AUTOSAR LinTrcv User Manual

Document Change History			
Date (YYYY-MM-DD)	Ver.	Editor	Change Descriptions
2020-12-22	1.0.0.0	SJ Kim	- Initial Version
2022-02-24	1.0.1.0	SM Kwon	- Update Scope of the Release - Add Change Log
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2024-04-08	1.0.7.0	Yubin Song	- Add LinTrcvChannel parameter “LinTrcvStandbyModeUsed”

Table of Contents

1 Overview

This document provides caution or reference information for users when setting parameters or designing systems for LinTrcv module in the HYUNDAI AUTOEVER AUTOSAR platform. It is written based on SRS/SWS AUTOSAR standard. More detailed information can be found in the reference document below.

The interpretation of the category related to setting is as follows:

- Changeable (C) : Items that can be set by the user.
- Fixed (F) : Items that cannot be changed by user
- Not Supported (N) : Items that not supported

Acronyms and abbreviations:

Abbreviation	Description
API	Application Program Interface
Channel	A channel is a software exchange medium for data that are defined with the same criteria
ComM	Communication Manager
Det	Default Error Tracer
Dio/DIO	Digital input output, one of the SPAL SW modules
EcuM	ECU State Manager
ECU	Electronic Control Unit
Gpt	General purpose Timer
ICU	Interrupt Control Unit
ISR	Interrupt Service Routine
LinTrcv	Lin Transceiver Driver
MCAL	Micro Controller Abstraction Layer
N/A	Not applicable
PDU	Protocol Data Unit
SW	Software
SPI	Serial Peripheral Interface

SPI Channel	A channel is a software exchange medium for data that are defined with the same criteria: configuration parameters, number of data elements with same size and data pointers (source & destination) or location. See specification of SPI driver for more details.
SPI Sequence	A sequence is a number of consecutive jobs to be transmitted. A sequence depends on a static configuration. See specification of SPI driver for more details.

2 Reference

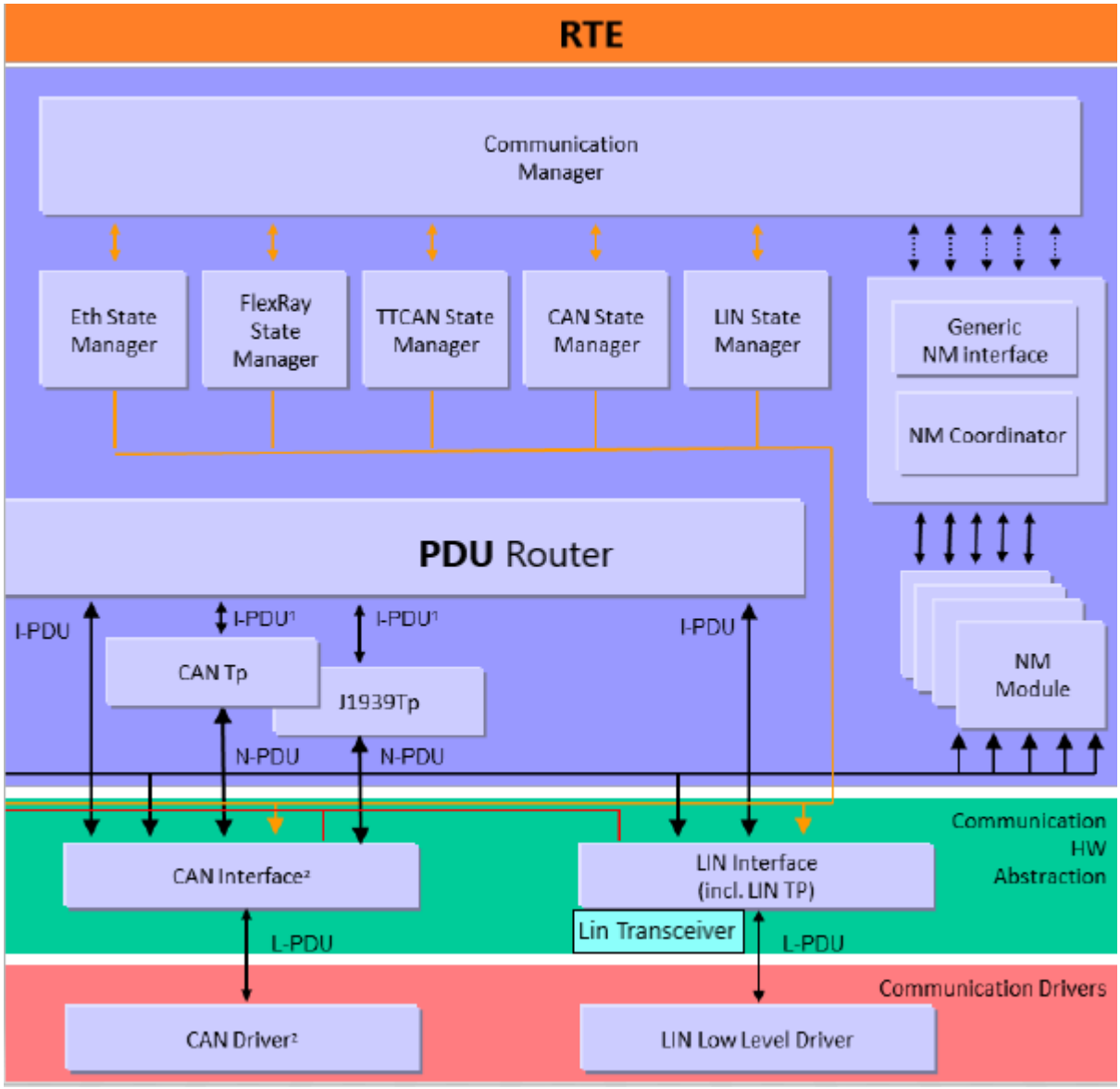
Sl. No.	Title	Version
1	AUTOSAR_SWS_LINTansceiverDriver.pdf	4.4.0
2	AUTOSAR_SWS_LINDriver.pdf	4.4.0
3	MC33661.pdf	Rev. 8.0, 4/2013
4	MCU_TC397.pdf	11-08-2018
5	(Spec No) ES90600-00E	
6	(Spec No) ES90600-10E	

3 AUTOSAR System

3.1 Overview of LinTrcv Module

LinTrcv is a module that controls the ECU's LIN transceiver hardware:

- Power supply control.
- Manage wakeup via bus.



4 Limitations and Deviations

4.1 Limitations

4.1.1 Wakeup interrupt detection by using ICU channel

LinTrcv channel can detect wakeup interrupt by referencing ICU channel. This feature is not supported.

4.1.2 Distribution for multiple ECUC Partitions

LinTrcv channels and LinTrcv module itself can be distributed to multiple ECUC Partitions. This feature is not supported.

4.2 Deviations

None

5 Configuration Guide

LinTrcv configurations of AUTOSAR platform distributed by HYUNDAI AUTOEVER should be set by the users follow by the project requirements.

5.1 LinTrcvGeneral Settings

Parameter Name	Value	Category
LinTrcvDevErrorDetect	True	C
LinTrcvIndex	0	F
LinTrcvTimerType	Timer_1us16bit	C
LinTrcvVersionInfoApi	True	C
LinTrcvWaitTime	User Defined	C
LinTrcvWakeUpSupport	True	C

1) LinTrcvDevErrorDetect
   - Setting whether to use Det.
2) LinTrcvIndex
   - Setting Module Instance Id.
3) LinTrcvTimerType
   - To assign type of the Time Service predefined timer.
4) LinTrcvVersionInfoApi
   - Setting whether to support version information.
5) LinTrcvWaitTime
   - Wait time for transceiver state changes in seconds.
6) LinTrcvWakeUpSupport
   - Setting whether to use the wakeup function.

5.2 LinTrcvChannel Settings

Parameter Name	Value	Category
LinTrcvChannelId	Index value	F
LinTrcvChannelUsed	True	C
LinTrcvWakeupByBusUsed	True	C
LinTrcvIcuChannelRef	Not Support	N
LinTrcvWakeupSourceRef	User Defined	C
LinTrcvChannelEcucPartitionRef	Not Support	N
LinTrcvStandbyModeUsed	True/False	C

1) LinTrcvChannelId
   - Setting the channel Id.
   - Enter values sequentially from 0.
2) LinTrcvChannelUsed
   - Setting whether to use Transceiver Channel.
3) LinTrcvWakeupByBusUsed
   - If LinTrcv handles Bus Wakeup, set to True.
   - If the item is True, you must set the LinTrcvWakeupSourceRef value.
4) LinTrcvIcuChannelRef
   - Setting for ICU channel to enable/disable Wakeup Interrupt.
   - Not used currently.
5) LinTrcvWakeupSourceRef
   - Specify the wakeup source set in EcuM.
6) LinTrcvChannelEcucPartitionRef
   - Not implemented follow SWS_LinTrcv_00174 Autosar specification 4.4.0.
7) LinTrcvStandbyModeUsed
   - If LinTrcv hardware support StandbyMode, set to True.

5.3 LinTrcvDioChannelAccess Settings

Parameter Name	Value	Category
LinTrcvHardwareInterfaceName	Rule naming	C
LinTrcvDioSymRefName	Following Dio configuration	C

1) LinTrcvHardwareInterfaceName
   - Setting the hardware interface name (the pin name to control value). Enter the following four values.
   - EN: Enable pin setting.
   - WK: WK pin setting (Optional: In case of Standby Mode is required)
   - TX: TX pin setting.
   - RX: RX pin setting (Optional: Configured when LinTrcvWakeupByBusUsed is set True)

   Rule naming

   Dio Channel: [EN|WK|TX|RX]

   Example: EN

   Dio Port, Dio GroupChannel: "(EN|WK|TX|RX)(1[0-5]|₩₩d)(_(EN|WK|TX|RX)(1[0-5]|₩₩d))*"

   Example: EN0_WK1_TX12.

   Number: specify Pin Index in Port.

2) LinTrcvDioSymRefName
   - Reference to symbolic name a Dio Port, Dio Channel or Dio Channel Group.

6 Application Programming Interface (API)

6.1 Type Definitions

6.1.1 LinTrcv_ConfigType

Type:	Structure	
Range:	implementation specific	--
Description:	Configuration data structure of the LinTrcv module.	

6.1.2 LinTrcv_TrcvModeType

Type:	Enumeration		
Range:	LINTRCV_TRCV_MODE_NORMAL	- -	Transceiver mode NORMAL
	LINTRCV_TRCV_MODE_STANDBY	- -	Transceiver mode STANDBY
	LINTRCV_TRCV_MODE_SLEEP	-	Transceiver mode SLEEP

		-	
Description:	Operating modes of the LIN Transceiver Driver		

6.1.3 LinTrcv_TrcvWakeupModeType

Type:	Enumeration		
Range:	LINTRCV_WUMODE_ENABLE	--	The notification for wakeup events is enabled on the addressed network.
	LINTRCV_WUMODE_DISABLE	--	The notification for wakeup events is disabled on the addressed network.
	LINTRCV_WUMODE_CLEAR	--	A stored wakeup event is cleared on the addressed network.
Description:	Wake up operating modes of the LIN Transceiver Driver.		

6.1.4 LinTrcv_TrcvWakeupReasonType

Type:	Enumeration		
Range:	LINTRCV_WU_ERROR	--	Due to an error wake up reason was not detected.
	LINTRCV_WU_NOT_SUPPORTED	--	The transceiver does not support any information for the wake up reason.
	LINTRCV_WU_BY_BUS	--	The transceiver has detected, that the network has caused the wake up of the ECU.
	LINTRCV_WU_BY_PIN	--	The transceiver has detected a wake-up event at one of the transceiver's pins (not at the LIN bus).
	LINTRCV_WU_INTERNALLY	--	The transceiver has detected, that the network has been woken up by the ECU via a request to NORMAL mode.
	LINTRCV_WU_RESET	--	The transceiver has detected, that the wake up is due to an ECU reset.
	LINTRCV_WU_POWER_ON	--	The transceiver has detected, that the wake up is due to an ECU reset after power on.
Description:	This type denotes the wake up reason detected by the LIN		

	transceiver in detail.

6.2 Macro Constants

None

6.3 Functions

Describes all functionalities of LIN Transceiver modules.

6.3.1 LinTrcv_Init

Service name	LinTrcv_Init	
Syntax	void LinTrcv_Init (const LinTrcv_ConfigType* ConfigPtr)	
Service ID[hex]	0x00	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (In)	ConfigPtr	Pointer to the selected configuration set.
Parameters (Inout)	None	
Parameters (Out)	None	
Return value	None	
Description	Initializes the Lin Transceiver Driver module. This function is used by BSW.	
Available via	LinIf.h	

6.3.2 LinTrcv_SetOpMode

Service name	LinTrcv_SetOpMode	
Syntax	Std_ReturnType LinTrcv_SetOpMode (uint8 LinNetwork, LinTrcv_TrcvModeType OpMode)	
Service ID[hex]	0x01	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (In)	LinNetwork	LIN network to wich API call has to be applied.

	OpMode	The parameter says to which operation mode the change shall be performed.
Parameters (Inout)	None	
Parameters (Out)	None	
Return value	Std_ReturnType	E_OK: will be returned if the transceiver state has been changed to the requested mode. E_NOT_OK: will be returned if the transceiver state change is not accepted or has failed or the parameter is out of the allowed range.
Description	The internal state of the LIN transceiver driver is switched to mode given in the parameter OpMode. This function is used by BSW.	
Available via	LinTrcv.h	

6.3.3 LinTrcv_GetOpMode

Service name	LinTrcv_GetOpMode	
Syntax	Std_ReturnType LinTrcv_GetOpMode (uint8 LinNetwork, LinTrcv_TrcvModeType* OpMode)	
Service ID[hex]	0x02	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	LinNetwork	LIN network to which API call has to be applied.
Parameters (Inout)	None	
Parameters (Out)	OpMode	Pointer to operation mode of the bus the API is applied to.
Return value	Std_ReturnType	E_OK: will be returned if the operation mode is detected. E_NOT_OK: will be returned, if service request is failed due to development errors or the operation mode is not detected.
Description	API detects the actual software state of LIN transceiver	

	driver. This function is used by BSW.
Available via	LinTrcv.h

6.3.4 LinTrcv_GetBusWuReason

Service name	LinTrcv_GetBusWuReason	
Syntax	Std_ReturnType LinTrcv_GetBusWuReason (uint8 LinNetwork, LinTrcv_TrcvWakeupReasonType* Reason)	
Service ID[hex]	0x03	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	LinNetwork	LIN network to which API call has to be applied.
Parameters (Inout)	None	
Parameters (Out)	Reason	Pointer to wakeup reason of the bus the API is applied to.
Return value	Std_ReturnType	E_OK: will be returned if the wake up reason is detected. E_NOT_OK: will be returned, if service request is failed due to development errors or the wakeup reason is not detected.
Description	This API provides the reason for the wakeup that the LIN transceiver has detected in the parameter "Reason". The ability to detect and differentiate the possible wakeup reasons depends strongly on the LIN transceiver hardware. This function is used by BSW.	
Available via	LinTrcv.h	

6.3.5 LinTrcv_GetVersionInfo

Service name	LinTrcv_GetVersionInfo
Syntax	void LinTrcv_GetVersionInfo (Std_VersionInfoType* versioninfo)
Service ID[hex]	0x04
Sync/Async	Synchronous

Reentrancy	Reentrant	
Parameters (In)	None	
Parameters (Inout)	None	
Parameters (Out)	versioninfo	Pointer to version information of this module.
Return value	None	
Description	This service provides the version information of this module through the parameter "versioninfo". This function is used by user. But it needs configuration. (It cannot be called directly by user)	
Available via	LinTrcv.h	

6.3.6 LinTrcv_CheckWakeup

Service name	LinTrcv_CheckWakeup	
Syntax	Std_ReturnType LinTrcv_CheckWakeup (uint8 LinNetwork)	
Service ID[hex]	0x07	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (In)	LinNetwork	LIN network to which API call has to be applied.
Parameters (Inout)	None	
Parameters (Out)	None	
Return value	Std_ReturnType	E_OK: Will be returned, if a wakeup has been detected. E_NOT_OK: Will be returned, if no wakeup has been detected.
Description	Notifies the calling function if a wakeup is detected. This function is used by BSW.	
Available via	LinTrcv.h	

6.3.7 LinTrcv_SetWakeupMode

Service name	LinTrcv_SetWakeupMode
Syntax	Std_ReturnType LinTrcv_SetWakeupMode (

	uint8 LINNetwork, LinTrcv_TrcvWakeupModeType TrcvWakupMode)	
Service ID[hex]	0x05	
Sync/Async	Synchronous	
Reentrancy	non Reentrant	
Parameters (In)	LINNetwork	LIN network to which API call has to be applied.
	TrcvWakupMode	Requested transceiver wakup reason.
Parameters (Inout)	None	
Parameters (Out)	None	
Return value	Std_ReturnType	E_OK: will be returned if the transceiver state has been changed to the requested mode. E_NOT_OK: will be returned, if service request is failed due to development errors or the wakeup mode is not set.
Description	This API enables, disables and clears the notification for wakeup events on the addressed network. This function is used by BSW.	
Available via	LinTrcv.h	

7 Generator

7.1 Generator Option

Options	Description
-G,--Generation	Symbolic parameters to be used for fore generation (skip validation).
-H,--Help	Display this help message.
-I,--Input <I>	ECU description file path of the module for which generation tool need to run.
-L,--Log	Symbolic parameters to be used for generation error log.
-M,--Module <M>	Specify module name and version to be generated code for.
-O,--Output <O>	Project-relative path to location where the generated code is to be placed.

-T,--Top_path <T>	Symbolic parameters to be used for set path of module.
-V,--Validate	Symbolic parameters to be used for invoking validation checks.

7.2 Generator Message

This section helps to analyze the errors or warnings displayed during the execution of the tool. It ensures conformance of input file(s) with syntax and semantics.

7.2.1 Error Messages

7.2.1.1 ERR064004: The reference path is empty for the parameter LinTrcvWakeupSourceRef in the container LinTrcvChannel with LinTrcvWakeupByBusUsed = 1.

Description: This error message is displayed if refer to Wakeup Source of module EcuM not configured, but parameter LinTrcvWakeupByBusUsed was configured <1/true>.

7.2.1.2 ERR064008: Value of the parameter LinTrcvWakeupByBusUsed in the container LinTrcvChannel should not be configured as <true/1>, since value of the parameter LinTrcvWakeUpSupport in the container LinTrcvGeneral is configured as <0/false>.

Description: This error message is displayed when parameter LinTrcvWakeUpSupport in the container LinTrcvGeneral was configured <0/false>, but parameter LinTrcvWakeupByBusUsed in the container LinTrcvChannel was configured <1/true>.

7.2.1.3 ERR064051: The value configured for the parameter LinTrcvHardwareInterfaceName in the container LinTrcvDioChannelAccess format should be (EN|WK|TX|RX)[index][0-15]...

Description: This error message is displayed when parameter LinTrcvHardwareInterfaceName wasn't configured properly follow Pattern "(EN|WK|TX|RX)" with Channel and "(EN|WK|TX|RX)(1[0-5]|₩₩d)(_(EN|WK|TX|RX)(1[0-5]|₩₩d))*" with Port, GroupChannel.
Example:

- w.r.t Channel: EN
- w.r.t Port or GroupChannel: EN0_WK5 (number: pin index in port)

7.2.1.4 ERR064053: The value <EN/TX> should be configured for parameter C in the container LinTrcvDioChannelAccess belong to LinTrcvChannel.

Description: This error message is displayed when EN, TX pin wasn't configured for parameters LinTrcvHardwareInterfaceName in the container LinTrcvDioChannelAccess.

7.2.1.5 ERR064054: Value of the parameter LinTrcvChannelId should be unique in in the container LinTrcvChannel.

Description: This error message is displayed when LinTrcvChannelId was duplicated.

7.2.1.6 ERR064055: Value of the parameter 'LinTrcvChannelId' should start from <0> and should be sequential in the containers LinTrcvChannel.

Description: This error message is displayed when the parameter 'LinTrcvChannelId' does not start from <0> and is not sequential in the container 'LinTrcvChannel'.

7.2.1.7 ERR064056: The value RX should be configured for parameter LinTrcvHardwareInterfaceName in the container LinTrcvDioChannelAccess belong to LinTrcvChannel when wakeup by bus supported.

Description: This error message is displayed when parameter LinTrcvWakeupByBusUsed in the container LinTrcvChannel, but pin RX wasn't configured for LinTrcvHardwareInterfaceName in the container LinTrcvDioChannelAccess.

7.2.1.8 ERR064057: LinTrcvChannel was duplicated Pin EN|WK|TX|RX.

Description: This error message is displayed when Pin's name was configured for parameter LinTrcvHardwareInterfaceName that duplicated in LinTrcvChannel.

7.2.2 Warning Messages

None

8 SWP Error Code

There are no production errors.

9 Appendix

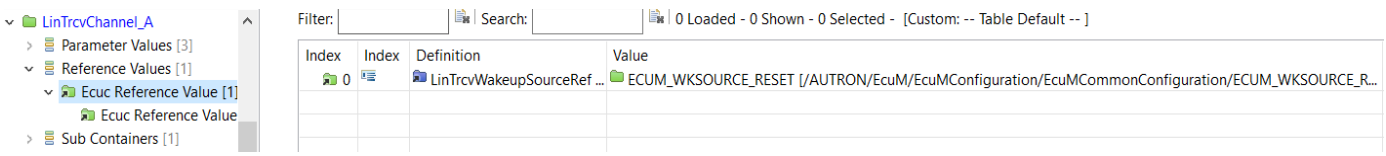
9.1 Lin Configuration Manual

Refer to IM Lin Stack.

9.2 LinTrcv Configuration Manual

9.2.1 LinTrcv Configuration

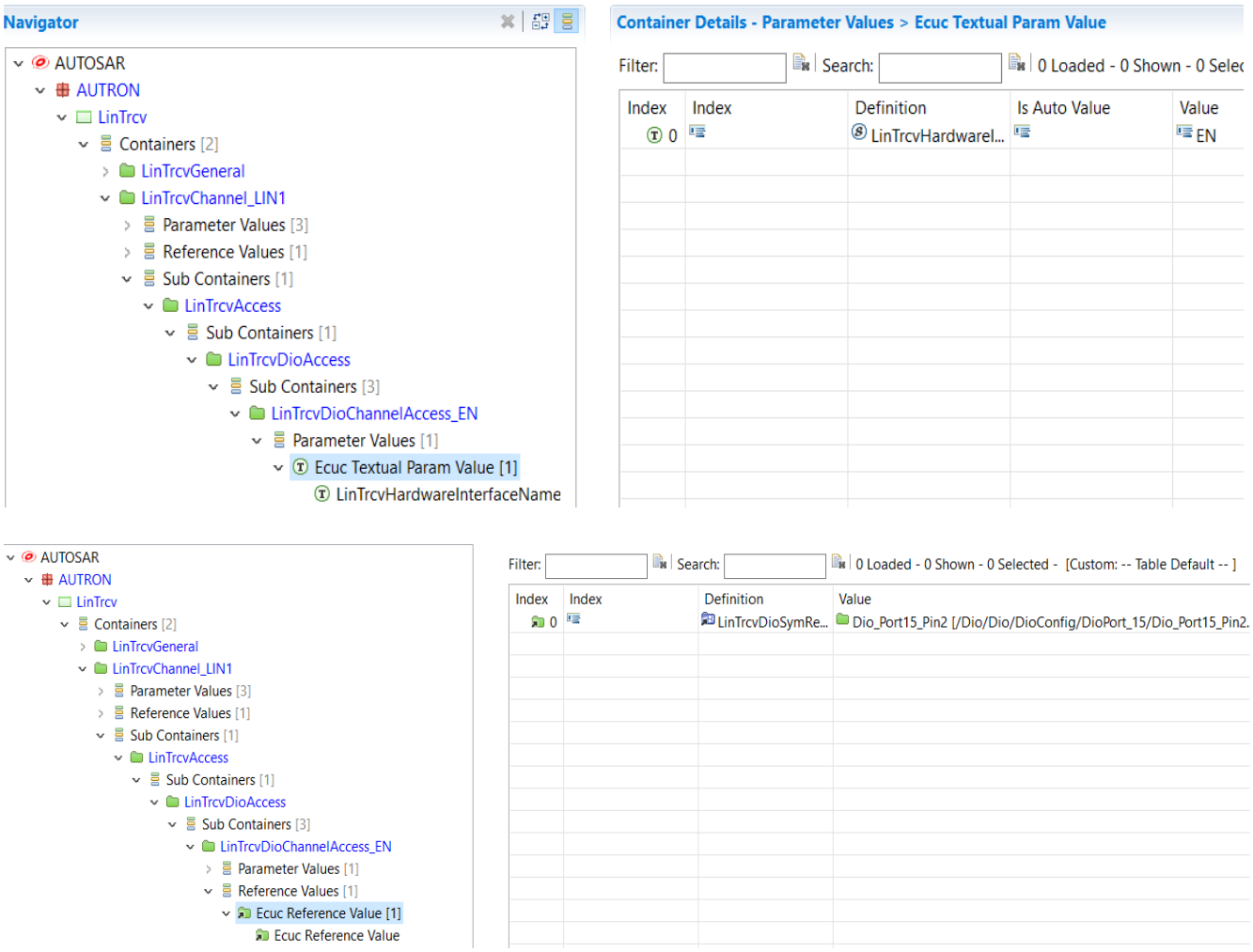
9.2.1.1 Wakeup Source Configuration



This term refer to EcuM's container name, this is symbol name descript for EcuM wakeup source ID.

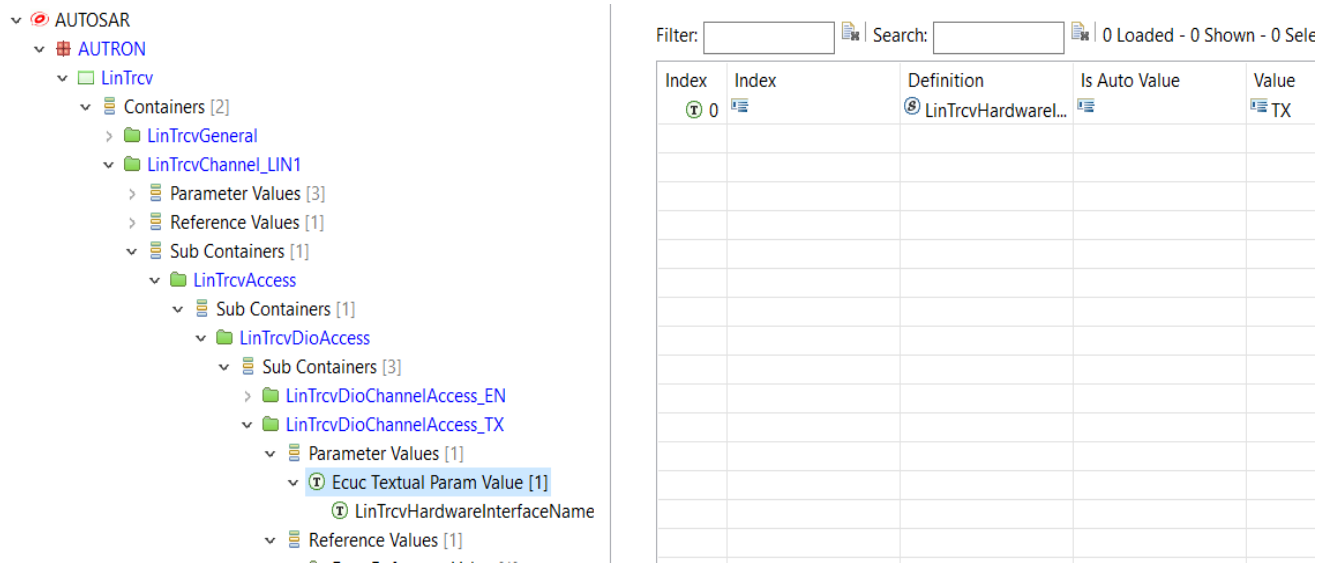
9.2.1.2 Channel Configuration

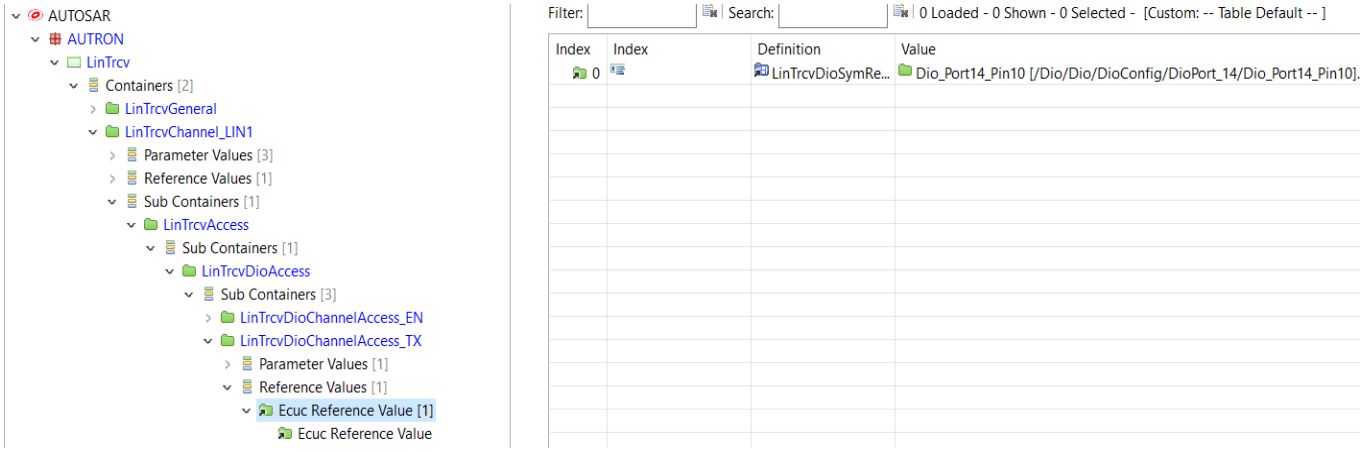
a. EN Pin Configuration



Configure EN pin to Pin 2 of Port 15.

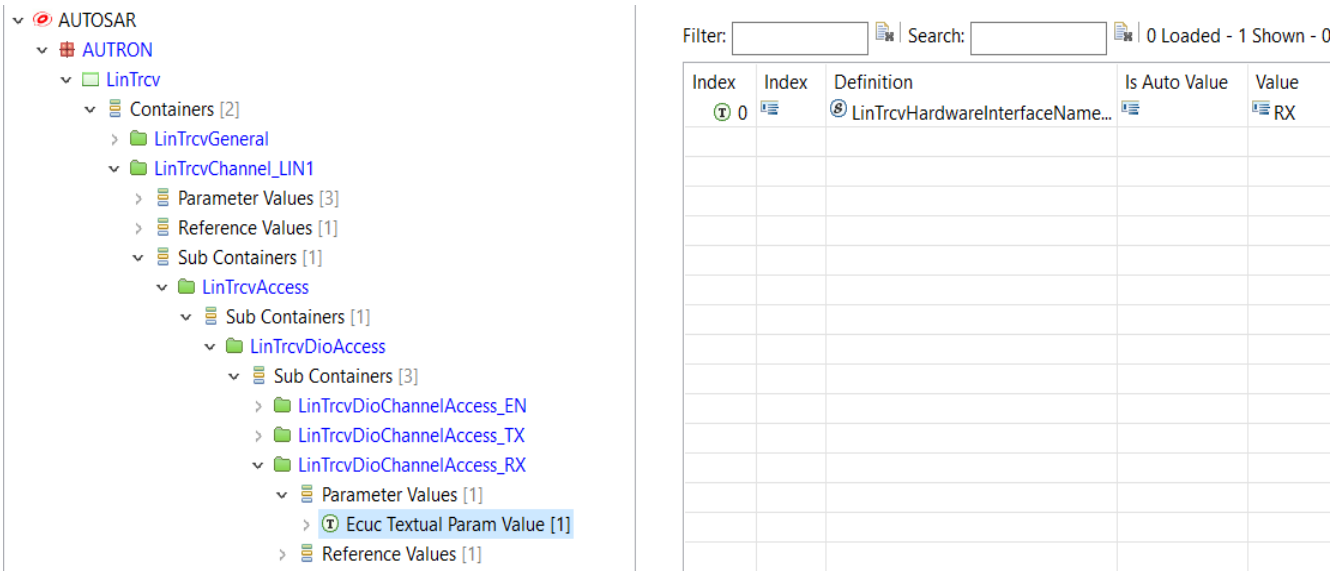
b. TX Pin Configuration

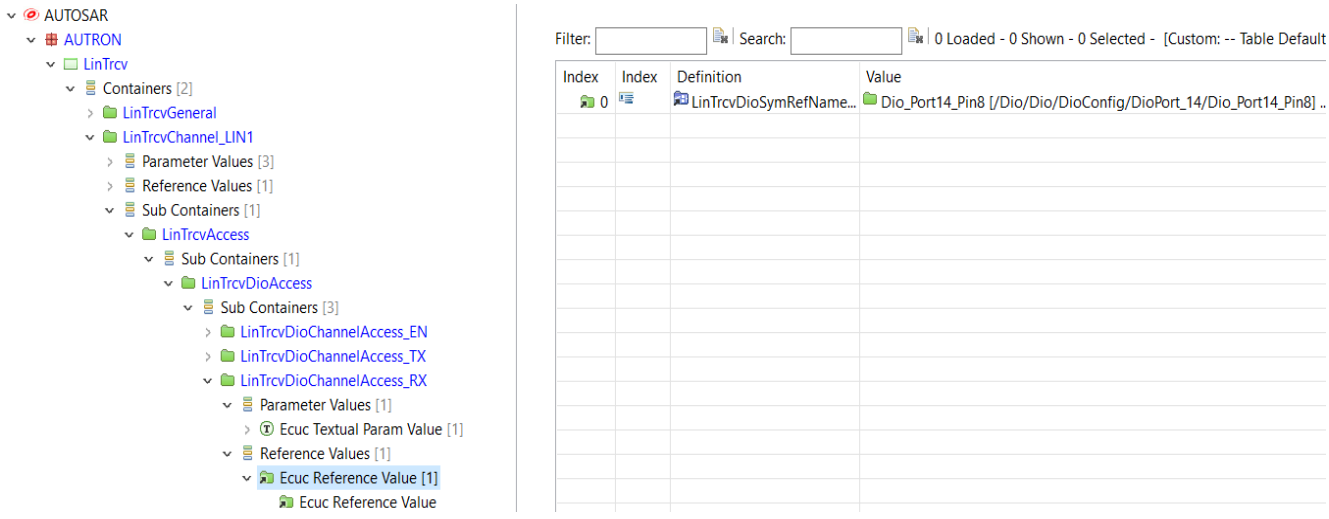




Configure TX pin to Pin 10 of Port 14.

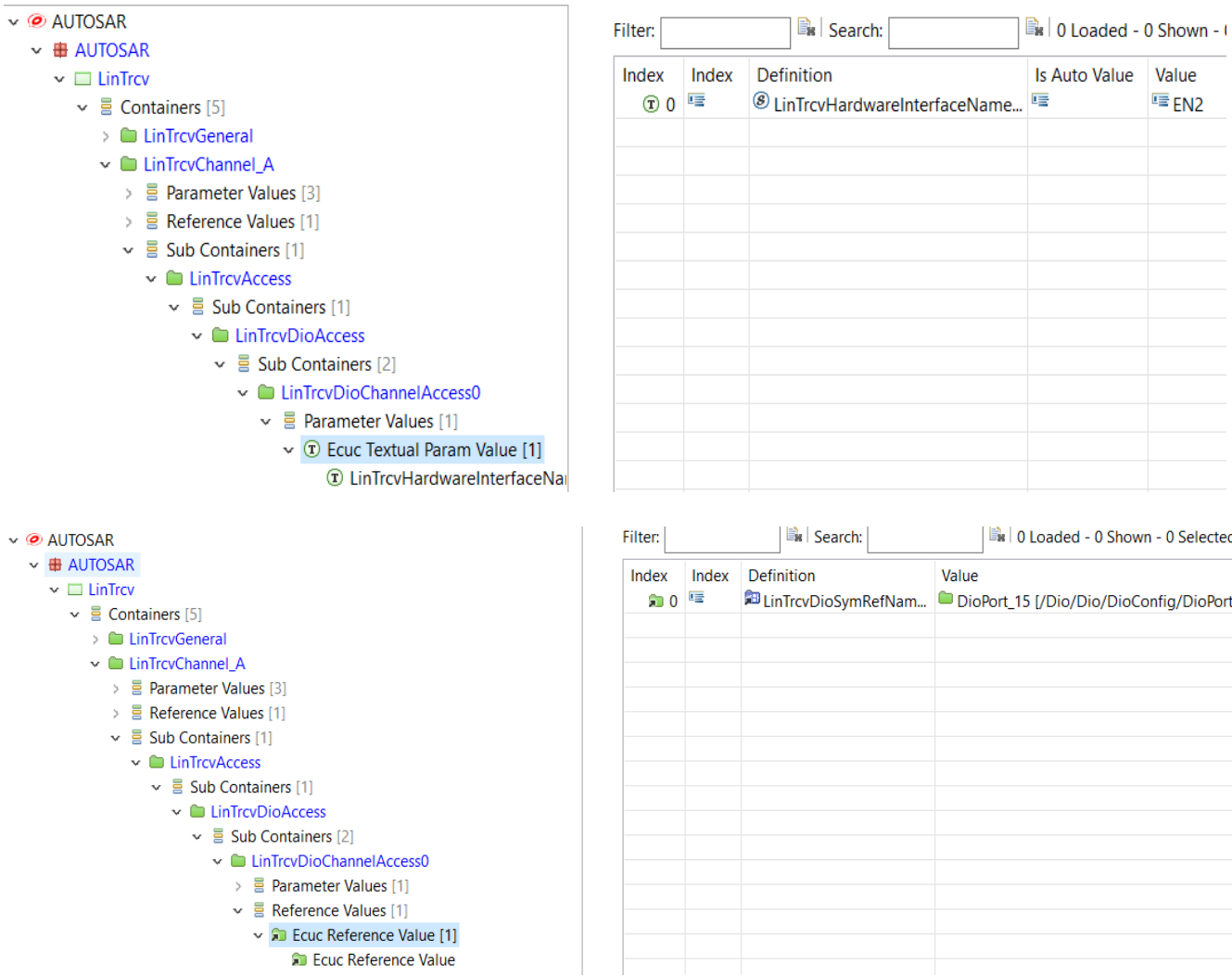
c. RX Pin Configuration





Configure TX pin to Pin 10 of Port 14.

9.2.1.3 Port Configuration

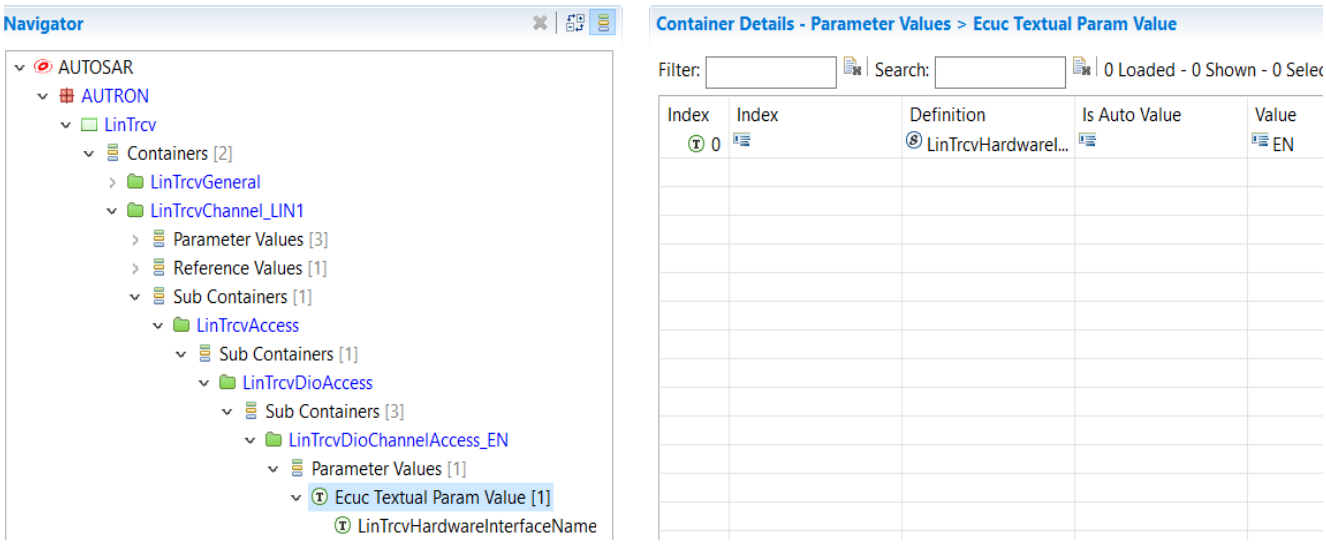


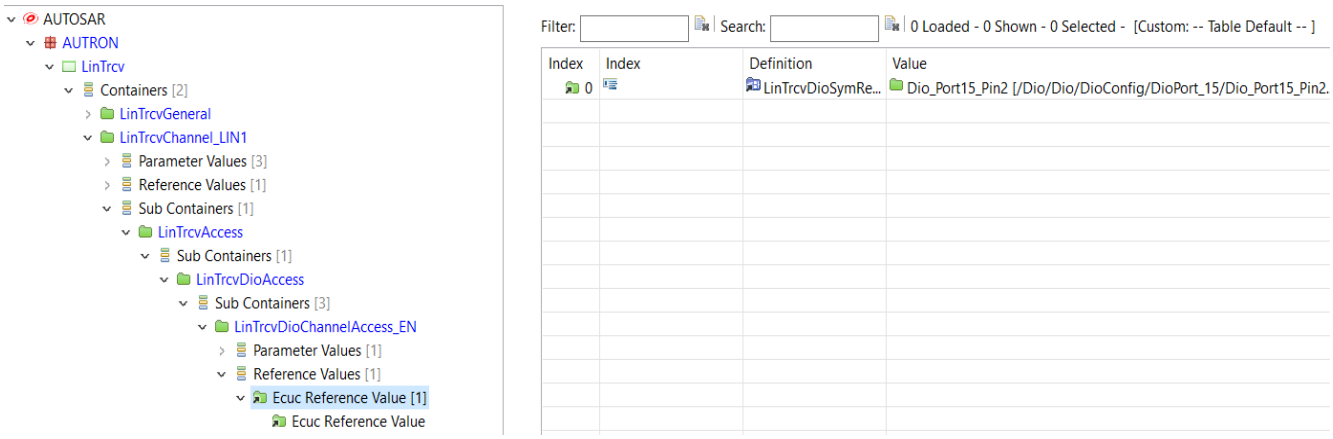
Configure EN pin to Port 15 (used Pin 2).

Note: TX, RX configuration, please refer 9.2.1.2 (configure Channel) or can configure to use Port follow EN pin.

9.2.1.4 Group Channel Configuration

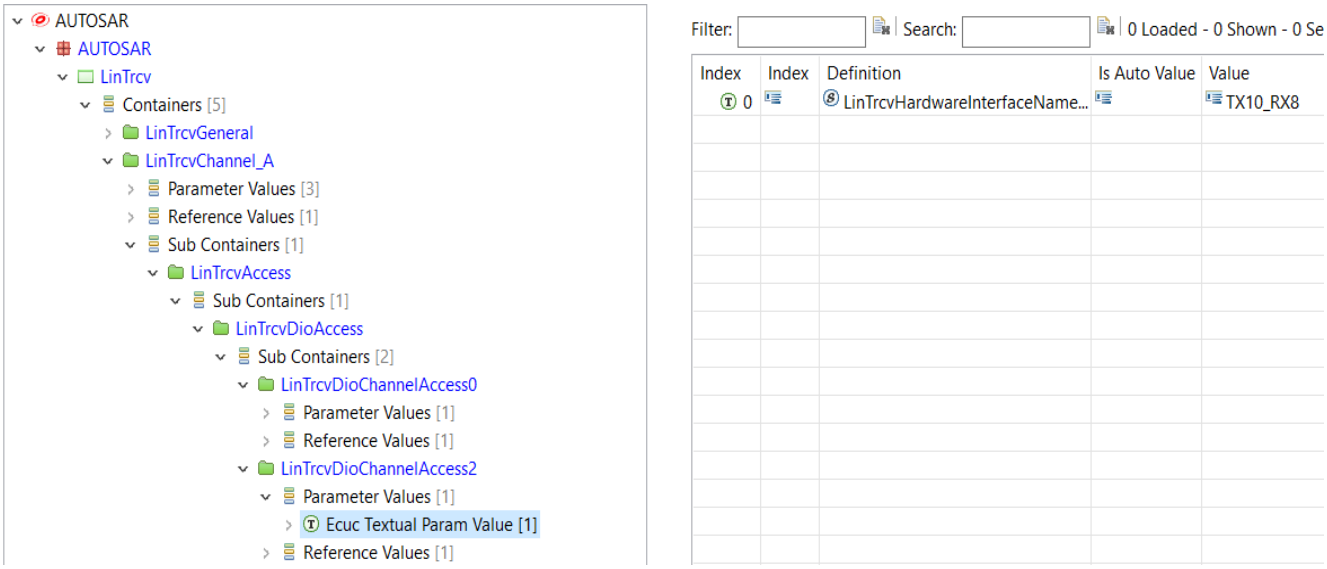
a. EN Pin Configuration By Channel

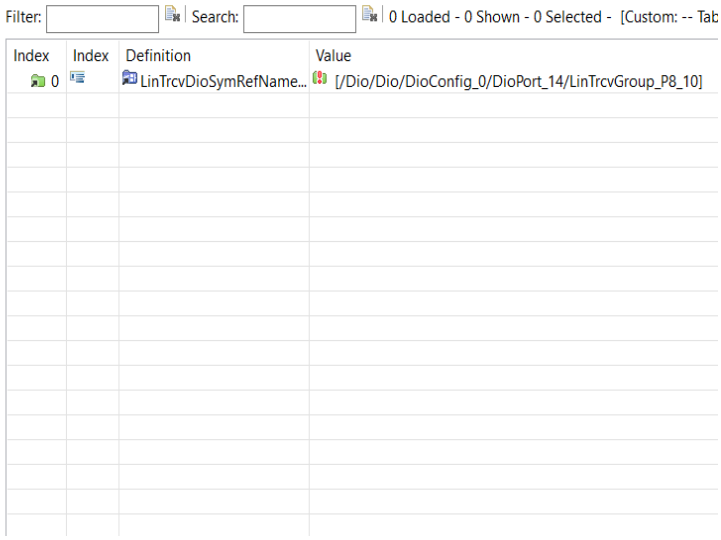




Configure EN pin to Pin 2 of Port 15.

b. TX Pin, RX Pin Configuration





Configure TX pin to LinTrcvGroup_P8_10, used pin 10 of port 14.
Configure RX pin to LinTrcvGroup_P8_10, used pin 8 of port 14.
Note: *GroupChannel used for case Dio module and HW supported Group channel. This case only demonstrate formula configure for GroupChannel.*

9.2.2 LinTrcv Module Operation Description

a. Calling LinTrcv_Init API at Power-On/Reset. Init State of LinTrcvChannel is LINTRCV_TRCV_MODE_SLEEP, set it to Transceiver sleep mode.

b. b. Request LINTRCV_TRCV_MODE_NORMAL through LinTrcv_SetOpMode API call when requesting full-communication for communication.

c. Request LINTRCV_TRCV_MODE_STANDBY or LINTRCV_TRCV_MODE_SLEEP through LinTrcv_SetOpMode API call when requesting communicate No-Communication.

- When Transceiver Passive Mode of LinSMChannel is true, Transceiver standby mode is requested through LinIf Module.
- When the Transceiver Passive Mode of LinSMChannel is false, the Transceiver sleep mode is requested through the LinIf Module.

9.3 LinTrcv Driver Development (When AutoEver Support Transceivers and External Transceivers are Mixed)

9.3.1 Implement LINTRCV Driver API

The user should implement the corresponding transceiver control logic in a function defined in the development target file for external transceiver control. For detailed implementation details for each function, refer to AUTOSAR 4.4.0 LINTtransceiver Driver Specification.

a. File Location
: Static_Code > Modules > LinTrcv_VendorId_VendorSpecificName_R44

b. Development target file
: LinTrcv_VendorId_VendorSpecificName.c

c. API to be implemented

API	Description
LinTrcv_VendorId_VendorspecificName_Init	Set Transceiver Initial Mode
LinTrcv_VendorId_VendorspecificName_SetOpMode	Set Transceiver Mode on FullCom, NoCom Request

※ VendorID: Use 255(0xFF) (external transceiver support policy)
※ VendorSpecificName: Transceiver control logic implementation company name

9.3.2 LinTrcv Module Operation Description

1. Calling LinTrcv_VendorId_VendorspecificName_Init API at Power-On/Reset , Set Init State of LinTrcv Channel
   - Set to transceiver normal mode if LinTrcv channel start status is 'LINTRCV_TRCV_MODE_NORMAL
   - Set to transceiver standby mode if LinTrcv channel start state is 'LINTRCV_TRCV_MODE_SLEEP
   - Set to transceiver sleep mode when LinTrcv channel start state is 'LINTRCV_TRCV_MODE_STANDBY'
2. Request LINTRCV_TRCV_MODE_NORMAL through LinTrcv_VendorId_VendorspecificName_SetOpMode API call when requesting full-communication for communication
3. Request LINTRCV_TRCV_MODE_STANDBY or LINTRCV_TRCV_MODE_SLEEP through LinTrcv_VendorId_VendorspecificName_SetOpMode API call when requesting communicate No-Communication.
   - When Transceiver Passive Mode of LinSMChannel is true, Transceiver standby mode is requested through LinIf Module.
   - When the Transceiver Passive Mode of LinSMChannel is false, the Transceiver sleep mode is requested through the LinIf Module.

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