITS_0_TO_10_13_14, PORTGROUP_1_BITS_1_TO_7, PORTGROUP_2_BITS_0_TO_15, PORTGROUP_3_BITS_0_TO_14, PORTGROUP_4_BITS_0_TO_14, PORTGROUP_5_BITS_4_TO_15_0_1, PORTGROUP_6_BITS_0_TO_15, PORTGROUP_7_BITS_0_TO_9, PORTGROUP_8_BITS_0_TO_15, PORTGROUP_9_BITS_0_TO_8, PORTGROUPJTAG_0_BITS_0_TO_5	This parameter specifies the DIO port group for a DIO port.

Container Name	Parameter Name	Parameter Type	Parameter Range	Parameter Description
			For R7F701373	
			PORTGROUP_0_BITS_0_TO_10_13_14, PORTGROUP_1_BITS_1_TO_7, PORTGROUP_2_BITS_0_TO_15, PORTGROUP_3_BITS_0_TO_14, PORTGROUP_4_BITS_0_TO_14, PORTGROUP_5_BITS_4_TO_15_0_1, PORTGROUP_6_BITS_0_TO_6_10_11_12_13, PORTGROUP_7_BITS_0_TO_5, PORTGROUP_9_BITS_7_8, PORTGROUPJTAG_0_BITS_0_TO_5	
			For R7F701374	

Container Name	Parameter Name	Parameter Type	Parameter Range	Parameter Description
			PORTGROUP_0_BITS_0_TO_10_13_14, PORTGROUP_1_BITS_1_TO_4, PORTGROUP_2_BITS_0_TO_15, PORTGROUP_3_BITS_0_TO_14, PORTGROUP_4_BITS_0_TO_14, PORTGROUP_5_BITS_4_TO_15_0_1, PORTGROUP_6_BITS_0_TO_3, PORTGROUPJTAG_0_BITS_0_TO_5	
DioChannel	DioChannelId	Integer	This value will be assigned to the symbolic names. This parameter is not used for implementation.	Channel Id of the DIO channel
	DioChannelBitPosition	Integer	0-15	This parameter contains channel bit position of the DIO channel.
DioChannelGroup	DioChannelGroupIdentification	String	This parameter is not used for implementation.	The DIO channel group is identified in DIO API by a pointer to a data structure (of type Dio_ChannelGroupType). That data structure contains the channel group information.
	DioPortMask	Integer	0-65535	This shall be the mask, which defines the positions of the channel group.
	DioPortOffset	Integer	0-15	The position of the Channel Group on the port, counted from the LSB. This value can be derived from DioPortMask.
DioDemEventParameterRefs	DioDemEventParameterRefs	Reference	Reference to DemEventId of Dem module.	Reference to the DemEventParameter which shall be issued when the error "DIO register write verification

Container Name	Parameter Name	Parameter Type	Parameter Range	Parameter Description
				failed (HW)" has occurred.

Chapter 9 Messages

The messages help to identify the syntax or semantic errors in the ECU Configuration Description File. Hence, it ensures validity and correctness of the information available in the ECU Configuration Description File.

The following section gives the list of error, warning and information messages displayed by the MCAL Code Generator Tool.

9.1 Error Messages

ERR_59_120_001: Parsing of Dio module is incorrect.
This error will occur when the parameter passed is not for Dio module.

ERR_59_120_002: The parameter 'parameter name' in the container 'container name' shall be configured.

This error will occur, if any of the mandatory configuration parameter(s) mentioned below is (are) not configured in ECU Configuration Description File.

Table 9-1 Parameters and Container related to error ERR_59_120_002

Container	Parameters
DioPort	DioPortName
DioChannel	DioChannelBitPosition
DioChannelGroup	DioPortMask
	DioPortOffset

Note: DioChannel and DioChannelGroup containers are optional container. If these containers are configured, then respective parameters from above table are mandatory.

ERR_59_120_003: The value <value for DioPortName> configured for the parameter 'DioPortName' present in the container 'DioPort' shall be unique.

This error will occur, if the Parameter DioPortName is configured with same value more than once in a configset.

ERR_59_120_004: The value for parameter 'DioChannelBitPosition' present in the container 'DioChannel' of the DIO port group <value for DioPortName parameter> is not in the range of <Start> and <End>.

This error will occur, if the value for parameter DioChannelBitPosition present in the container DioChannel for respective DIO port group is not valid as configured channel bit position must belongs to the respective DIO port group. In above error message, <Start> and <End> will be replaced by 'start channel bit position' and 'end channel bit position' respectively for selected DIO port group.

Example: Suppose in PORTGROUP_2_BITS_0_TO_2, only 0 to 2 channels are available. If user configures channels, which does not belong to PORTGROUP_2_BITS_0_TO_2 then it is invalid configuration. Here start is 0 and end is 2.

ERR_59_120_005: The value <value for DioChannelBitPosition> configured for the parameter 'DioChannelBitPosition' present in the container 'DioChannel' of the DIO port group <value for DioPortName parameter> shall be unique.

This error will occur, if the value for parameter DioChannelBitPosition present in the container DioChannel is not unique for respective DIO port group configured for the parameter DioPortName.

ERR_59_120_006: The value for parameter 'DioPortMask' <value for the DioPortMask> present in the container 'DioChannelGroup' of the DIO port group <value for DioPortName parameter> is not valid.

This error will occur, if value for parameter DioPortMask present in the container DioChannelGroup for respective DIO port group is not valid as the grouped channels must belong to the respective DIO port group.

Example: Suppose in PORTGROUP_2_BITS_0_TO_2, only 0 to 2 channels are available. In this case, user should not consider channel 3 and channel 4 in channel grouping, since channel 3 and channel 4 does not belong to PORTGROUP_2_BITS_0_TO_2.

ERR_59_120_007: The number of 'DioChannelGroup' container is not same across multiple configuration sets.

This error will occur, if the number of DioChannelGroup container is not same across multiple configuration sets

ERR_59_120_008: The value for parameter 'DioPortOffset' <value for the DioPortOffset> present in the container 'DioChannelGroup' of the DIO port group <value for DioPortName parameter> is not valid. The value of the parameter 'DioPortOffset' shall be equal to the start position of the DIO channel group.

This error will occur, if the value for parameter DioPortOffset present in the container DioChannelGroup is not valid. The value of the parameter DioPortOffset shall be equal to the start position of the DIO channel group.

Example: Suppose DIO channel grouping started from Channel 2 then value for parameter DioPortOffset shall be 2.

ERR_59_120_009: The short name <short name for DioPort> configured for the container 'DioPort' shall be unique.

This error will occur, if short name of the container DioPort is not unique in ECU Configuration Description File.

ERR_59_120_010: The short name <short name for DioChannel> configured for the container 'DioChannel' shall be unique.

This error will occur, if short name of the container DioChannel is not unique in each DioPort container.

ERR_59_120_011: The short name <short name for DioChannelGroup> configured for the container 'DioChannelGroup' shall be unique.

This error will occur, if short name of the container DioChannelGroup is not unique in each DioPort container.

ERR_59_120_012: The number of 'DioPort' container is not same across multiple configuration sets.

This error will occur, if the number of DioPort container is not same across multiple configuration sets.

ERR_59_120_013: The number of 'DioChannel' container is not same across multiple configuration sets.

This error will occur, if the number of DioChannel container is not same across multiple configuration sets.

ERR_59_120_014: The number of ‘DioChannelGroup’ container is not same across multiple configuration sets.

This error will occur, if the number of DioChannelGroup container is not same across multiple configuration sets.

ERR_59_120_015: DioWriteVerifyErrorInterface should have a valid error notification, since the value of the parameter DioWriteVerify is <WV_INIT_RUNTIME> and the parameter DioUseWriteVerifyErrorInterface is configured as true.

This error will occur if there is no valid error notification configured for the parameter DioUseWriteVerifyErrorInterface when write-verify check is enabled.

ERR_59_120_016: DioUseWriteVerifyErrorInterface parameter should not be configured as true in DioGeneral Container, since the value of DioWriteVerify is <WV_DISABLE>

This error will occur when the parameter DioUseWriteVerifyErrorInterface is configured as true, when the write-verify check is disabled.

ERR_59_120_017: The reference path <path> provided for the parameter 'DIO_E_REG_WRITE_VERIFY’ within the container ‘DioDemEventParameterRefs’ is incorrect.

This error will occur, if the path provided for the parameter DIO_E_REG_WRITE_VERIFY in the container DioDemEventParameterRefs is incorrect.

ERR_59_120_018: The reference parameter 'DIO_E_REG_WRITE_VERIFY' of the container 'DioDemEventParameterRefs' shall be configured, since the value of the parameter 'DioWriteVerify' of the container 'DioGeneral' is configured as <WV_INIT_RUNTIME>.

This error will occur, if there is no path provided for parameter DIO_E_REG_WRITE_VERIFY

ERR_59_120_019: The error notification configured for the parameter 'DioWriteVerifyErrorInterface' should follow C syntax <[a-z A-Z][a-z A-Z 0-9_]>

This error will occur if the parameter DioWriteVerifyErrorInterface in container DioGeneral0 does not follow C syntax <[a-zA-Z][a-zA-Z0-9_]>.

ERR_59_120_020: The container short name of ‘DioChannel’ container is not same across multiple configuration sets.

This error will occur, if the container short name of DioChannel container is not same across multiple configuration sets.

ERR_59_120_021: The variant is not supported currently.

This error occurs when the parameter 'DioDeviceName' in the General container is configured other than the supported devices.

ERR_59_120_022: The error notification configured for the parameter 'DioWriteVerifyErrorInterface' should not be $ErrInterface, since the value of the parameter 'DioWriteVerify' of the container 'DioGeneral' is configured as <WV_INIT_RUNTIME>.

This error will occur if error notification configured as NULL/NULL_PTR for the parameter DioUseWriteVerifyErrorInterface when write-verify check is enabled.

ERR_59_120_023: The container DioGeneral0 shall be configured

This error occur if the container DioGeneral0 is not configured.

ERR_59_120_1001: The specified AR-PACKAGE Name not found in description file

This error will occur, if Specified AR-PACKAGE Name not found in description file

ERR_59_100_1008: The parameter DioDevErrorDetect in the DioGeneral0 Container is not configured.

This error will occur, if the parameter DioDevErrorDetect in the DioGeneral0 Container is not configured.

9.2 Warning Messages

None

9.3 Information Messages

None

Revision History

Sl. No.	Description	Version	Date
1.	Initial Version	1.0.0	04-Aug-2015
2.	The following changes are made: 1. R number is added in the last page 2. Added parameter DioCriticalSectionProtection in Figure 8-1 Configuration overview. 3. Added parameter DioCriticalSectionProtection in 8.2 Pre-Compile Configurable Parameters. 4. Added error message ERR_59_120_009 in 10.1.1 Error Messages 5. Description added for error messages in 10.1.1 Error Messages 6. Compiler version updated in 9.3 User Environment Settings	1.0.1	30-Mar-2016
3	The following changes are made: 1. Chapter 1, Updated Introduction. 2. Section 2.1, Updated reference document details. Chapter 5, Updated description of output files. 3. Chapter 6, Added one more point in precautions. 4. Section 8.2, Updated Pre-Compile Configurable Parameters 5. Section 8.3, Updated Post Build Time Configurable Parameters 6. Chapter 9.1.1, Modified Error messages ERR_59_120_001 to ERR_59_120_009 and added ERR_59_120_010 to ERR_59_120_022 7. Chapter 7, Updated the format of Error/Warning/Information message. 8. Chapter 4, Updated description of Input files. 9. Updated Chapters 1,3,4,5,6,7 by rephrasing Tool and DIO Driver Generation Tool with MCAL Code Generator Tool 10. Removed Chapter 9 Generation Tool Options, Chapter-10 Notes. 11. Chapter 3, Added remark for common MCAL Code Generator Tool user manual. 12. Figure 3-2 is renamed from Flow-Diagram of MCAL Code Generator Tool to Flow-Diagram of Code Generation 13. Chapter 3, Updated Figure 3-2 Flow-Diagram of Code Generation 14. Chapter 3, Renamed chapter name MCAL Code Generator Tool Overview to Code Generation Overview 15. Removed parameters from Figure 8-1, Configuration Overview 16. Updated copyright year.	1.0.2	23-Feb-2017
4	The following changes are made: 1. Added details of Error message ERR_59_120_023 in section 9.1 2. Copyright details and notice are changed. 3. Modified Table 8-2 to update values of the parameter DioPortName. 4. Added ERR_59_120_1001 and ERR_59_120_1008 in section 9.1. 5. Chapter 3, Removed extension.vm from Velocity template files.	1.0.3	23-May-2017
5	1. Updated Table 8-1 to change the parameter type and parameter range of the parameter DioWriteVerify. 2. Updated R number of the Component User Manual in Chapter 6.	1.0.4	16-Jun-2017

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