



Elektrobit

# EB tresos<sup>®</sup> AutoCore Generic 8 Time Sync documentation

product release 8.8.0



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# 1. Overview of EB tresos AutoCore Generic 8 Time Sync documentation

Welcome to the EB tresos AutoCore Generic 8 Time Sync (ACG8 Time Sync) product documentation.

This document provides:

- ▶ [Chapter 2, “Supported Features”](#): list of services supported by the ACG8 Time Sync
- ▶ [Chapter 3, “ACG8 Time Sync release notes”](#): release notes for the ACG8 Time Sync modules
- ▶ [Chapter 4, “ACG8 Time Sync user's guide”](#): containing background information and instructions
- ▶ [Chapter 5, “ACG8 Time Sync module references”](#): information about configuration parameters and the application programming interface

## 2. Supported Features

Time synchronization supports the following main features according to the AUTOSAR and IEEE 802.1AS specification:

- ▶ Clock synchronization between master and slave
- ▶ Clock rate correction (needs support from the Ethernet driver)
- ▶ Propagation delay measurement
- ▶ Hardware timestamping (needs support from the Ethernet driver)
- ▶ Time synchronization gateway functionality
- ▶ Announcement of time synchronization priority

## 3. ACG8 Time Sync release notes

### 3.1. Overview

This chapter provides the ACG8 Time Sync product specific release notes. General release notes that are applicable to all products are provided in the EB tresos AutoCore Generic documentation. Refer to the general release notes in addition to the product release notes documented here.

### 3.2. Scope of the release

#### 3.2.1. Configuration tool

Your release of EB tresos AutoCore is compatible with the release of the EB tresos Studio configuration tool:

- ▶ EB tresos Studio: 27.1.0 b200625-0900

#### 3.2.2. AUTOSAR modules

The following table lists the AUTOSAR modules that are part of this ACG8 Time Sync release.

Module name	AUTOSAR version and revision	SWS version and revision	Module version	Supplier
<a href="#">CanTSyn</a>	4.4.0 []	4.4.0 [0000]	2.0.1	Elektrobit Automotive GmbH
<a href="#">FrTSyn</a>	4.4.0 []	4.4.0 [0000]	2.0.0	Elektrobit Automotive GmbH

Table 3.1. Hardware-Independent Modules specified by the AUTOSAR standard

#### 3.2.3. EB (Elektrobit) modules

The following table lists all modules which are part of this release but are not specified by the AUTOSAR standard. These modules include tooling developed by EB or they may hold files shared by all other modules.

Module name	Module version	Supplier
<a href="#">EthTSyn</a>	2.0.1	Elektrobit Automotive GmbH
<a href="#">StbM</a>	3.0.0	Elektrobit Automotive GmbH

Table 3.2. Modules not specified by the AUTOSAR standard

## 3.2.4. MCAL modules and EB tresos AutoCore OS

For information about MCAL modules and OS, refer to the respective documentation, which is available as PDF at `$TRESOS_BASE/doc/3.0_EB_tresos_AutoCore_OS` and `$TRESOS_BASE/doc/5.0_MCAL_modules`<sup>1</sup>. It is also available in the online help in EB tresos Studio. Browse to the folders `EB tresos AutoCore OS` and `MCAL modules`.

## 3.3. Module release notes

### 3.3.1. CanTSyn module release notes

- ▶ AUTOSAR R4.4 Rev 0
- ▶ AUTOSAR SWS document version: 4.4.0
- ▶ Module version: 2.0.1.B337087
- ▶ Supplier: Elektrobit Automotive GmbH

#### 3.3.1.1. Change log

This chapter lists the changes between different versions.

##### Module version 2.0.1

2020-06-19

---

<sup>1</sup>`$TRESOS_BASE` is the location at which you installed EB tresos Studio.

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 2.0.0**

2020-05-22

- ▶ Update CanTSyn module to be compliant with the AUTOSAR 4.4 specification.

#### **Module version 1.6.12**

2020-04-24

- ▶ ASCCANTSYN-191 Fixed known issue: Mismatch of sequence counter value that appeared on bus and reported to StbM for Time Validation.
- ▶ ASCCANTSYN-193 Fixed known issue: StbM\_CanTSyn.h header file is not included in CanTSyn module.

#### **Module version 1.6.11**

2020-03-25

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.6.10**

2020-02-21

- ▶ Implement time validation.

#### **Module version 1.6.9**

2019-09-06

- ▶ ASCCANTSYN-178 Fixed known issue: Consecutive SYNC messages with the same SC are incorrectly accepted.

#### **Module version 1.6.8**

2019-08-09

- ▶ HandleIDs are not automatically calculated by HandleID Wizard.





**Module version 1.6.7**

2019-07-12

- ▶ Internal module improvement. This module version update does not affect module functionality.

**Module version 1.6.6**

2019-06-14

- ▶ Enhance CanTSyn exclusive areas to support multicore environment

**Module version 1.6.5**

2019-04-18

- ▶ Internal module improvement. This module version update does not affect module functionality.

**Module version 1.6.4**

2019-03-22

- ▶ ASCCANTSYN-171 Fixed known issue: CRC check on SYNC, FUP, OFS and OFNS is performed independently of CanTSynRxCrcValidated.

**Module version 1.6.3**

2019-02-15

- ▶ Internal module improvement. This module version update does not affect module functionality.

**Module version 1.6.2**

2018-12-21

- ▶ Internal module improvement. This module version update does not affect module functionality.

**Module version 1.6.1**

2018-10-26

- ▶ ASCCANTSYN-157 Fixed known issue: SC check is omitted after CanTSynGlobalTimeFollowUpTimeout time-out at reception.
- ▶ ASCCANTSYN-155 Fixed known issue: CanTSyn accepts messages with a stuck sequence counter.

#### **Module version 1.6.0**

2018-09-20

- ▶ Provide CAN FD support according to AUTOSAR 4.3.1.
- ▶ Enhance precision of Global Time.

#### **Module version 1.5.2**

2018-06-22

- ▶ ASCCANTSYN-129 Fixed known issue: The OVS field is incorrectly processed when a FUP frame is received.
- ▶ Ignore received SC when Time Base timeout detected in StbM.
- ▶ Enable transmission mode per Controller.

#### **Module version 1.5.1**

2018-05-25

- ▶ ASCCANTSYN-110 Fixed known issue: Debounce counter is not considered after FUP or OFNS message transmission.

#### **Module version 1.5.0**

2018-04-20

- ▶ ASCCANTSYN-104 Fixed known issue: Immediate synchronization request is ignored if cyclicMsgResumeCounter is running.
- ▶ Implement Global Time Measurement Support.
- ▶ Add support for uint32 PduLengthType.

#### **Module version 1.4.5**

2018-02-16

- ▶ ASCCANTSYN-120 Fixed known issue: Processing of received SYNC frames interprets timestamp according to the wrong byte order.
- ▶ ASCCANTSYN-95 Fixed known issue: Invalid configuration if CanTSynGlobalTimeDebounceTime is smaller than CanTSynMasterConfirmationTimeout.

#### **Module version 1.4.4**

2017-12-15

- ▶ Align const-ness in CanTSyn\_RxIndication() Signature with CanIf.
- ▶ Disabling of periodic transmission by setting CanTSynGlobalTimeTxPeriod to 0.
- ▶ ASCCANTSYN-100 Fixed known issue: CanTSyn sends messages without having the GLOBAL\_TIME\_BASE bit set.
- ▶ ASCCANTSYN-86 Fixed known issue: Follow-up messages are dropped erroneously.
- ▶ Provide rate correction in addition to pure offset correction.

#### **Module version 1.4.3**

2017-10-20

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.2**

2017-09-22

- ▶ Time domain specific data ID lists for CRC.

#### **Module version 1.4.1**

2017-08-25

- ▶ Remove unused structure elements.

#### **Module version 1.4.0**

2017-07-28

- ▶ Provide actual precision of individual time bases.



#### **Module version 1.3.0**

2017-06-02

- ▶ On-request transmission of TimeSync messages.

#### **Module version 1.2.4**

2017-03-31

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.2.3**

2017-03-10

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.2.2**

2017-03-03

- ▶ ASCCANTSYN-35 Fixed known issue: Removed consecutive zero-based CanTSynGlobalTimeDomainIds constrain.
- ▶ Align function declaration with function definition.

#### **Module version 1.2.1**

2017-02-03

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.2.0**

2016-11-04

- ▶ Support of Time Slave functionality

#### **Module version 1.1.0**

2016-09-23

- ▶ Full support of time master functionality (normal and offset time bases, CRC, and user data)

#### **Module version 1.0.0**

2016-05-31

- ▶ Initial AUTOSAR 4.2 version

### **3.3.1.2. New features**

- ▶ Update CanTSyn module to be compliant with the AUTOSAR 4.4.

### **3.3.1.3. EB-specific enhancements**

This chapter lists the enhancements provided by the module.

- ▶ Zero disables CanTSynGlobalTimeFollowUpTimeout

Description:

If CanTSynGlobalTimeFollowUpTimeout parameter is configured to zero, CanTSynGlobalTimeFollowUpTimeout will not be taken into consideration while waiting for FUP or OFNS.

After reception of a SYNC frame, if CanTSynGlobalTimeFollowUpTimeout is configured to 0, the awaited FUP frame shall be accepted whenever it comes.

After reception of an OFS frame, if CanTSynGlobalTimeFollowUpTimeout is configured to 0, the awaited OFNS frame shall be accepted whenever it comes.

- ▶ Time Validation

Description:

CanTSyn supports Time Validation as per AUTOSAR R19-11.

### **3.3.1.4. Deviations**

This chapter lists the deviations of the module from the AUTOSAR standard.

- ▶ The CanTSyn PDUs should be unique across all masters and slaves

Description:

The CanTSyn module doesn't support the PDUs across different masters and slaves to be not unique.

Requirements:

SWS\_CanTSyn\_00029, SWS\_CanTSyn\_00039

- ▶ The CanTSyn does not support Post-Build

Description:

The CanTSyn module doesn't support Post-Build loadable or Post-Build variant handling.

### 3.3.1.5. Limitations

This chapter lists the limitations of the module. Refer to the module references chapter *Integration notes*, subsection *Integration requirements* for requirements on integrating this module.

- ▶ Confirmation Timeout of Master Time Domain

Description:

Up to four seconds supported.

Rationale:

This restriction allows to use a timeout smaller than four seconds because of the internal virtual local time calculation function which is limited to differences of four seconds.

- ▶ FollowUp Timeout and CanTSynCyclicMsgResumeTime

Description:

Up to 65535 supported.

Rationale:

CanTSyn does not use values greater than UINT32 for CanTSynGlobalTimeFollowUpTimeout and CanTSynCyclicMsgResumeTime.

- ▶ CanTSyn is not able to detect a wrap around

Description:

CanTSyn is not able to detect a wrapped around Sequence Counter, when a SYNC/OFS message is received.

Rationale:

When two consecutive SYNC/OFS messages with the same Sequence Counter are received, the second SYNC/OFS message will always be rejected, considering its SC to be a "stuck" one.

- ▶ CanTSyn is not able to multiplex OFFSET messages with SYNC messages (using the same PDU)

Description:

CanTSyn does not support multiplexing.

Rationale:

When 2 CanTSynGlobalTimeMasterPdu are referring the same EcuC Pdu, CanIf module will not be able to map the received Id with the right CanTSynGlobalTimeMasterConfirmationHandleId. Even if the same handle id would be used, CanTSyn will not differentiate between consecutive TxConfirmations

### 3.3.1.6. Open-source software

CanTSyn does not use open-source software.

## 3.3.2. EthTSyn module release notes

- ▶ AUTOSAR R4.4 Rev 0
- ▶ AUTOSAR SWS document version: 0.0.0
- ▶ Module version: 2.0.1.B337087
- ▶ Supplier: Elektrobit Automotive GmbH

### 3.3.2.1. Change log

This chapter lists the changes between different versions.

#### Module version 2.0.1

2020-06-19

- ▶ EthTSyn calculates propagation delay independent of execution order of the mainfunctions in a task.
- ▶ ASCETHTSYN-656 Fixed known issue: Incomplete reporting of EthTSynPdelayFailedReportToDem event.

#### **Module version 2.0.0**

2020-05-22

- ▶ Updated EthTSyn module to AUTOSAR 4.4
- ▶ ASCETHTSYN-627 Fixed known issue: Wrong timeout supervision on EthTSyn slave.
- ▶ Implement EthTSynGlobalTimeFollowUpTimeout.
- ▶ ASCETHTSYN-638 Fixed known issue: PDelay can be calculated with wrong time stamps
- ▶ ASCETHTSYN-651 Fixed known issue: Incorrect seconds value in case of nanoseconds field bigger than one second

#### **Module version 1.4.15**

2020-04-24

- ▶ ASCETHTSYN-603 Fixed known issue: StbM\_EthTSyn.h header file is not included in EthTSyn module.
- ▶ ASCETHTSYN-613 Fixed known issue: Wrong calculation of responseOriginTimestamp.

#### **Module version 1.4.14**

2020-03-25

- ▶ ASCETHTSYN-587 Fixed known issue: Time domain IDs cannot be correctly configured
- ▶ ASCETHTSYN-588 Fixed known issue: EthTSyn does not validate the Time Domain ID when receiving a message

#### **Module version 1.4.13**

2020-03-11

- ▶ Implemented support of Authentication Challenge TLV for Device Authentication supplicant.

#### **Module version 1.4.12**

2020-02-21

- ▶ ASCETHTSYN-562 Fixed known issue: No AUTOSAR Sub-TLV in SyncFUp frame if only CRC\_NOT\_SUPPORTED is used.
- ▶ Support for interfaces which allow time validation of synchronized time.





- ▶ Implemented EthTSynSendSyncFrameOnlyOnHostPort functionality.
- ▶ ASCETHTSYN-572 Fixed known issue: SYNC FUP messages are sent with wrong data if immediate transmission is used.
- ▶ Implemented the pdelay functionality for the Time Aware Bridge with GTM as Management CPU.

#### **Module version 1.4.11**

2020-01-24

- ▶ ASCETHTSYN-563 Fixed known issue: Field gmTimeBaseIndicator is initialized with wrong values.

#### **Module version 1.4.10**

2019-11-08

- ▶ ASCETHTSYN-549 Fixed known issue: Wrong value used for Pdelay calculation.

#### **Module version 1.4.9**

2019-10-11

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.8**

2019-09-06

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.7**

2019-08-09

- ▶ Simple Bridge in relation with EthSwt.

#### **Module version 1.4.6**

2019-06-14

- ▶ Enhance EthTSyn exclusive areas to support multicore environment.

#### **Module version 1.4.5**

2019-04-18

- ▶ Introduce support for Offset Timebases.

#### **Module version 1.4.4**

2019-03-22

- ▶ ASCETHTSYN-459 Fixed known issue: Fields gmTimeBaseIndicator, lastGmPhaseChange and scaled-LastGmFreqChange are initialized with wrong values.
- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.3**

2019-02-15

- ▶ ASCETHTSYN-455 Fixed known issue: EthIf\_GetEgressTimeStamp() called with wrong BufIdx after a pdelay\_req frame was sent.
- ▶ ASCETHTSYN-458 Fixed known issue: EthTSyn\_SwitchPorts variable is wrongly mapped in CONST memory area.

#### **Module version 1.4.2**

2019-01-25

- ▶ Introduce support for Diagnostic event reporting for Ethernet TimeSync.
- ▶ Implemented EthTSynGlobalTimePdelayRespEnable functionality.

#### **Module version 1.4.1**

2018-10-26

- ▶ ASCETHTSYN-407 Fixed known issue: Pdelay response time stamp is not retrieved in context of EthTSyn\_TxConfirmation().
- ▶ ASCETHTSYN-412 Fixed known issue: Variable is not defined in an appropriate MemMap section.

- ▶ ASCETHTSYN-418 Fixed known issue: EthTSyn rejects Pdelay response and Pdelay response follow-up frames.

#### **Module version 1.4.0**

2018-09-20

- ▶ ASCETHTSYN-391 Fixed known issue: EthTSyn corrects the time in the Eth driver before StbM can check for time leap.
- ▶ ASCETHTSYN-386 Fixed known issue: EthTSyn master: SYNC periodicity is wrong.
- ▶ Implemented enhancement for precision of global time.

#### **Module version 1.3.2**

2018-06-22

- ▶ Added support for debounce transmissions.
- ▶ Updated signature of EthTSyn\_SetTransmissionMode() to AR 4.2.2.

#### **Module version 1.3.1**

2018-05-18

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.3.0**

2018-04-20

- ▶ ASCETHTSYN-339 Fixed known issue: organizationId incorrectly set in AUTOSAR TLV header
- ▶ ASCETHTSYN-334 Fixed known issue: EthTSyn performs a write access on NULL\_PTR if EthSwt\_ProvideTxBuffer() returns an NULL\_PTR for parameter BufPtr.
- ▶ ASCETHTSYN-388 Fixed known issue: organizationId incorrectly set in IEEE TLV header.
- ▶ ASCETHTSYN-353 Fixed known issue: The Time Gateway synchronization status is incorrectly used in Status Sub-TLV.
- ▶ ASCETHTSYN-358 Fixed known issue: EthTSyn generates incorrect values for switch host port

#### **Module version 1.2.1**

2018-02-16

- ▶ ASCETHTSYN-285 Fixed known issue: Length value of FUP frame is not correctly set for certain Sub-TLVs
- ▶ ASCETHTSYN-273 Fixed known issue: Only Modulo 16 part of Sequence Counter shall be used for Data ID selection
- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.2.0**

2017-12-15

- ▶ Added switch delay compensation for acting as global time master.
- ▶ Updated API calls of StbM\_GetCurrentTimeRaw() and StbM\_GetCurrentTimeDiff() according to AUTOSAR RfC 77248.
- ▶ ASCETHTSYN-280 Fixed known issue: A compiler error occurs if the CRC support is disabled for Tx PDUs and enabled for Rx PDUs.
- ▶ Added on-request transmission of TimeSync messages.

#### **Module version 1.1.7**

2017-11-17

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.1.6**

2017-10-24

- ▶ Updated design

#### **Module version 1.1.5**

2017-09-22

- ▶ ASCETHTSYN-228 Fixed known issue: If the SyncToGateway bit is not set in the status Sub-TLV, the received frame shall be wrongfully discarded.
- ▶ ASCETHTSYN-223 Fixed known issue: DET errors reported incorrectly during EthTSyn\_TrcvLinkStateChg() and EthTSyn\_TxConfirmation().
- ▶ Updated to MISRA 2012

#### **Module version 1.1.4**

2017-08-25

- ▶ Added UserData Sub-TLV support

#### **Module version 1.1.3**

2017-07-28

- ▶ Updated receiving unexpected SubTLVs according to RfC 77619

#### **Module version 1.1.2**

2017-06-30

- ▶ ASCETHTSYN-206 Fixed known issue: Valid received sync follow-up frame gets discarded due to incorrect check.

#### **Module version 1.1.1**

2017-04-25

- ▶ ASCETHTSYN-197 Fixed known issue: Sync follow up frame TLVs get corrupted
- ▶ ASCETHTSYN-198 Fixed known issue: If EthTSynMessageCompliance is set to false, received sync follow-up frames are discarded
- ▶ ASCETHTSYN-176 Fixed known issue: EthTSyn compilation reports an error if no slave is configured.

#### **Module version 1.1.0**

2017-03-31

- ▶ Added configurable link delay handling
- ▶ Added CRC calculation for TimeSync message

#### **Module version 1.0.7**

2017-03-03

- ▶ Updated the configuration schema to AUTOSAR 4.3.0
- ▶ ASCETHTSYN-154 Fixed known issue: Temporary synchronization inaccuracy of 1 second

#### **Module version 1.0.6**

2017-02-03

- ▶ Internal module improvement. This module version update does not affect module functionality

#### **Module version 1.0.5**

2017-01-05

- ▶ Added support of full range correction field handling
- ▶ Added VLAN support

#### **Module version 1.0.4**

2016-12-03

- ▶ Updated `EthTSyn_Init()` to also allow a call with `NULL_PTR`

#### **Module version 1.0.3**

2016-11-04

- ▶ Added usage of `EthIf_UpdatePhysAddrFilter()`
- ▶ Added support for `Eth_BufIdxType`

#### **Module version 1.0.2**

2015-11-06

- ▶ Internal module improvement. This module version update does not affect module functionality

#### **Module version 1.0.1**

2015-06-19

- ▶ Added DBC/LDF/Fibex importer support
- ▶ Added task auto assign of `EthTSyn_MainFunction()` for RTE

#### **Module version 1.0.0**

2015-02-20

- ▶ Initial release for AUTOSAR 4.2 rev. 1

### 3.3.2.2. New features

- Update EthnTSyn module to be compliant with the AUTOSAR 4.4.

### 3.3.2.3. EB-specific enhancements

This chapter lists the enhancements provided by the module.

- Periodic sending of announce frames

Description:

EthTSyn masters can send announce frames periodically. This can be configured through The EB configuration parameter `EthTSynGeneral/EthTSynAnnounceFrameSupport`.

Value	Description
TRUE	An EthTSyn master sends announce frames in the same interval as sync frames.
FALSE	No announce frames are sent.

- Filtering of measured peer delay values

Description:

It is possible to filter measured peer delay values. The filter reduces a negative impact of incorrect peer delay measurements on the synchronization. The filtering is controlled through the EB configuration parameter `EthTSynGlobalTimeDomain/EthTSynGlobalTimeSlave/EthTSynPdelayFilter`. Setting the configuration parameter to zero disables the filtering.

- Adding and removing MAC address

Description:

EthTSyn uses `EthIf_UpdatePhysAddrFilter()` in the context of `EthTSyn_TrcvLinkStateChg()` to add and remove the MAC address 01-80-C2-00-00-0E to/from the `Eth` filter.

- Correction field range

Description:

EthTSyn supports the full ns range of the correction field from a sync follow up frame. It allows time aware bridges to use the correction field as an offset from the origin time stamp in case there is a master breakdown.

- Switch delay compensation for global time master of a switch

Description:

`EthTSyn` supports switch delay compensation for global time master of a switch. `EthTSyn` masters with configured switch port in `EthTSynSwitchManagementEthSwitchPortRef` will act as a global master for the referred port, providing the same origin time stamp on each port(referred from the same global time domain masters) for every sync frame cycle. `EthTSynPortConfig` contains configuration parameters that should not port depended, but should be the same for all masters in the respective `EthTSynGlobalTimeDomain`(e.g. `EthTSynGlobalTimeEthIfRef`, `EthTSynFramePrio`). Therefore the configuration values used will be of the first master configured in the time domain. This EB feature requires EB specific `EthSwt` and `EthIf` modules. It is also necessary that `EthTSynSwitchManagementEthSwitchPortHostRef` contains a reference to the switch port with port role set to host. For more details: AUTOSAR\_RfC\_79958.

- ▶ Use ns fractional part to store `SwitchIdx` and `PortIdx`

Description:

If the configuration parameter `EthTSynSwtPortIdxInCorrField` is set to true, `SwitchIdx` and `PortIdx` shall be stored in the unused 2 bytes of fractional ns part of the correction field.

- ▶ `EthTSyn` calculates propagation delay independent of execution order of the mainfunctions in a task.
- ▶ Time Validation

Description:

`EthTSyn` supports Time Validation as per AUTOSAR R19-11.

### 3.3.2.4. Deviations

This chapter lists the deviations of the module from the AUTOSAR standard.

- ▶ Pdelay request period is used instead of a separate response timeout.

Description:

If pdelay response/followup frames get lost the pdelay state machine gets reset as soon as next pdelay request is sent, consequently the `PdelayRespAndRespFollowUpTimeout` is not supported.

Rationale:

There is no benefit if a separate timeout detects missing frames earlier.

Requirements:

PRS\_TS\_00164, PRS\_TS\_00210, ECUC\_EthTSyn\_00074\_Conf

- ▶ `Eth_BufIdxType` is used instead of `uint8`.

Description:



EthTSyn uses Eth\_BufIdxType instead of uint8 for its APIs EthTSyn\_TxConfirmation() and the API calls EthIf\_EnableEgressTimeStamp(), EthIf\_GetEgressTimeStamp() and EthIf\_GetIngressTimeStamp().

Rationale:

With AUTOSAR 4.2.2 Eth\_BufIdxType was introduced throughout the whole stack as new type for BufIdx.

Requirements:

SWS\_EthTSyn\_00042

- ▶ Runtime Error Detection not supported.

Description:

The errors shall be reported via Det\_ReportError().

Requirements:

SWS\_EthTSyn\_00145, SWS\_EthTSyn\_00146, SWS\_EthTSyn\_00144

- ▶ The position of each Sub-TLV is not arbitrary.

Description:

The Sub-TLVs will be added in the order that is defined in AUTOSAR SWS.

Requirements:

PRS\_TS\_00072

- ▶ ResidenceTime is not supported.

Description:

rx\_residence\_time and tx\_residence\_time are not supported.

Requirements:

PRS\_TS\_00168, PRS\_TS\_00169, PRS\_TS\_00170, PRS\_TS\_00171, PRS\_TS\_00166, PRS\_TS\_00167, ECUC\_EthTSyn\_00061\_Conf, ECUC\_EthTSyn\_00060\_Conf

- ▶ No Pdelay on switch bridge.

Description:

Pdelay is not calculated on Time Aware Bridge with GTM not as Management CPU.

Requirements:

PRS\_TS\_00059, PRS\_TS\_00060

- ▶ ETHTSYN\_E\_INIT\_FAILED det error not supported.

Description:

EthTSyn\_Init() shall always be successful.

Requirements:

SWS\_EthTSyn\_00030

- ▶ ETHTSYN\_E\_CTRL\_IDX not reported for EthTSyn\_TxConfirmation() and EthTSyn\_TrcvLinkStateChg().

Description:

If EthTSyn\_TxConfirmation() or EthTSyn\_TrcvLinkStateChg() are called with invalid CtrlIdx, no error shall be reported to det.

Rationale:

See info: ASCETHTSYN-223.

Requirements:

SWS\_EthTSyn\_00174, SWS\_EthTSyn\_00175

- ▶ Incomplete Pdelay protocol.

Description:

Incomplete Pdelay protocol not supported.

Requirements:

PRS\_TS\_00004

- ▶ PdelayLatencyThreshold

Description:

PdelayLatencyThreshold not supported.

Requirements:

PRS\_TS\_00154, ECUC\_EthTSyn\_00076\_Conf

- ▶ TMAC

Description:

These configuration parameters are not used by EthTSyn: EthTSynGlobalTimeSecureTmacLength, EthTSynTxTmacCalculated and EthTSynRxTmacValidated.

Rationale:

These configuration parameters, within ASR4.4.0, are marked as "draft" and no functionality is provided for them

Requirements:

ECUC\_EthTSyn\_00077\_Conf, ECUC\_EthTSyn\_00079\_Conf, ECUC\_EthTSyn\_00080\_Conf

- Not clarified requirements

Description:

These configuration parameters are not used by EthTSyn: EthTSynGlobalTimeSecureTmacLength, EthTSynTxTmacCalculated, EthTSynRxTmacValidated and EthTSynGlobalTimeMinMsgGap.

Rationale:

These configuration parameters, within ASR4.4.0, are marked as "draft" and no functionality is provided for them

Requirements:

ECUC\_EthTSyn\_00077\_Conf, ECUC\_EthTSyn\_00079\_Conf, ECUC\_EthTSyn\_00080\_Conf, EthTSyn.-ASR44.ECUC\_EthTSyn\_00078\_Conf

- T0 used as preciseOriginTimestamp.

Description:

Using T0 as preciseOriginTimestamp if EthTSynHardwareTimestampSupport is not supported.

Requirements:

SWS\_EthTSyn\_00189

### 3.3.2.5. Limitations

This chapter lists the limitations of the module. Refer to the module references chapter *Integration notes*, subsection *Integration requirements* for requirements on integrating this module.

- The correctionField calculation is not supported

Description:

`EthTSyn` does not perform calculation of `correctionField`. The function `StbM_GetCurrentTimeRaw()` is not used for `correctionField` calculation.

Rationale:

The `correctionField` calculation is only necessary for network time aware bridges.

- ▶ Peer delay calculation is not supported for switches

Description:

Peer delay calculation is not supported for switches. `EthTSyn` does not compensate the switch delay. Therefore, static Peer delay shall be used.

- ▶ The config values of the first master entry of each time domain are used.

Description:

Multiple masters configured on the same Time Domain are used to get more references to switch ports. For remaining configuration parameters (such as `EthTSynGlobalTimeTxPeriod`), the MCG shall only use the values taken from the first entry of master port config list and ignore the other entries, on the same Time Domain.

- ▶ The supplicant must be an `EthTSyn` slave.

Description:

`DevAuth` module is supporting only the supplicant side.

- ▶ Corrections Std 802.1AS/Cor 1-2013 and IEEE Std 802.1AS-2011/Cor 2-2015 are not supported.

Description:

`EthTSyn` module is supporting the IEEE Standard 802.1AS - 30 of March 2011 version as specified by the Autosar SWS chapter 3.2([13]).

- ▶ The use case “Time Aware Bridge with GTM not as Management CPU” is not fully implemented, the synchronization of the Bridge/Slave is missing.

Description:

The Bridge/Slave is receiving the Sync/Fup pairs and this is forwarded to the master ports. The Fup frame contains an updated `correctionField` for each master switch port.

- ▶ Diagnostic event reporting for Ethernet TimeSync is not supported for switches (Bridge/Master or Bridge/Slave).

Description:

EthTSyn does not perform diagnostic event reporting if more than 12 Sync-/Follow\_Up message in a row are dropped (missing) (Ausfall der Uhrensynchronisation). on a Bridge/Slave. EthTSyn does not perform diagnostic event reporting if more than 6 responses of a Pdelay\_Req to a Pdelay\_Resp-/Pdelay\_Resp\_Follow\_Up are missing (Ausfall der Uhrensynchronisation) on a Bridge/Master or Bridge/Slave. EthTSyn does not perform diagnostic event reporting if Sync messages are received on an Ethernet switch port configured as master (Ungültige Anzahl Uhrensynchronisationsmaster) on a Bridge/Master..

- ▶ The timeout supervision of the Follow\_Up frame (of the subsequent Sync message) is not supported for the use case “Time Aware Bridge with GTM not as Management CPU”.

Description:

Because the synchronization of the Bridge/Slave is not implemented, is not relevant to supervise the missing Follow\_Up frame. This timeout can be configured on the time slave where the bridge forwards the messages.

### 3.3.2.6. Open-source software

EthTSyn does not use open-source software.

## 3.3.3. FrTSyn module release notes

- ▶ AUTOSAR R4.4 Rev 0
- ▶ AUTOSAR SWS document version: 4.4.0
- ▶ Module version: 2.0.0.B337087
- ▶ Supplier: Elektrobit Automotive GmbH

### 3.3.3.1. Change log

This chapter lists the changes between different versions.

#### Module version 2.0.0

2020-06-19

- ▶ Upgrade FrTSyn module to AUTOSAR 4.4.0.

#### Module version 1.4.11

2020-04-24

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.10**

2020-02-21

- ▶ ASCFRTSYN-193 Fixed known issue: TxPeriod not maintained in case of transmission failure.
- ▶ Fixed known issue: ASCFRTSYN-184 Race condition during transmission can lead to data loss
- ▶ Added support for Time Validation.

#### **Module version 1.4.9**

2019-12-06

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.8**

2019-11-08

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.7**

2019-10-11

- ▶ ASCFRTSYN-142 Fixed known issue: FrTSyn accepts messages with stuck sequence counter.

#### **Module version 1.4.6**

2019-06-14

- ▶ Enhance FrTSyn exclusive areas to support multicore environment.

#### **Module version 1.4.5**

2019-04-18

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.4**

2019-03-22



- ▶ ASCFRTSYN-155 Fixed known issue: Synchronization message delayed on start-up

#### **Module version 1.4.3**

2019-02-15

- ▶ ASCFRTSYN-153 Fixed known issue: FrTSyn fails if FrTSynRxCrcValidated equals CRC\_IGNORED and SYNC message type equals 0x20
- ▶ ASCFRTSYN-154 Fixed known issue: StbM\_GetCurrentVirtualLocalTime() is not called within an exclusive area for Offset Time bases

#### **Module version 1.4.2**

2019-01-25

- ▶ Internal module improvement. This module version update does not affect module functionality

#### **Module version 1.4.1**

2018-10-26

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.4.0**

2018-09-20

- ▶ ASCFRTSYN-81 Fixed known issue: User data byte handling fails for FRTSYN\_CRC\_IGNORED
- ▶ ASCFRTSYN-134 Fixed known issue: FrTSyn does not send a SYNC or OFS message immediately after cyclicMsgResumeCounter expires
- ▶ Added support for enhanced precision (AUTOSAR SWS 4.4.0)

#### **Module version 1.3.3**

2018-08-24

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.3.2**

2018-06-22



- ▶ ASCFRTSYN-118 Fixed known issue: StbM\_BusSetGlobalTime() should not be called if the call to FrIf\_GetGlobalTime() fails

#### **Module version 1.3.1**

2018-05-25

- ▶ Moved FrTSynGlobalTimeSequenceCounterJumpWidth under FrTSynGlobalTimeSlave.

#### **Module version 1.3.0**

2018-04-20

- ▶ Implement Global Time Measurement Support.

#### **Module version 1.2.0**

2018-02-16

- ▶ ASCFRTSYN-102 Fixed known issue: Incorrect calculation of global time in FrTSyn time slaves.
- ▶ ASCFRTSYN-43 Added support for Offset Time Bases.

#### **Module version 1.1.4**

2018-01-19

- ▶ ASCFRTSYN-77 Fixed known issue: FrTSyn accepts messages with wrong message type.
- ▶ ASCFRTSYN-81 Fixed known issue: User data byte handling fails for FRTSYN\_CRC\_IGNORED.

#### **Module version 1.1.3**

2017-12-15

- ▶ Added support for disabled periodic transmission.
- ▶ Added support for Time domain specific data ID lists for CRC.
- ▶ ASCFRTSYN-87 Fixed known issue: FrTSyn transmits SYNC messages without global time base being initially set.
- ▶ Changed signature of FrTSyn\_RxIndication(), aligned with FrIf.

#### **Module version 1.1.2**

2017-10-20





- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.1.1**

2017-09-22

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.1.0**

2017-07-28

- ▶ ASCFRTSYN-55 Fixed known issue: FrTSyn\_TriggerTransmit function return type is wrong.
- ▶ Support for Immediate Time Synchronization

#### **Module version 1.0.6**

2017-03-31

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.0.5**

2017-03-10

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 1.0.4**

2017-03-03

- ▶ Move integration requirements to separate reqm file.

#### **Module version 1.0.3**

2017-01-05

- ▶ Documented MISRA violation.

#### **Module version 1.0.2**

2016-12-02

- ▶ Create implementation for FrTSyn ASR 4.2.2 for the Master Domain Feature including CRC support and User Data support, without Offset Time Bases support.

#### **Module version 1.0.1**

2016-11-04

- ▶ Design updates.

#### **Module version 1.0.0**

2016-09-23

- ▶ Initial AUTOSAR 4.2 version
- ▶ Create implementation for FrTSyn ASR 4.2.2 for the Slave Domain Feature including CRC support and User Data support, without Offset Time Bases support.

### **3.3.3.2. New features**

- ▶ Added support for Time Recording Safety Validation
- ▶ Module was upgraded to AR4.4.0

### **3.3.3.3. EB-specific enhancements**

This chapter lists the enhancements provided by the module.

- ▶ Time Validation

Description:

FrTSyn supports Time Validation as per AUTOSAR R19-11.

### **3.3.3.4. Deviations**

This chapter lists the deviations of the module from the AUTOSAR standard.

- ▶ Only pre-compile configuration is supported

Description:

The FrTSyn module only supports configuration variant VARIANT-PRE-COMPILE. VARIANT-POST-BUILD is not supported.

Variant handling is not supported.

Requirements:

SWS\_FrTSyn\_00077

- Not clarified requirements

Description:

These configuration parameters are not used by FrTSyn: ECUC\_FrTSyn\_00034 ECUC\_FrTSyn\_00035 ECUC\_FrTSyn\_00036 ECUC\_FrTSyn\_00037 ECUC\_FrTSyn\_00038 ECUC\_FrTSyn\_00039

Rationale:

These configuration parameters, within ASR4.4.0, are marked as "draft" and no functionality is provided for them

Requirements:

ECUC\_FrTSyn\_00034 ECUC\_FrTSyn\_00035 ECUC\_FrTSyn\_00036 ECUC\_FrTSyn\_00037 ECUC\_FrTSyn\_00038 ECUC\_FrTSyn\_00039

### 3.3.3.5. Limitations

This chapter lists the limitations of the module. Refer to the module references chapter *Integration notes*, subsection *Integration requirements* for requirements on integrating this module.

- Number of supported Time Domains

Description:

Up to 254 Time Domains are supported.

Rationale:

The number of supported Time Domains is reduced from Infinity to a size which fits into an uint8. Additionally one slot is reserved for the handling of multiplexed PDUs.

- Confirmation Timeout of Master Time Domain

Description:

Up to one second supported.

Rationale:

Only a timeout smaller than one second can be used because the RawTime API StbM\_GetCurrentTimeDiff() from StbM is limited to intervals of one second.

- Values of configuration parameter FrTSynRxCrcValidated

Description:

The value of CRC\_OPTIONAL for the configuration parameter FrTSynRxCrcValidated is not supported.

Rationale:

The implementation of FrTSyn is according to SWS version 4.2.2 with certain features taken over from 4.-3.1. At this moment this hasn't been taken over.

- FrTSyn is not able to detect a wrap around

Description:

FrTSyn is not able to detect a wrapped around Sequence Counter, when a SYNC/OFS message is received.

Rationale:

When two consecutive SYNC/OFS messages with the same Sequence Counter are received, the second SYNC/OFS message will always be rejected, considering its SC to be a "stuck" one.

### 3.3.3.6. Open-source software

FrTSyn does not use open-source software.

## 3.3.4. StbM module release notes

- AUTOSAR R4.4 Rev 0
- AUTOSAR SWS document version: 0.0.0
- Module version: 3.0.0.B337087
- Supplier: Elektrobit Automotive GmbH

### 3.3.4.1. Change log

This chapter lists the changes between different versions.

**Module version 3.0.0**

2020-06-19

- ▶ Upgraded StbM module to Autosar 4.4 SWS.

**Module version 2.6.19**

2020-05-22

- ▶ ASCSTBM-526 Fixed known issue: StbM does not compile when Trigger Customers are used with an OS other than EB's

**Module version 2.6.18**

2020-04-24

- ▶ Support Autosar 4.2/4.3/4.4 Gpt MCALs with StbM.
- ▶ ASCSTBM-520 Fixed known issue: StbM fails to load the Global Time from NvM at initialization.

**Module version 2.6.17**

2020-03-25

- ▶ ASCSTBM-494 Fixed known issue: Rte wrongly generates Measurement Notification R-PORTs for MASTER StbM time bases.

**Module version 2.6.16**

2020-02-21

- ▶ Implement Time Validation support in StbM.
- ▶ Implement Time Notification support in StbM.

**Module version 2.6.15**

2019-11-08

- ▶ Internal module improvement. This module version update does not affect module functionality.

**Module version 2.6.14**

2019-10-11



- ▶ ASCSTBM-445 Fixed known issue: Time Recording data is wrong at initialization.
- ▶ ASCSTBM-447 Fixed known issue: TimeRecording records a wrong value for the rate deviation.
- ▶ ASCSTBM-448 Fixed known issue: StbM time base data written in the shared memory location can be wrong.

#### **Module version 2.6.13**

2019-09-06

- ▶ ASCSTBM-441 Fixed known issue: Inconsistent Virtual Local Time between EthTSyn and StbM.

#### **Module version 2.6.12**

2019-08-09

- ▶ ASCSTBM-437 Fixed known issue: StbM provides wrong time if interrupted by a Time Setter function.

#### **Module version 2.6.11**

2019-07-12

- ▶ Implement VSwt support in StbM.

#### **Module version 2.6.10**

2019-06-14

- ▶ Enhance StbM exclusive areas to support multicore environment
- ▶ Implement the use of OS\_GetTimeStamp()/Mk\_ReadTime as EB specific extension.

#### **Module version 2.6.9**

2019-05-17

- ▶ ASCSTBM-413 Fixed known issue: Rate Correction Measurement is not initialized when only one measurement is configured for the first Time Base.
- ▶ ASCSTBM-405 Fixed known issue: StbM does not use StbMClockPrescaler/StbMClockFrequency configuration parameters.

#### **Module version 2.6.8**

2019-04-18



- ▶ ASCSTBM-404 Fixed known issue: PORT-API-OPTION has wrong DEST value for MeasurementNotification PORT-REF.

#### **Module version 2.6.7**

2019-03-22

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 2.6.6**

2019-02-15

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 2.6.5**

2019-01-25

- ▶ Internal module improvement. This module version update does not affect module functionality.

#### **Module version 2.6.4**

2018-12-13

- ▶ ASCSTBM-370 Fixed known issue: Runnable entities with the same SHORT-NAME are generated twice when slave and master are configured.

#### **Module version 2.6.3**

2018-11-23

- ▶ Internal module improvement. This module version update does not affect module functionality

#### **Module version 2.6.2**

2018-10-26

- ▶ Use of GPT counter as source for the virtual local time base.
- ▶ ASCSTBM-350 Fixed known issue: StbM\_GetRateDeviation() returns E\_OK even if the slave rate correction was not calculated.
- ▶ ASCSTBM-268 Fixed known issue: Wrong order of StbM\_SyncRecordTableBlockType elements leads to wrong element data.

#### **Module version 2.6.1**

2018-09-28

- ▶ ASCSTBM-296 Fixed known issue: Progression of time fails for timeouts greater than 16 seconds.
- ▶ ASCSTBM-312 Fixed known issue: Rte generates incompatible prototypes for StbM functions.
- ▶ ASCSTBM-340 Fixed known issue: Wrong order of StbM\_SyncRecordTableBlockType elements leads to wrong element data.

#### **Module version 2.6.0**

2018-09-20

- ▶ Enhance precision of Global Time.

#### **Module version 2.5.0**

2018-08-24

- ▶ Add pure local time base support.

#### **Module version 2.4.0**

2018-07-27

- ▶ Provide means to store/load the time in NvM.

#### **Module version 2.3.2**

2018-06-22

- ▶ Introduce S/R StbM\_StatusNotification interface.
- ▶ StbM\_SetGlobalTime behaviour for offset time bases
- ▶ ASCSTBM-309 Fixed known issue: StbM\_MasterRateCorrectionData[] has an unprotected write access in StbM\_SetGlobalTimeOffset()
- ▶ ASCSTBM-310 Fixed known issue: StbM\_OffsetSign[] has an unprotected write access in StbM\_SetGlobalTimeOffset()
- ▶ ASCSTBM-311 Fixed known issue: StbM\_RecordTableBlocksInfo[] has an unprotected read/write access in StbM\_UpdateVirtualLocalTimeOs()

#### **Module version 2.3.1**

2018-05-25



- ▶ Introduce StbM\_UpdateGlobalTime() API
- ▶ ASCSTBM-300 Fixed known issue: If StbM uses Rte, TSyn modules do not have access to function prototypes

#### **Module version 2.3.0**

2018-04-20

- ▶ ASCSTBM-290 Fixed known issue: Rate deviation returned by StbM\_GetRateDeviation is wrong in some cases
- ▶ Update signature of StbM\_BusSetGlobalTime to use measureDataPtr instead of syncToGateway
- ▶ ASCSTBM-285 Fixed known issue: Os counter wrap-around is not considered in case of preemption
- ▶ ASCSTBM-292 Fixed known issue: StbMEthHwTimestampBehaviourSelect parameter cannot be enabled because of compilation error

#### **Module version 2.2.1**

2018-03-16

- ▶ ASCSTBM-232 Fixed known issue: StbM module generation fails if modules that support hardware time stamp are not configured first in the StbMBswModule list
- ▶ ASCSTBM-271 Fixed known issue: Symbolic names are not generated for StbMSynchronizedTimeBaseIdentifier

#### **Module version 2.2.0**

2018-02-16

- ▶ Provide actual precision of individual time bases

#### **Module version 2.1.1**

2018-01-19

- ▶ Internal module improvement. This module version update does not affect module functionality

#### **Module version 2.1.0**

2017-12-15

- ▶ Notification interface for global time synchronization events
- ▶ Provide rate correction in addition to pure offset correction

- ▶ ASCSTBM-245 Fixed known issue: TIMELEAP detection fails

#### **Module version 2.0.9**

2017-09-22

- ▶ ASCSTBM-213 Fixed known issue: StbM compilation fails if triggered customers are used without local time
- ▶ Added immediate Time Synchronization
- ▶ Implement updates of AUTOSAR 4.2.2
- ▶ Updated signature of API StbM\_GetOffset() to AUTOSAR 4.3
- ▶ Updated signature of API StbM\_SetOffset() to AUTOSAR 4.3
- ▶ Updated for MISRA-C:2012 compliance

#### **Module version 2.0.8**

2017-03-31

- ▶ ASCSTBM-168 Fixed known issue: StbM does not update local time if exclusive area locks interrupts
- ▶ ASCSTBM-177 Fixed known issue: StbM uses incorrect conversion macro for Os counter

#### **Module version 2.0.7**

2016-11-04

- ▶ Internal module improvement. This module version update does not affect module functionality

#### **Module version 2.0.6**

2016-09-09

- ▶ ASCSTBM-138 Fixed known issue: StbM generates service ports with unknown CLIENT-SERVER-OPERATION

#### **Module version 2.0.5**

2016-08-05

- ▶ The first invocation of StbM\_BusSetGlobalTime() does not perform time leap detection (status bit TIMELEAP)
- ▶ Added user data support



#### **Module version 2.0.4**

2016-05-25

- ▶ ASCSTBM-104 Fixed known issue: Os timestamp functions used without considering the availability of these functions
- ▶ ASCSTBM-107 Fixed known issue: Unresolved possible error references in StbM\_swc\_interfaces.arxml lead to warnings during import
- ▶ Internal improvements of the StbM code generator

#### **Module version 2.0.3**

2016-02-05

- ▶ Added support for BSW modules without Module Properties file

#### **Module version 2.0.2**

2015-11-06

- ▶ Added check to validate the existence of a configured BSW module

#### **Module version 2.0.1**

2015-06-19

- ▶ Add support for ComTransformer
- ▶ ASCSTBM-82 Fixed known issue: StbM uses wrong references to ImplementationDataTypes
- ▶ ASCSTBM-83 Fixed known issue: StbM always using the type EthTSyn\_SyncStateType
- ▶ ASCSTBM-84 Fixed known issue: Update of time might fail for time bases using a local time and a triggered customer

#### **Module version 2.0.0**

2015-02-20

- ▶ Initial AUTOSAR 4.2 version

#### **Module version 1.0.0**

2013-02-12

- ▶ Initial Release

### 3.3.4.2. New features

- ▶ Support Autosar 4.2/4.3/4.4 Gpt MCALs.
- ▶ Upgrade StbM module to Autosar 4.4 SWS.

### 3.3.4.3. EB-specific enhancements

This chapter lists the enhancements provided by the module.

- ▶ Avoidance of time leaps

Description:

`StbM` allows to avoid leaps in the global time when using the APIs `StbM_SetGlobalTime()` and `StbM_BusSetGlobalTime()`.

Calling `StbM_SetGlobalTime()` or `StbM_SetGlobalTime()` for an offset time base (instead of a synchronized time base) lets the time of the underlying synchronized time base unchanged. The difference of the absolute time passed via API and the actual time of the synchronized time base is stored as offset value.

Calling `StbM_SetCurrentTime()` for an offset time base returns the sum of both values (and therefore the absolute time) again.

Note that the new absolute time must not be smaller than the actual time of the synchronized time base.

Rationale:

This enhancement allows to avoid time leaps by splitting an absolute time in `SYNC` and `OFFSET` messages.

- ▶ Support of Time Validation

Description:

`StbM` supports Time Validation as per AUTOSAR R19-11. when an event was detected.

- ▶ Implement VSwt support in StbM

Description:

`StbM` module can provide data of selected time bases to a shared memory location.

MemMap section : `VAR_SHARED_TIME_DATA`

Rationale:

Through this enhancement, other users can read the time base data directly from the shared memory location.

### 3.3.4.4. Deviations

This chapter lists the deviations of the module from the AUTOSAR standard.

- ▶ Monitoring of `StbM_Mainfunction()` cyclic execution not supported

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

`StbM` does not monitor the cyclic execution of API service `StbM_Mainfunction()`.

Rationale:

Monitoring of the `StbM_Mainfunction()` cyclic execution is strictly dependent on the integration strategy and is not provided by `StbM` internally.

Requirements:

SWS\_StbM\_00031

- ▶ API `StbM_GetCurrentTimeExtended()` not supported

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

`StbM` does not provide the API service `StbM_GetCurrentTimeExtended()`.

Rationale:

AUTOSAR is restricted to the ISO/IEC 9899:1990 (C90) standard. The API `StbM_GetCurrentTimeExtended()` would require the usage of `long long` data types which are introduced in the ISO/IEC 9899:1999 (C99) standard.

Requirements:

SWS\_StbM\_00200 ECUC\_StbM\_00032 SWS\_StbM\_00201 SWS\_StbM\_00202 SWS\_StbM\_00242  
SWS\_StbM\_00247 SWS\_StbM\_00434 SWS\_StbM\_00173 SWS\_StbM\_00177 SWS\_StbM\_00398

- ▶ `StbMLocalTimeHardware` allows empty reference when `StbMUseOSGetTimeStamp` is enabled

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

The time source for the virtual local time, will be derived from Os, if one of the following steps are made: - Configure StbMLocalTimeHardware parameter to point to an OsCounter or - Set StbMUseOSGetTimeStamp parameter to TRUE. Changes made according to the following RFC: <https://jira.autosar.org/browse/AR-3543>.

Requirements:

StbM.ASR44.ECUC\_StbM\_00053\_Conf

- ▶ StbMRateCorrectionMeasurementDuration shall be limited to 14 seconds

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

StbMRateCorrectionMeasurementDuration shall be limited to 14 seconds to not cause an overflow during the calculation of the Rate Correction.

Requirements:

SWS\_StbM\_00353 SWS\_StbM\_00356

- ▶ StbMClockFrequency/StbMClockPrescaler factor to convert the time of its local hardware reference clock to the actual time of the Virtual Local Time, is not used in the scope of StbM\_GetCurrentTime(), StbM\_GetCurrentTimeExtended() or StbM\_BusGetCurrentTime(). Instead, StbMClockFrequency/StbMClockPrescaler factor is applied in the moment when the local hardware time is taken from the time source.

StbMClockFrequency/StbMClockPrescaler factor to convert the time of its local hardware reference clock to the actual time of the Virtual Local Time, is used only when a GPT channel is used as a time source by a Time Base.

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

StbM uses StbMClockFrequency/StbMClockPrescaler factor only when a GPT channel is used as a time source by a Time Base. StbM does not use StbMClockFrequency/StbMClockPrescaler in the scope of StbM\_GetCurrentTime(), StbM\_GetCurrentTimeExtended() or StbM\_BusGetCurrentTime().

Rationale:

StbMClockFrequency/StbMClockPrescaler factor is not used when EthTSyn is configured as a time source, because when the time is taken from EthTSyn, it has the type StbM\_TimeStampType (timeBaseStatus, nanoseconds, seconds and secondsHi) and there is no need for conversion.

StbMClockFrequency/StbMClockPrescaler factor is not used when OS is configured as a time source, because when the time is taken from OS, it is represented in ticks and a conversion macro `OS_TICKS2 Unit_Counter(ticks)` as specified by req. OS393 in the Os AUTOSAR SWS, is used.

StbMClockFrequency/StbMClockPrescaler factor is used when a GPT Channel is configured as a time source, because when the time is taken from Gpt, it has the type `Gpt_ValueType (ticks)` and a conversion from ticks into nanoseconds is needed.

It is more precise to use the StbMClockFrequency/StbMClockPrescaler factor when the time is taken from the time source and after that use it in the conversion.

Requirements:

SWS\_StbM\_00352

- ▶ StbMTimerStartThreshold is limited to 4290s

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

StbMTimerStartThreshold can have a maximum configured value of 4290s, in order for Gpt to be able to monitor the time after `Gpt_StartTimer()` is called. Changes made when ASCSTBM-424 feature was introduced.

Requirements:

StbM.ASR19-11.ECUC\_StbM\_00063

- ▶ StbM module does not support POST-BUILD loadable, or POST-BUILD selectable

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

POST-BUILD loadable and selectable are not supported by StbM module. Because of this `StbMAllowSystemWideGlobalTimeMaster` and `StbMIsSystemWideGlobalTimeMaster` are also not supported.

Requirements:

SWS\_StbM\_CONSTR\_00001, SWS\_StbM\_CONSTR\_00002, StbM.ASR44.ECUC\_StbM\_00066\_Conf, SWS\_StbM\_91001, SWS\_StbM\_00428

- ▶ Triggered Customers: The Synchronization of `OsScheduleTable` is based on the fact that StbM converts the nanoseconds to `OsTicks`

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

When OsScheduleTables are synchronized to a counter value, the conversion of the StbM local time (nanoseconds) to ticks, is made based on Os Macros.

Conversion is only done for the "nanoseconds" part of the time base, since the schedule table duration will be in the range of tens of milliseconds.

Requirements:

SWS\_StbM\_00303

- ▶ StbM\_GetTimeLeap() API is not supported

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

StbM\_GetTimeLeap() API is not supported.

Requirements:

SWS\_StbM\_00268, SWS\_StbM\_00269, SWS\_StbM\_00425, SWS\_StbM\_00267

- ▶ StbM\_GetMasterConfig() API is not supported

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

StbM\_GetMasterConfig() API is not supported.

Requirements:

SWS\_StbM\_00415, SWS\_StbM\_00240, SWS\_StbM\_91002, SWS\_StbM\_00408

- ▶ Rte interfaces are generated once

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

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Description:



GlobalTime\_Master, GlobalTime\_Slave and MeasurementNotification Client-Server Interfaces are generated only once and not one for each time base.

Requirements:

SWS\_StbM\_00240, SWS\_StbM\_00240, SWS\_StbM\_00247, SWS\_StbM\_00339

- ▶ StbM\_BusGetCurrentTime API ServiceID was changed from 0x07 to 0x1F

Affected AUTOSAR releases:

- ▶ R4.4 rev 0

Description:

The ServiceID of the StbM\_BusGetCurrentTime API was changed from 0x07 to 0x1F, in order to be different from the ServiceID of the StbM\_GetCurrentTime API, which is also 0x07. For more details, see <https://jira.autosar.org/browse/AR-3074>.

Requirements:

SWS\_StbM\_91005

### 3.3.4.5. Limitations

This chapter lists the limitations of the module. Refer to the module references chapter *Integration notes*, subsection *Integration requirements* for requirements on integrating this module.

- ▶ Limitation on number of Os counters

Description:

The StbM can only handle one Os counter. This limitation applies to configuration parameter StbMLocalTimeHardware.

Rationale:

The alignment of multiple time bases from a single Os counter does not affect functionality or precision of the time bases.

- ▶ StbMRateCorrectionMeasurementDuration is limited

Description:

The StbMRateCorrectionMeasurementDuration parameter, and the resynchronization time of the StbM should be configured in a way that the following values do not exceed 15 seconds:

- ▶ the difference (TGstop minus TGstart)

- ▶ the difference (TVstop minus TVstart)

These are part of the rate correction calculation formula:  $rrc = (TGStop - TGStart) / (TVStop - TVStart)$ . If they do exceed the above value, an overflow could emerge when calculating the Rate Correction.

Rationale:

The application does not use, float, doubles, or uint64(multiplication and division) values. Calculation is only controlled by types smaller or equal with uint32. This limitation allows for higher precision.

- ▶ StbMOffsetCorrectionAdaptionInterval is limited

Description:

The `StbMOffsetCorrectionAdaptionInterval` parameter, shall be configured in a way that roc does not exceed a value of 4:  $roc = (TG - TLSync) / (TCorrInt)$ .

Also `StbMOffsetCorrectionAdaptionInterval` shall not exceed 15 sec.

So:  $(TG - TLSync) / (TCorrInt) \leq 4$

These are part of the rate correction calculation formula:  $rrc = (TGStop - TGStart) / (TVStop - TVStart)$ . If they do exceed the above value, an overflow could emerge when calculating the Rate Correction.

Rationale:

The application does not use values of type float, double or uint64(multiplication and division). Calculation is only controlled by types smaller or equal with uint32. This limitation allows for higher precision.

- ▶ Calculating Slave Local Time with Offset Correction is limited

Description:

The following shall be taken into consideration when configuring the StbM module.

When calculating the local time with additional rate the following formula is this formula:

$$TL = TLSync + (TV - TVSync) * (rrc + roc)$$

It shall be considered that the sum (or the difference) between the two rates ( $rrc + roc$ ) shall be under the limit of uint32.

Attention: the rates are represented in Q format when the sum is done.

Rationale:

The application does not use values of type float, double or uint64(multiplication and division). Calculation is only controlled by types smaller or equal with uint32. This limitation allows for higher precision.

- ▶ Calculating Master Local Time is limited

Description:

The following shall be taken into consideration when configuring the StbM module.

When calculating the local time with rrc for Master side the following formula is used:

$$TL = TLSync + (TV - TVSync) * rrc$$

It shall be considered that the sum (or the difference) between the two virtual local time values shall not exceed 15 seconds.

Rationale:

The application does not use values of type float, double or uint64. Calculation is only controlled by types smaller or equal with uint32. This limitation allows for higher precision.

- ▶ Subtracting Virtual Local Times is limited

Description:

The following shall be taken into consideration:

Subtracting two virtual local times shall be limited to a difference of 2.305.843.004s and 918.726.656ns

This limitation is located in the StbM\_SubtractVirtualLocalTimes() function

Rationale:

Summing more would cause an overflow of seconds, this should not happen in a vehicle life time

- ▶ Limitation on StbMOffsetCorrectionJumpThreshold

Description:

Up to 65535 supported.

Rationale:

StbM does not use values greater than UINT32 for StbMOffsetCorrectionJumpThreshold.

- ▶ Limitation on the number of TSyn MASTER Time Domains referencing an StbM Time Base

Description:

The StbM can only be referenced by 1 TSyn MASTER Time Domain. This limitation applies to the following configuration parameters: - in case the Time Domain belongs to CANTSYN: CanTSynSynchronizedTimeBaseRef - in case the Time Domain belongs to FRTSYN: FrTSynSynchronizedTimeBaseRef - in case the Time Domain belongs to ETHTSYN: EthTSynSynchronizedTimeBaseRef

Rationale:

TIME VALIDATION feature (ASCSTBM-365) does not handle StbM Time Bases which are referenced by more than 1 TSyn MASTER Time Domain.

- Limitation on the number of TSyn SLAVE Time Domains referencing an StbM Time Base

Description:

The `StbM` can only be referenced by 1 TSyn SLAVE Time Domain. This limitation applies to the following configuration parameters: - in case the Time Domain belongs to CANTSYN: `CanTSynSynchronizedTimeBaseRef` - in case the Time Domain belongs to FRTSYN: `FrTSynSynchronizedTimeBaseRef` - in case the Time Domain belongs to ETHTSYN: `EthTSynSynchronizedTimeBaseRef`

Rationale:

TIME VALIDATION feature (ASCSTBM-365) does not handle StbM Time Bases which are referenced by more than 1 TSyn SLAVE Time Domain

- Limitation on Time Validation feature

Description:

The `StbM` can only use Time Validation feature, together with Time Recording. Each StbM time base which has TimeValidation on it, it will also handle the Time Recording blocks.

Rationale:

As per current implementation, TIME VALIDATION feature (ASCSTBM-365) will only work together with Time Recording. This will be addressed in the future.

- Limitation regarding the supported Gpt Autosar version

Description:

The `StbM` only supports 4.0 GPT version.

Rationale:

As per current implementation, StbM does not support GPT 4.2 version.

- Limitation on the number of `StbM_StartTimer()` calls

Description:

`StbM_StartTimer()` function shall be called at least 1 time and maximum `StbMTimerStartMaxNumberOfCalls` times.

Rationale:

`StbM_StartTimer()` function shall be called at least 1 time, because there shall be at least one call, in order for Notification of Customers feature to be used. `StbM_StartTimer()` function shall be called maximum

StbMTimerStartMaxNumberOfCalls times, because each time a call to StbM\_StartTimer() occurs, the StbM shall calculate, save and sort the 'customerTimerExpireTime' in a list and dynamic memory allocation shall be avoided when doing that.

► Limitation on the calculation of the deviation for Notification Customers

Description:

The calculated deviation reported to the Notification Customer through the notification callback, does not include the decoupling time between the interruption from the Gpt and the time the above notification is called.

Rationale:

The Autosar requirements do not cover this part. The decoupling time was not included in the deviation because the use cases are not clear and could be different for each user.

► Limitation on multiple Gpt drivers support

Description:

StbM does not support referencing channels from multiple Gpt drivers.

Rationale:

The Autosar requirements do not cover this part. Typically there is only one Gpt Driver per project.

### 3.3.4.6. Open-source software

StbM does not use open-source software.

## 4. ACG8 Time Sync user's guide

### 4.1. Overview

The ACG8 Time Sync user's guide provides information about the concepts of the time synchronization in the AUTOSAR context.

- ▶ [Section 4.2, “Background information”](#) describes the concept of time synchronization in the AUTOSAR context.
- ▶ [Section 4.3, “Using time synchronization in your project”](#) provides basic information about using the time synchronization modules in your project.

### 4.2. Background information

This chapter provides general information about the time synchronization concepts in the AUTOSAR context. If you are not familiar with the general concepts of AUTOSAR, read the general information provided in the EB tresos AutoCore Generic documentation first.

#### 4.2.1. Clock synchronization between master and slave

The main functionality of time synchronization is to provide a common time base for different ECUs in a network. One particular ECU is configured to be the time master which provides its time base to other ECUs in the same network. The other time slave ECUs synchronize to the time master and update their local time to match the master's time base.

The process of time synchronization is depicted in [Figure 4.1, “Time Synchronization via Sync and Followup frames”](#) and consists of these steps:

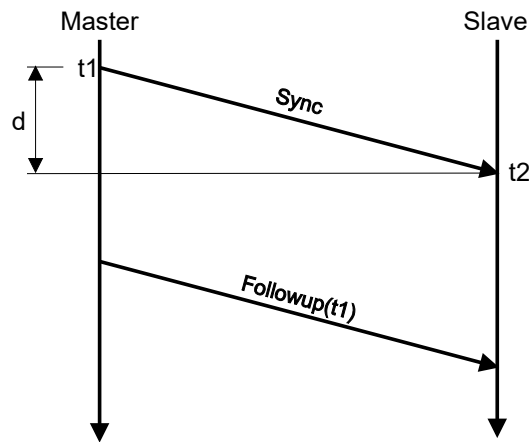


Figure 4.1. Time Synchronization via *Sync* and *Followup* frames

- ▶ The master periodically sends *Sync* frames to the slave.
- ▶ The slave measures its local time ( $t_2$ ) at the time the frame is received.
- ▶ The master sends a *Followup* frame which contains the time  $t_1$  at which the *Sync* frame was sent.
- ▶ The slave computes the offset between its local time base and the master's time base.  
This offset is  $t_2 - t_1 - d$  where  $d$  is the so-called propagation delay (also called link delay or path delay) that is introduced on the network (e.g. by routers and switches used). If this propagation delay is not known it is assumed to be zero, leading to an inaccuracy of the computed offset. The propagation delay can be determined by the feature 'propagation delay measurement' (see [Section 4.2.3, "Propagation delay measurement"](#)).
- ▶ The slave updates its local time based on the computed offset.

## 4.2.2. Clock rate correction

Using clock synchronization between master and slave ECUs will regularly synchronize the slave time to the master time. However, if both clocks do not run at the same frequency there will continuously be an increasing time offset between master and slave. This inaccuracy can be reduced if the slave determines the offsets of two subsequent synchronizations and computes a correction for its clock rate. The clock rate is then updated in a way that the expected offset for the next synchronization period is zero. The `EthTSyn` module reports the measured time offsets to the `Eth` module which then updates its clock rate if this is supported by the Ethernet controller.

### 4.2.3. Propagation delay measurement

The time synchronization between master and slave can be improved if the propagation delay is known. The propagation delay is the time between transmission of the frame by the master and the reception of the frame by the slave. There is a specific value for each slave that can be measured by the following mechanism (see [Figure 4.2, "Propagation delay measurement"](#)):

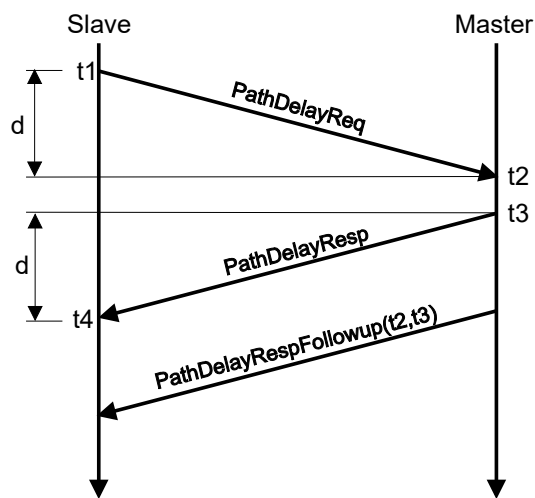


Figure 4.2. Propagation delay measurement

- ▶ The slave sends a `PathDelayReq` frame to the master. The slave stores time  $t_1$  at which the frame was transmitted, the master stores time  $t_2$  at which the frame was received.
- ▶ The master replies with a `PathDelayResp` frame. It saves time  $t_3$  at which the frame was transmitted, the slave stores time  $t_4$  at which the frame was received.
- ▶ The master sends a `PathDelayRespFollowup` frame which includes  $t_2$  and  $t_3$  in the frame payload. Now the slave can compute the propagation delay which is  $((t_4 - t_1) - (t_3 - t_2)) / 2$ .
- ▶ The slave uses the propagation delay during time synchronization with the master to improve the accuracy of the offset calculation.



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**NOTE**



**ACG8 Time Sync time masters also transmit PathDelayReq frames**

In ACG8 Time Sync, the time masters also transmit `PathDelayReq` frames. This avoids compatibility issues with some AVB switches.

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## 4.2.4. Hardware time-stamping

If the Ethernet controller has an integrated clock which provides a hardware time-stamp for incoming Ethernet frames the accuracy of time synchronization can be increased. EB tresos AutoCore supports `Eth` drivers with and without hardware time-stamping support.

## 4.2.5. Time synchronization gateway functionality

A single gateway ECU can act as time slave in one network and as time master in another network. This way, a global time can be propagated from one network to another network. EB tresos AutoCore supports time synchronization gateway functionality.

## 4.2.6. Time synchronization priority announcement

Time master ECUs are expected to send `Announce` frames to report their priority and accuracy with respect to time synchronization. This information could be used to determine the time master with the most accurate clock and elect this time master as global time master (the grand master). Transmitting `Announce` frames may also avoid compatibility issues with some AVB switches which expect to receive these frames. EB tresos AutoCore supports configurable transmission of `Announce` frames.

# 4.3. Using time synchronization in your project

This section gives brief instructions for integrating the time synchronization modules in your project.

To use time synchronization, you must configure two modules. The first is the `StbM` module. The second is a network-specific module, for example the `EthTSyn` module.

You find information about configuring the modules in the parameter descriptions provided in the module references section [Chapter 5, “ACG8 Time Sync module references”](#). You also see this information in EB tresos Studio in the **Properties** tab. Click on the parameter name and select the **Description** page of the **Properties** tab to read the parameter description.



You find additional information about integrating the modules in the `Integration notes` section of the module references. The integration notes provide information about exclusive areas used by the module, production errors and memory mapping.

## 5. ACG8 Time Sync module references

### 5.1. Overview

This chapter provides module references for the ACG8 Time Sync product modules. These include a detailed description of all configuration parameters. Furthermore this chapter lists the application programming interface with all data types, constants and functions.

The content of the sections is sorted alphabetically according to the EB tresos AutoCore Generic module names.

For further information on the functional behavior of these modules, refer to the chapter ACG8 Time Sync user's guide.

#### 5.1.1. Notation in EB module references

EB notation may differ from the AUTOSAR standard notation in the software specification documents (SWS). This section describes the notation of *default value* and *range* fields in the EB module references.

##### 5.1.1.1. Default value of configuration parameters

If there is no default value specified for a parameter, the default value field is omitted to prevent ambiguity with parameters that have -- as default values.

Example: The parameter `BswMCompuConstText` of the `BswM` module of EB tresos AutoCore Generic 8 Mode Management has no default value field, therefore it is omitted.

##### 5.1.1.2. Range information of configuration parameters

The range of a configuration parameter contains an upper and a lower boundary. However, in special cases the range of allowed values can be computed by means of an XPath function that is evaluated at configuration time. An XPath function can either be a standard `xpath:<function>()` or a custom `cxpath:<function>()` function. The range of a configuration parameter may be computed based on other configuration parameters that are referenced from the XPath function. For more information on custom XPath functions, see section *Custom XPath Functions API* of the EB tresos Studio developer's guide.

Example: The parameter `BswMCompuConstText` of the `BswM` module of EB tresos AutoCore Generic 8 Mode Management has the custom XPath function `cxpath:getCompuMethodsVT()` in the range field which provides the allowed values.

## 5.2. CanTSyn

### 5.2.1. Configuration parameters

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGeneral</a>	1..1	This container contains the general configuration parameters of the CanTSyn module.
<a href="#">CanTSynGlobalTimeDomain</a>	1..n	This represents the existence of a global time domain on CAN. The CanTSyn module can administrate several global time domains at the same time that in itself form a hierarchy of domains and sub-domains.
<a href="#">CommonPublishedInformation</a>	1..1	<b>Label:</b> Common Published Information Common container, aggregated by all modules. It contains published information about vendor and versions.
<a href="#">PublishedInformation</a>	1..1	<b>Label:</b> EB Published Information Additional published parameters not covered by Common-PublishedInformation container.

Parameters included	
Parameter name	Multiplicity
<a href="#">IMPLEMENTATION_CONFIG_VARIANT</a>	1..1

Parameter Name	IMPLEMENTATION_CONFIG_VARIANT
Label	Config Variant
Multiplicity	1..1
Type	ENUMERATION
Default value	VariantPreCompile
Range	VariantPreCompile
Configuration class	VariantPreCompile: VariantPreCompile

### 5.2.1.1. CanTSynGeneral

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynDevErrorDetect</a>	1..1
<a href="#">CanTSynMainFunctionPeriod</a>	1..1
<a href="#">CanTSynVersionInfoApi</a>	1..1
<a href="#">CanTSynTimeValidationSupport</a>	1..1

Parameter Name	CanTSynDevErrorDetect	
Description	Switch for enabling the development error detection.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynMainFunctionPeriod	
Description	Schedule period of the main function CanTSyn_MainFunction(). Unit: [s].	
Multiplicity	1..1	
Type	FLOAT	
Range	<=1000	
	>=0.000001	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynVersionInfoApi	
Description	Activates the CanTSyn_GetVersionInfo() API.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	FALSE	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynTimeValidationSupport	
Description	The CanTSyn shall support Time Validation, if CanTSynTimeValidationSupport set to TRUE.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	M4_ECUC_ORIGIN_ASRR19-11	

### 5.2.1.2. CanTSynGlobalTimeDomain

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGlobalTimeFup-DataIDList</a>	0..1	The DataIDList for FUP messages ensures the identification of data elements due to CRC calculation process.
<a href="#">CanTSynGlobalTimeOfns-DataIDList</a>	0..1	The DataIDList for OFNS messages ensures the identification of data elements due to CRC calculation process.
<a href="#">CanTSynGlobalTimeOfs-DataIDList</a>	0..1	The DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.
<a href="#">CanTSynGlobalTimeSync-DataIDList</a>	0..1	The DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.
<a href="#">CanTSynGlobalTimeMaster</a>	0..1	Configuration of the global time master. Each global time domain is required to have exactly one global time master. This master may or may not exist on the configured ECU.
<a href="#">CanTSynGlobalTimeSlave</a>	0..1	Configuration of a global time slave. Each global time domain is required to have at least one time slave. The configured ECU may or may not represent a time slave.

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeDomainId</a>	1..1
<a href="#">CanTSynGlobalTimeSecureTmacLength</a>	1..1
<a href="#">CanTSynEnableTimeValidation</a>	1..1
<a href="#">CanTSynSynchronizedTimeBaseRef</a>	1..1
<a href="#">CanTSynUseExtendedMsgFormat</a>	1..1

Parameter Name	CanTSynGlobalTimeDomainId	
Description	The global time domain ID.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<=31	
	>=0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeSecureTmacLength	
Description	Represents the number of bytes for the used Truncated Message Authentication Code (TMAC). If 0, no message authentication will be used.  TMAC is not supported.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<=16	
	>=0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynEnableTimeValidation	
Description	CanTSyn shall do time recording for TimeValidation for this Time Domain, if CanTSynEnableTimeValidation set to TRUE and CanTSynEnableTimeValidation of this time domain is set to TRUE.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	PreCompile:	VariantPreCompile
Origin	M4_ECUC_ORIGIN_ASRR19-11	

Parameter Name	CanTSynSynchronizedTimeBaseRef	
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<b>Description</b>	Mandatory reference to the required synchronized time-base.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	REFERENCE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>CanTSynUseExtendedMsgFormat</b>	
<b>Description</b>	Switches support for 16 Byte Timesync messages on or off (for CAN FD only) <ul style="list-style-type: none"> <li>▶ true: use 16 byte Timesync message formats (for CAN FD only).</li> <li>▶ false: use 8 byte Timesync message formats.</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

### 5.2.1.3. CanTSynGlobalTimeFupDataIDList

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGlobalTimeFupDataIDListElement</a>	16..16	Element of the DataIDList for FUP messages ensures the identification of data elements due to CRC calculation process.

### 5.2.1.4. CanTSynGlobalTimeFupDataIDListElement

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeFupDataIDListIndex</a>	1..1
<a href="#">CanTSynGlobalTimeFupDataIDListValue</a>	1..1

<b>Parameter Name</b>	<b>CanTSynGlobalTimeFupDataIDListIndex</b>
-----------------------	--



<b>Description</b>	Index of the DataIDList for FUP messages ensures the identification of data elements due to CRC calculation process.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Default value</b>	0	
<b>Range</b>	<=15	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>CanTSynGlobalTimeFupDataIDListValue</b>	
<b>Description</b>	Value of the DataIDList for FUP messages ensures the identification of data elements due to CRC calculation process.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Default value</b>	0	
<b>Range</b>	<=255	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.2.1.5. CanTSynGlobalTimeOfnsDataIDList

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGlobalTimeOfns-DataIDListElement</a>	16..16	The DataIDList for OFNS messages ensures the identification of data elements due to CRC calculation process.

#### 5.2.1.6. CanTSynGlobalTimeOfnsDataIDListElement

Parameters included	
Parameter name	Multiplicity

Parameters included	
<a href="#">CanTSynGlobalTimeOfnsDataIDListIndex</a>	1..1
<a href="#">CanTSynGlobalTimeOfnsDataIDListValue</a>	1..1

Parameter Name	CanTSynGlobalTimeOfnsDataIDListIndex	
Description	The DataIDList for OFNS messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<div>&lt;=15</div> <div>&gt;=0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeOfnsDataIDListValue	
Description	The DataIDList for OFNS messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<div>&lt;=255</div> <div>&gt;=0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.2.1.7. CanTSynGlobalTimeOfnsDataIDList

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGlobalTimeOfnsDataIDListElement</a>	16..16	Element of the DataIDList for FUP messages ensures the identification of data elements due to CRC calculation process.

### 5.2.1.8. CanTSynGlobalTimeOfsDataIDListElement

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeOfsDataIDListIndex</a>	1..1
<a href="#">CanTSynGlobalTimeOfsDataIDListValue</a>	1..1

Parameter Name	CanTSynGlobalTimeOfsDataIDListIndex	
Description	Index of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<div>&lt;=15</div> <div>&gt;=0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeOfsDataIDListValue	
Description	Value of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<div>&lt;=255</div> <div>&gt;=0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.2.1.9. CanTSynGlobalTimeSyncDataIDList

Containers included		
Container name	Multiplicity	Description

Containers included		
<a href="#">CanTSynGlobalTimeSyncDataIDListElement</a>	16..16	Element of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.

#### 5.2.1.10. CanTSynGlobalTimeSyncDataIDListElement

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeSyncDataIDListIndex</a>	1..1
<a href="#">CanTSynGlobalTimeSyncDataIDListValue</a>	1..1

Parameter Name	CanTSynGlobalTimeSyncDataIDListIndex	
Description	Index for the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<div>&lt;=15</div> <div>&gt;=0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeSyncDataIDListValue	
Description	Value of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Range	<div>&lt;=255</div> <div>&gt;=0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.2.1.11. CanTSynGlobalTimeMaster

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGlobalTimeMasterPdu</a>	1..1	This container encloses the configuration of the PDU that is supposed to contain the global time information.

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynCyclicMsgResumeTime</a>	1..1
<a href="#">CanTSynGlobalTimeDebounceTime</a>	1..1
<a href="#">CanTSynGlobalTimeTxCrcSecured</a>	1..1
<a href="#">CanTSynGlobalTimeTxPeriod</a>	1..1
<a href="#">CanTSynImmediateTimeSync</a>	1..1
<a href="#">CanTSynMasterConfirmationTimeout</a>	1..1
<a href="#">CanTSynTxTmacCalculated</a>	1..1

Parameter Name	CanTSynCyclicMsgResumeTime	
Description	Defines the time where the 1st regular cycle time based message transmission takes place, after an immediate transmission before. Unit: seconds	
Multiplicity	1..1	
Type	FLOAT	
Range	<=65535	
	>=0.0	
Configuration class	PreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeDebounceTime	
Description	This represents the configuration of a TX debounce time for SYNC, FUP, OFS and OFNS messages compared to a message before with the same PDU. Unit: seconds	
Multiplicity	1..1	
Type	FLOAT	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeTxCrcSecured	
Description	This represents the configuration of whether or not CRC is supported.	
Multiplicity	1..1	
Type	ENUMERATION	
Range	CRC_NOT_SUPPORTED	
	CRC_SUPPORTED	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynGlobalTimeTxPeriod	
Description	<p>This represents configuration of the TX period. Unit: seconds</p> <p><b>Note:</b> If the value of this configuration parameter is 0 the cyclic transmission of SYNC and OFS messages is disabled.</p> <p>The immediate transmission if it is enabled with CanTSynImmediateTimeSync is not affected by the value of this parameter.</p>	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynImmediateTimeSync	
Description	Enables/Disables the cyclic polling of StbM_GetTimeBaseUpdateCounter() within CanTSyn_MainFunction().	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynMasterConfirmationTimeout	
Description	This represents the confirmation timeout after transmission of a SYNC message resp. OFS message. Unit: seconds.	

<b>Multiplicity</b>	1..1
<b>Type</b>	FLOAT
<b>Default value</b>	0.0
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>CanTSynTxTmacCalculated</b>
<b>Description</b>	This parameter controls whether or not TMAC calculation shall be supported.  TMAC is not supported.
<b>Multiplicity</b>	1..1
<b>Type</b>	ENUMERATION
<b>Default value</b>	TMAC_NOT_CALCULATED
<b>Range</b>	TMAC_CALCULATED TMAC_NOT_CALCULATED
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

#### 5.2.1.12. CanTSynGlobalTimeMasterPdu

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeMasterConfirmationHandleId</a>	1..1
<a href="#">CanTSynGlobalTimePduRef</a>	1..1

<b>Parameter Name</b>	<b>CanTSynGlobalTimeMasterConfirmationHandleId</b>
<b>Description</b>	This represents the handle ID of the PDU that contains the global time information.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Default value</b>	0
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

Parameter Name	CanTSynGlobalTimePduRef	
Description	This represents the reference to the Pdu taken to transmit the global time information. The global time master of a global time domain acts as the sender of the Pdu while all the time slaves are supposed to receive the Pdu.	
Multiplicity	1..1	
Type	REFERENCE	
Configuration class	<b>VariantPreCompile:</b>	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.2.1.13. CanTSynGlobalTimeSlave

Containers included		
Container name	Multiplicity	Description
<a href="#">CanTSynGlobalTimeSlavePdu</a>	1..1	This container encloses the configuration of the PDU that is supposed to contain the global time information.

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeFollowUpTimeout</a>	1..1
<a href="#">CanTSynGlobalTimeMinMsgGap</a>	1..1
<a href="#">CanTSynRxCrcValidated</a>	1..1
<a href="#">CanTSynRxTmacValidated</a>	1..1
<a href="#">CanTSynGlobalTimeSequenceCounterJumpWidth</a>	1..1

Parameter Name	CanTSynGlobalTimeFollowUpTimeout	
Description	Rx timeout for the follow-up message. This is only relevant for selected bus systems Unit:seconds Unit: [s]  <b>Note:</b> This parameter is only relevant for configured CanTSyn slaves of this time domain.	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Configuration class	<b>VariantPreCompile:</b>	VariantPreCompile
Origin	AUTOSAR_ECUC	



Parameter Name	CanTSynGlobalTimeMinMsgGap	
Description	<p>This parameter represents the configuration of a minimum message gap time for received Timesync messages compared to a message before with the same PDU . If PDUs are received more often in between than this parameter allows, they shall be ignored. Unit: seconds</p> <p>CanTSynGlobalTimeMinMsgGap is not supported.</p>	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Range	<div>&lt;=65535</div> <div>&gt;=0.0</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynRxCrcValidated	
Description	Definition of whether or not validation of the CRC is supported.	
Multiplicity	1..1	
Type	ENUMERATION	
Range	<div>CRC_IGNORED</div> <div>CRC_NOT_VALIDATED</div> <div>CRC_OPTIONAL</div> <div>CRC_VALIDATED</div>	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	CanTSynRxTmacValidated	
Description	<p>This parameter controls whether or not TMAC validation shall be supported.</p> <p>TMAC is not supported.</p>	
Multiplicity	1..1	
Type	ENUMERATION	
Default value	TMAC_NOT_VALIDATED	
Range	<div>TMAC_NOT_VALIDATED</div> <div>TMAC_VALIDATED</div>	

<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>CanTSynGlobalTimeSequenceCounterJumpWidth</b>	
<b>Description</b>	<p>The SequenceCounterJumpWidth specifies the maximum allowed gap of the Sequence Counter between two SYNC resp. two OFS messages. Unit: [s]</p> <p><b>Note:</b> This parameter is only relevant for configured CanTSyn slaves of this time domain.</p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Default value</b>	1	
<b>Range</b>	<=15	
	>=1	
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile	
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.2.1.14. CanTSynGlobalTimeSlavePdu

Parameters included	
Parameter name	Multiplicity
<a href="#">CanTSynGlobalTimeSlaveHandleId</a>	1..1
<a href="#">CanTSynGlobalTimePduRef</a>	1..1

<b>Parameter Name</b>	<b>CanTSynGlobalTimeSlaveHandleId</b>	
<b>Description</b>	This represents the handle ID of the PDU that contains the global time information.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile	
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>CanTSynGlobalTimePduRef</b>
-----------------------	--------------------------------

<b>Description</b>	This represents the reference to the Pdu taken to transmit the global time information. The global time master of a global time domain acts as the sender of the Pdu while all the time slaves are supposed to receive the Pdu.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	REFERENCE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

### 5.2.1.15. CommonPublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">ArMajorVersion</a>	1..1
<a href="#">ArMinorVersion</a>	1..1
<a href="#">ArPatchVersion</a>	1..1
<a href="#">SwMajorVersion</a>	1..1
<a href="#">SwMinorVersion</a>	1..1
<a href="#">SwPatchVersion</a>	1..1
<a href="#">ModuleId</a>	1..1
<a href="#">VendorId</a>	1..1
<a href="#">Release</a>	1..1

Parameter Name	ArMajorVersion
<b>Label</b>	AUTOSAR Major Version
<b>Description</b>	Major version number of AUTOSAR specification on which the appropriate implementation is based on.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	4
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

Parameter Name	ArMinorVersion
<b>Label</b>	AUTOSAR Minor Version

<b>Description</b>	Minor version number of AUTOSAR specification on which the appropriate implementation is based on.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	4	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>ArPatchVersion</b>	
<b>Label</b>	AUTOSAR Patch Version	
<b>Description</b>	Patch level version number of AUTOSAR specification on which the appropriate implementation is based on.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>SwMajorVersion</b>	
<b>Label</b>	Software Major Version	
<b>Description</b>	Major version number of the vendor specific implementation of the module.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	2	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>SwMinorVersion</b>	
<b>Label</b>	Software Minor Version	
<b>Description</b>	Minor version number of the vendor specific implementation of the module. The numbering is vendor specific.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	0	

<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>SwPatchVersion</b>	
<b>Label</b>	Software Patch Version	
<b>Description</b>	Patch level version number of the vendor specific implementation of the module. The numbering is vendor specific.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	1	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>ModuleId</b>	
<b>Label</b>	Numeric Module ID	
<b>Description</b>	Module ID of this module from Module List	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	161	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>VendorId</b>	
<b>Label</b>	Vendor ID	
<b>Description</b>	Vendor ID of the dedicated implementation of this module according to the AUTOSAR vendor list	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	1	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>Release</b>	
<b>Label</b>	Release Information	

<b>Multiplicity</b>	1..1
<b>Type</b>	STRING_LABEL
<b>Default value</b>	
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

### 5.2.1.16. PublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">PbcfgMSupport</a>	1..1

<b>Parameter Name</b>	<b>PbcfgMSupport</b>
<b>Label</b>	PbcfgM support
<b>Description</b>	Specifies whether or not the CanTSyn can use the PbcfgM module for post-build support.
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

## 5.2.2. Application programming interface (API)

### 5.2.2.1. Macro constants

#### 5.2.2.1.1. CANTSYN\_E\_INIT\_FAILED

<b>Purpose</b>	
<b>Value</b>	0x04U

<b>Description</b>	DET error code: CanTSyn initialization failed
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#### 5.2.2.1.2. CANTSYN\_E\_INVALID\_PDUID

<b>Purpose</b>	
<b>Value</b>	0x01U
<b>Description</b>	DET error code: Module called with wrong PDU or SDU ID

#### 5.2.2.1.3. CANTSYN\_E\_INV\_CTRL\_IDX

<b>Purpose</b>	
<b>Value</b>	0x06U
<b>Description</b>	DET error code: Invalid Controller index

#### 5.2.2.1.4. CANTSYN\_E\_NULL\_POINTER

<b>Purpose</b>	
<b>Value</b>	0x03U
<b>Description</b>	DET error code: Invalid pointer (NULL_PTR)

#### 5.2.2.1.5. CANTSYN\_E\_PARAM

<b>Purpose</b>	
<b>Value</b>	0x05U
<b>Description</b>	DET error code: API called with invalid parameter

#### 5.2.2.1.6. CANTSYN\_E\_UNINIT

<b>Purpose</b>	
<b>Value</b>	0x02U

<b>Description</b>	DET error code: Module not initialized
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#### 5.2.2.1.7. CANTSYN\_INSTANCE\_ID

<b>Purpose</b>	Module instance ID.
<b>Value</b>	0U
<b>Description</b>	Defines the instance number of this module. Since multiple instances are not supported this ID is always zero.

#### 5.2.2.1.8. CANTSYN\_SID\_GETVERSIONINFO

<b>Purpose</b>	Defines API id of function <a href="#">CanTSyn_GetVersionInfo()</a> .
<b>Value</b>	0x02U

#### 5.2.2.1.9. CANTSYN\_SID\_INIT

<b>Purpose</b>	Defines API id of function <a href="#">CanTSyn_Init()</a> .
<b>Value</b>	0x01U

#### 5.2.2.1.10. CANTSYN\_SID\_MAINFUNCTION

<b>Purpose</b>	Defines API id of function <a href="#">CanTSyn_MainFunction()</a> .
<b>Value</b>	0x06U

#### 5.2.2.1.11. CANTSYN\_SID\_RXINDICATION

<b>Purpose</b>	Defines API id of function <a href="#">CanTSyn_RxIndication()</a> .
<b>Value</b>	0x42U

#### 5.2.2.1.12. CANTSYN\_SID\_SETTRANSMISSIONMODE

<b>Purpose</b>	Defines API id of function <a href="#">CanTSyn_SetCurrentTime()</a> .
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<b>Value</b>	0x03U
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#### 5.2.2.1.13. CANTSYN\_SID\_TXCONFIRMATION

<b>Purpose</b>	Defines API id of function <a href="#">CanTSyn_TxConfirmation()</a> .
<b>Value</b>	0x40U

### 5.2.2.2. Functions

#### 5.2.2.2.1. CanTSyn\_GetVersionInfo

<b>Purpose</b>	API to get the module version information.	
<b>Synopsis</b>	<pre>void <b>CanTSyn_GetVersionInfo</b> ( Std_                                VersionInfoType * versioninfo );</pre>	
<b>Service ID</b>	0x02	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (out)</b>	versioninfo	- Pointer to return the module version information.
<b>Description</b>	This service returns the version information of this module.	

#### 5.2.2.2.2. CanTSyn\_Init

<b>Purpose</b>	Initializes the CanTSyn module.	
<b>Synopsis</b>	<pre>void <b>CanTSyn_Init</b> ( const CanTSyn_ConfigType * configPtr );</pre>	
<b>Service ID</b>	0x01	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	configPtr	- Address of the configuration data structure.

<b>Description</b>	This service initializes the CanTSyn module. It shall be the first function of the module to be called.
--------------------	---

#### 5.2.2.2.3. CanTSyn\_MainFunction

<b>Purpose</b>	CanTSyn module main function.
<b>Synopsis</b>	<pre>void CanTSyn_MainFunction ( void );</pre>
<b>Service ID</b>	0x06
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant

#### 5.2.2.2.4. CanTSyn\_RxIndication

<b>Purpose</b>	Rx-Indication function.	
<b>Synopsis</b>	<pre>void CanTSyn_RxIndication ( PduIdType Rx- PduId , PduInfoType * PduInfoPtr );</pre>	
<b>Service ID</b>	0x42	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	RxPduId	- ID of the received I-PDU.
	PduInfoPtr	- Pointer to a buffer containing the I-PDU.
<b>Description</b>	This service is called by CanIf in case a reception is indicated.	

#### 5.2.2.2.5. CanTSyn\_SetTransmissionMode

<b>Purpose</b>	This service is used to turn on or off the TX capabilities of CanTSyn.	
<b>Synopsis</b>	<pre>void CanTSyn_SetTransmissionMode ( uint8 Ctr- lIdx , CanTSyn_TransmissionModeType Mode );</pre>	
<b>Service ID</b>	0x03	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	

<b>Parameters (in)</b>	CtrlIdx	- Index of the CAN channel.
	Mode	- Mode to indicate if frame shall be transmitted.

#### 5.2.2.2.6. CanTSyn\_TxConfirmation

<b>Purpose</b>	Tx-Confirmation callback function.	
<b>Synopsis</b>	<pre>void CanTSyn_TxConfirmation ( PduIdType TxPduId );</pre>	
<b>Service ID</b>	0x07	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	TxPduId	- ID of the I-PDU that has been transmitted.
<b>Description</b>	This service is called by CanIf in case a transmission is confirmed.	

## 5.2.3. Integration notes

### 5.2.3.1. Exclusive areas

This section describes the exclusive areas used by the CanTSyn module.

#### 5.2.3.1.1. SCHM\_CANTSYN\_EXCLUSIVE\_AREA\_0

<b>Protected data structures</b>	The exclusive area protects the shared variable access of all global variables.
<b>Recommended locking mechanism</b>	<p>This exclusive area must always be protected by a locking mechanism. The options for locking are described in the EB tresos AutoCore Generic documentation. Refer to the section Mapping exclusive areas in the basic software modules in the Integration notes section for details.</p> <p>The locking mechanism can be disabled if it is ensured that:</p>



	<ul style="list-style-type: none"><li>▶ <code>CanTSyn_MainFunction()</code> does not preempt <code>CanTSyn_RxIndication()</code> and vice versa.</li><li>▶ No <code>CanTSyn</code> API function preempts <code>CanTSyn_Init()</code>.</li></ul>
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#### 5.2.3.1.2. SCHM\_CANTSYN\_EXCLUSIVE\_AREA\_1

<b>Protected data structures</b>	In order to provide enhanced precision of the Virtual Local Time the module <code>CanTSyn</code> requires this exclusive area to increase the precision of the Virtual Local Time.
<b>Recommended locking mechanism</b>	<p>This exclusive area must always be protected by a locking mechanism. The options for locking are described in the <code>EB tresos AutoCore Generic</code> documentation. Refer to the section <code>Mapping exclusive areas in the basic software modules</code> in the <code>Integration notes</code> section for details.</p> <p>The locking mechanism can be disabled if the Time Base that is referenced in <code>StbM</code> uses an <code>OsCounter</code> as Hardware reference.</p>

#### 5.2.3.2. Production errors

Production errors are not reported by the `CanTSyn` module.

#### 5.2.3.3. Memory mapping

General information about memory mapping is provided in the `EB tresos AutoCore Generic` documentation. Refer to the section `Memory mapping and compiler abstraction` in the `Integration notes` section for details.

The following table provides the list of sections that may be mapped for this module:

Memory section
<code>CONFIG_DATA_UNSPECIFIED</code>
<code>CONST_8</code>
<code>VAR_INIT_8</code>

VAR_CLEARED_UNSPECIFIED
VAR_CLEARED_8
CODE

#### 5.2.3.4. Integration requirements

##### WARNING



##### Integration requirements list is not exhaustive

The following list of integration requirements helps you to integrate your product. However, this list is not exhaustive. You also require information from the user guide, release notes, and EB tresos AutoCore known issues to successfully integrate your product.

Integration requirements are not listed for the CanTSyn module.

## 5.3. EthTSyn

### 5.3.1. Configuration parameters

Containers included		
Container name	Multiplicity	Description
<a href="#">CommonPublishedInformation</a>	1..1	<b>Label:</b> Common Published Information Common container, aggregated by all modules. It contains published information about vendor and versions.
<a href="#">EthTSynDefensiveProgramming</a>	1..1	<b>Label:</b> Defensive Programming Options Parameters for defensive programming
<a href="#">EthTSynGeneral</a>	1..1	This container contains the general configuration parameters of the EthTSyn module.
<a href="#">EthTSynGlobalTimeDomain</a>	1..n	This represents the existence of a global time domain on Ethernet. The EthTSyn module can administrate several global time domains at the same time that in itself form a hierarchy of domains and sub-domains.
<a href="#">ReportToDem</a>	1..1	<b>Label:</b> Production error handling

Containers included		
		Production error handling
<a href="#">PublishedInformation</a>	1..1	<b>Label:</b> EB Published Information Additional published parameters not covered by Common-PublishedInformation container.

Parameters included	
Parameter name	Multiplicity
<a href="#">IMPLEMENTATION_CONFIG_VARIANT</a>	1..1

Parameter Name	IMPLEMENTATION_CONFIG_VARIANT	
Label	Config Variant	
Multiplicity	1..1	
Type	ENUMERATION	
Default value	VariantPreCompile	
Range	VariantPreCompile	
Configuration class	VariantPreCompile:	VariantPreCompile

### 5.3.1.1. CommonPublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">ArMajorVersion</a>	1..1
<a href="#">ArMinorVersion</a>	1..1
<a href="#">ArPatchVersion</a>	1..1
<a href="#">SwMajorVersion</a>	1..1
<a href="#">SwMinorVersion</a>	1..1
<a href="#">SwPatchVersion</a>	1..1
<a href="#">ModuleId</a>	1..1
<a href="#">VendorId</a>	1..1
<a href="#">Release</a>	1..1

Parameter Name	ArMajorVersion
----------------	----------------

<b>Label</b>	AUTOSAR Major Version	
<b>Description</b>	Major version number of AUTOSAR specification on which the appropriate implementation is based on.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>ArMinorVersion</b>	
<b>Label</b>	AUTOSAR Minor Version	
<b>Description</b>	Minor version number of AUTOSAR specification on which the appropriate implementation is based on.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>ArPatchVersion</b>	
<b>Label</b>	AUTOSAR Patch Version	
<b>Description</b>	Patch level version number of AUTOSAR specification on which the appropriate implementation is based on.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>SwMajorVersion</b>	
<b>Label</b>	Software Major Version	
<b>Description</b>	Major version number of the vendor specific implementation of the module.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	

<b>Default value</b>	2
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwMinorVersion</b>
<b>Label</b>	Software Minor Version
<b>Description</b>	Minor version number of the vendor specific implementation of the module. The numbering is vendor specific.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwPatchVersion</b>
<b>Label</b>	Software Patch Version
<b>Description</b>	Patch level version number of the vendor specific implementation of the module. The numbering is vendor specific.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	1
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>ModuleId</b>
<b>Label</b>	Numeric Module ID
<b>Description</b>	Module ID of this module from Module List
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	164
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>VendorId</b>
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<b>Label</b>	Vendor ID
<b>Description</b>	Vendor ID of the dedicated implementation of this module according to the AUTOSAR vendor list
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	1
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>Release</b>
<b>Label</b>	Release Information
<b>Multiplicity</b>	1..1
<b>Type</b>	STRING_LABEL
<b>Default value</b>	
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

### 5.3.1.2. EthTSynDefensiveProgramming

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynDefProgEnabled</a>	1..1
<a href="#">EthTSynPrecondAssertEnabled</a>	1..1
<a href="#">EthTSynPostcondAssertEnabled</a>	1..1
<a href="#">EthTSynStaticAssertEnabled</a>	1..1
<a href="#">EthTSynUnreachAssertEnabled</a>	1..1
<a href="#">EthTSynInvariantAssertEnabled</a>	1..1

<b>Parameter Name</b>	<b>EthTSynDefProgEnabled</b>
<b>Label</b>	Enable Defensive Programming
<b>Description</b>	<p>Enables or disables the defensive programming feature for the module EthTSyn.</p> <p>Note: This feature is dependent on the use of the development error detection module. To use the defensive programming feature, proceed as follows:</p>

	<ol style="list-style-type: none"> <li>1. Enable development error detection</li> <li>2. Enable defensive programming</li> <li>3. Enable assertions as required</li> </ol>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynPrecondAssertEnabled</b>	
<b>Label</b>	Enable Precondition Assertions	
<b>Description</b>	<p>Enables handling of precondition assertion checks reported from the module EthTSyn.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (EthTSynDevErrorDetect): must be enabled</li> <li>▶ Enable Defensive Programming (EthTSynDefProgEnabled): must be enabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynPostcondAssertEnabled</b>	
<b>Label</b>	Enable Postcondition Assertions	
<b>Description</b>	<p>Enables handling of postcondition assertion checks reported from the module EthTSyn.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (EthTSynDevErrorDetect): must be enabled</li> <li>▶ Enable Defensive Programming (EthTSynDefProgEnabled): must be enabled</li> </ul>	

<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynStaticAssertEnabled</b>
<b>Label</b>	Enable Static Assertions
<b>Description</b>	<p>Enables handling of static assertion checks reported from the module EthTSyn.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (EthTSynDevErrorDetect): must be enabled</li> <li>▶ Enable Defensive Programming (EthTSynDefProgEnabled): must be enabled</li> </ul>
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynUnreachAssertEnabled</b>
<b>Label</b>	Enable Unreachable Code Assertions
<b>Description</b>	<p>Enables handling of unreachable code assertion checks reported from the module EthTSyn.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (EthTSynDevErrorDetect): must be enabled</li> <li>▶ Enable Defensive Programming (EthTSynDefProgEnabled): must be enabled</li> </ul>
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile

<b>Origin</b>	Elektrobit Automotive GmbH	
<b>Parameter Name</b>	<b>EthTSynInvariantAssertEnabled</b>	
<b>Label</b>	Enable Invariant Assertions	
<b>Description</b>	<p>Enables handling of invariant assertion checks reported from functions of the module EthTSyn.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (EthTSynDevErrorDetect): must be enabled</li> <li>▶ Enable Defensive Programming (EthTSynDefProgEnabled): must be enabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

### 5.3.1.3. EthTSynGeneral

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynDestPhyAddr</a>	1..1
<a href="#">EthTSynDevErrorDetect</a>	1..1
<a href="#">EthTSynGlobalTimeRxToUplinkSwitchResidenceTime</a>	0..1
<a href="#">EthTSynGlobalTimeUplinkToTxSwitchResidenceTime</a>	0..1
<a href="#">EthTSynHardwareTimestampSupport</a>	1..1
<a href="#">EthTSynMainFunctionPeriod</a>	1..1
<a href="#">EthTSynMasterSlaveConflictDetection</a>	1..1
<a href="#">EthTSynMessageCompliance</a>	1..1
<a href="#">EthTSynSwitchMgmtRxMessageBufferCount</a>	0..1
<a href="#">EthTSynVersionInfoApi</a>	1..1
<a href="#">EthTSynTimeValidationSupport</a>	1..1
<a href="#">EthTSynAnnounceFrameSupport</a>	1..1

Parameters included	
<a href="#">EthTSynSendSyncFrameOnlyOnHostPort</a>	1..1
<a href="#">EthTSynEnableDeviceAuthenticationSupport</a>	1..1
<a href="#">EthTSynEthIffFrameType</a>	1..1

Parameter Name	EthTSynDestPhyAddr	
Description	<p>Destination Physical Address (MAC-Address).</p> <p>With this parameter it is possible to overwrite the default IEEE 802.1AS MAC address 01:80:C2:00:00:0E by an individual address. Use the format FF:FF:FF:FF:FF:FF .</p> <p>Caution: By using another MAC address the IEEE 802.1AS is left which may cause a decrease of accuracy.</p>	
Multiplicity	1..1	
Type	STRING	
Default value	01:80:C2:00:00:0E	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynDevErrorDetect	
Description	Switches the development error detection and notification on or off.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	true	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimeRxToUplinkSwitchResidenceTime	
Description	<p>This parameter is specifying the default value used for the residence time of the Ethernet Switch [Ingress to Uplink].</p> <p><b>Note: This configuration parameter is not used.</b></p>	
Multiplicity	0..1	
Type	FLOAT	
Default value	0.0	
Configuration class	PreCompile:	VariantPreCompile

Origin	AUTOSAR_ECUC
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Parameter Name	<b>EthTSynGlobalTimeUplinkToTxSwitchResidenceTime</b>	
Description	This parameter is specifying the default value used for the residence time of the Ethernet Switch [Uplink to Egress].  <b>Note: This configuration parameter is not used.</b>	
Multiplicity	0..1	
Type	FLOAT	
Default value	0.0	
Configuration class	PreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynHardwareTimestampSupport</b>	
Description	Activate/Deactivate the hardware time stamping functionality of the Ethernet hardware.  <b>True:</b> Time stamp is retrieved from the Ethernet hardware.  <b>False:</b> Time stamp is retrieved from the StbM.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	true	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynMainFunctionPeriod</b>	
Description	Schedule period of the main function EthTSyn_MainFunction.	
Multiplicity	1..1	
Type	FLOAT	
Default value	1.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynMasterSlaveConflictDetection</b>	
Description	Enables master / slave conflict detection and notification.	
Multiplicity	1..1	

Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynMessageCompliance</b>	
Description	* true: IEEE 802.1AS compliant message format will be used.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	true	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynSwitchMgmtRxMessageBufferCount</b>	
Description	This parameter is used to determine the amount of Rx message buffers available in the EthTSyn when EthTSyn is used in a Bridge configuration.  <b>Note: This configuration parameter is not used.</b>	
Multiplicity	0..1	
Type	INTEGER	
Default value	10	
Configuration class	PreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynVersionInfoApi</b>	
Description	Activate/Deactivate the version information API (EthTSyn_GetVersionInfo). True: version information API activated False: version information API deactivated.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	TRUE	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynTimeValidationSupport</b>	
Description	Enables/Disables the usage of the recording functionality for Synchronized time-bases for Global Time precision measurement purpose.	

<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynAnnounceFrameSupport</b>
<b>Description</b>	Switch for enabling the transmission of IEEE 802.1AS-2011 announce frames. If enabled, a EthTSyn master periodically sends announce frames in the same interval as defined for sync frames.  <b>Note: This parameter has no effect for configured EthTSyn slaves.</b>
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynSendSyncFrameOnlyOnHostPort</b>
<b>Description</b>	If this parameter is set, EthTSyn will send only one sync frame on host port and EthSwt will handle the transmission on the other ports. This parameter makes sense only if Switch delay compensation feature is enabled.
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	true
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynEnableDeviceAuthenticationSupport</b>
<b>Description</b>	Enables support of Authentication Challenge TLV for Device Authentication.  DevAuth module supports only the supplicant side.  The supplicant must be an EthTSyn slave.
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false



<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynEthIfFrameType</b>	
<b>Description</b>	<p>The chosen frame owner determines which frames (in respect to ethertype) are received.</p> <p><b>Note: This configuration parameter is not used.</b></p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	REFERENCE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.3.1.4. EthTSynGlobalTimeDomain

Containers included		
Container name	Multiplicity	Description
<a href="#">EthTSynGlobalTimeFollowUpDataIDList</a>	0..1	The DataIDList for Follow_Up message ensures the identification of data elements due to CRC calculation process.
<a href="#">EthTSynPortConfig</a>	1..n	Configuration of the EthTSyn-Ports within the TimeDomain.

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynGlobalTimeDomainId</a>	1..1
<a href="#">EthTSynGlobalTimeSecureTmacLength</a>	1..1
<a href="#">EthTSynSynchronizedTimeBaseRef</a>	1..1
<a href="#">EthTSynEnableTimeValidation</a>	1..1
<a href="#">EthTSynSwitchManagementEthSwitchPortHostRef</a>	0..1
<a href="#">EthTSynSwitchPortHostGlobalTimeDebounceTime</a>	1..1

<b>Parameter Name</b>	<b>EthTSynGlobalTimeDomainId</b>
<b>Description</b>	<p>The global time domain ID.</p> <p>Synchronized time bases: 0 and 15 - EthTSynSynchronizedTimeBaseRef must refer a SyncTimeBase Offset time bases: 16 and 31 - EthTSynSynchronizedTimeBaseRef must refer an OffsetTimeBase</p>

<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Default value</b>	0
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynGlobalTimeSecureTmacLength</b>
<b>Description</b>	Represents the number of bytes for the used Truncated Message Authentication Code (TMAC). If 0, no message authentication will be used. Tags: atp.- Status=draft
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Default value</b>	0
<b>Range</b>	<=16 >=0
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynSynchronizedTimeBaseRef</b>
<b>Description</b>	Mandatory reference to the required synchronized time-base.
<b>Multiplicity</b>	1..1
<b>Type</b>	REFERENCE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynEnableTimeValidation</b>
<b>Description</b>	Enables/disables time recording for time validation for a specific Time Domain. To be able to use this feature EthTSynTimeValidationSupport must be enabled.  True: time validation is enabled.  False: time validation is disabled.
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false

<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynSwitchManagementEthSwitchPortHostRef</b>	
<b>Multiplicity</b>	0..1	
<b>Type</b>	SYMBOLIC-NAME-REFERENCE	
<b>Configuration class</b>	<b>PreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynSwitchPortHostGlobalTimeDebounceTime</b>	
<b>Description</b>	This represents the configuration of a TX debounce time for all Timesync PDUs over EthSwitchPortHost. If value of EthTSynSwitchPortHostGlobalTimeDebounceTime is 0 it will be sent immediately, else, if greater, EthTSynSwitchPortHostGlobalTimeDebounceTime will be round up to full main function periods.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	FLOAT	
<b>Default value</b>	0.0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

### 5.3.1.5. EthTSynGlobalTimeFollowUpDataIDList

Containers included		
Container name	Multiplicity	Description
<a href="#">EthTSynGlobalTimeFollowUpDataIDListElement</a>	16..16	Element of the DataIDList for Follow_Up message ensures the identification of data elements due to CRC calculation process.

### 5.3.1.6. EthTSynGlobalTimeFollowUpDataIDListElement

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynGlobalTimeFollowUpDataIDListIndex</a>	1..1

Parameters included	
<a href="#">EthTSynGlobalTimeFollowUpDataIDListValue</a>	1..1

Parameter Name	EthTSynGlobalTimeFollowUpDataIDListIndex	
Description	Index of the DataIDList for Follow_Up message ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Range	<=15	
	>=0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimeFollowUpDataIDListValue	
Description	Value of the DataIDList for Follow_Up message ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Range	<=255	
	>=0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.3.1.7. EthTSynPortConfig

Containers included		
Container name	Multiplicity	Description
<a href="#">EthTSynPdelayConfig</a>	1..1	Configuration of cyclic propagation delay measurement.
<a href="#">EthTSynPortRole</a>	1..1	Specifying the Role of the EthTSyn-Port (Master or Slave).

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynFramePrio</a>	0..1

Parameters included	
<a href="#">EthTSynGlobalTimeDebounceTime</a>	1..1
<a href="#">EthTSynGlobalTimeMinMsgGap</a>	1..1
<a href="#">EthTSynGlobalTimeEthIfRef</a>	1..1
<a href="#">EthTSynSwitchManagementEthSwitchPortRef</a>	0..1

Parameter Name	EthTSynFramePrio	
Description	<p>This optional parameter, if present, indicates the priority of outgoing EthTSyn messages, if sent via VLAN (used for the 3-bit PCP field of the VLAN tag). If this optional parameter is not present, frames are sent without a priority and VLAN field.</p> <p><b>Note: If this optional parameter is not present, frames are sent without a priority and VLAN field.</b></p>	
Multiplicity	0..1	
Type	INTEGER	
Default value	0	
Configuration class	PreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimeDebounceTime	
Description	<p>This represents the configuration of a TX debounce time for all Timesync PDUs of the same time domain and for the same port. Unit: seconds. If value of EthTSynGlobalTimeDebounceTime is 0 it will be sent immediately, else, if greater, EthTSynGlobalTimeDebounceTime will be round up to full main function periods.</p>	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimeMinMsgGap	
Description	<p>This parameter represents the configuration of a minimum message gap time for received Timesync messages compared to a message before with the same PDU. If PDUs are received more often in between than this parameter allows, they shall be ignored. Tags: atp.Status=draft</p>	

<b>Multiplicity</b>	1..1
<b>Type</b>	FLOAT
<b>Default value</b>	0.0
<b>Range</b>	<Infinity >=0.0
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynGlobalTimeEthIfRef</b>
<b>Description</b>	This represents the reference to the Ethernet interface taken to fetch the global time information.
<b>Multiplicity</b>	1..1
<b>Type</b>	REFERENCE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynSwitchManagementEthSwitchPortRef</b>
<b>Description</b>	In an AVB-Bridge config, this reference is used to assign the EthTSyn-Port to an Ethernet Switch-Port.
<b>Multiplicity</b>	0..1
<b>Type</b>	REFERENCE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

### 5.3.1.8. EthTSynPdelayConfig

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynGlobalTimePdelayRespEnable</a>	1..1
<a href="#">EthTSynGlobalTimePropagationDelay</a>	1..1
<a href="#">EthTSynGlobalTimeTxPdelayReqPeriod</a>	1..1
<a href="#">EthTSynPdelayLatencyThreshold</a>	0..1
<a href="#">EthTSynPdelayRespAndRespFollowUpTimeout</a>	1..1

Parameter Name	EthTSynGlobalTimePdelayRespEnable	
Description	This parameter allows disabling Pdelay_Resp / Pdelay_Resp_Follow_Up transmission, if no Pdelay_Req messages are expected.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	true	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimePropagationDelay	
Description	If cyclic propagation delay measurement is enabled, this parameter represents the default value of the propagation delay until the first actually measured propagation delay is available. If cyclic propagation delay measurement is disable, this parameter represents a static propagation delay.	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimeTxPdelayReqPeriod	
Description	This represents configuration of the TX period for Pdelay_Req messages. Unit: seconds.	
Multiplicity	1..1	
Type	FLOAT	
Default value	1.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynPdelayLatencyThreshold	
Description	Threshold for calculated Pdelay. If a measured Pdelay exceeds EthTSynPdelay-LatencyThreshold, this value is discarded.	
Multiplicity	0..1	
Type	FLOAT	
Default value	1.0E-5	

Range	<Infinity	
	>0.0	
Configuration class	PreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>EthTSynPdelayRespAndRespFollowUpTimeout</b>	
Description	Timeout value for Pdelay_Resp and Pdelay_Resp_Follow_Up after a Pdelay_Req has been transmitted resp. a Pdelay_Resp has been received.  <b>Note: This configuration parameter is not used.</b>	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.3.1.9. EthTSynPortRole

Containers included		
Container name	Multiplicity	Description
<a href="#">EthTSynGlobalTimeMaster</a>	1..1	Configuration of the global time master. Each global time domain is required to have exactly one global time master. This master may or may not exist on the configured ECU.
<a href="#">EthTSynGlobalTimeSlave</a>	1..1	Configuration of a time slave. Each global time domain is required to have at least one time slave. The configured ECU may or may not represent a time slave.

### 5.3.1.10. EthTSynGlobalTimeMaster

Containers included		
Container name	Multiplicity	Description
<a href="#">EthTSynCrcTimeFlagsTxSecured</a>	0..1	This container collects definitions which parts of the Follow_Up message elements shall be used for CRC calculation.



Containers included		
<a href="#">EthTSynDemEventParameterRefs</a>	0..1	<b>Label:</b> Dem Events Container for the references to DemEventParameter elements which shall be invoked using the API Dem_ReportErrorStatus API in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId value. The standardized errors are provided in the container and can be extended by vendor specific error references.

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynCyclicMsgResumeTime</a>	1..1
<a href="#">EthTSynGlobalTimeTxCrcSecured</a>	1..1
<a href="#">EthTSynGlobalTimeTxPeriod</a>	1..1
<a href="#">EthTSynImmediateTimeSync</a>	1..1
<a href="#">EthTSynTLVFollowUpOFSSubTLV</a>	1..1
<a href="#">EthTSynTLVFollowUpStatusSubTLV</a>	1..1
<a href="#">EthTSynTLVFollowUpTimeSubTLV</a>	1..1
<a href="#">EthTSynTLVFollowUpUserDataSubTLV</a>	1..1
<a href="#">EthTSynTxTmacCalculated</a>	1..1
<a href="#">EthTSynSwtPortIdxInCorrField</a>	1..1

Parameter Name	EthTSynCyclicMsgResumeTime	
Description	Defines the time where the 1st regular cycle time based message transmission takes place, after an immediate transmission before. EthTSynCyclicMsgResumeTime must be smaller than EthTSynGlobalTimeTxPeriod. EthTSynImmediateTimeSync must be set to true to get this parameter enabled. Unit: seconds.	
Multiplicity	1..1	
Type	FLOAT	
Default value	0.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynGlobalTimeTxCrcSecured
Description	This represents the configuration of whether or not CRC is supported.

<b>Multiplicity</b>	1..1
<b>Type</b>	ENUMERATION
<b>Default value</b>	CRC_NOT_SUPPORTED
<b>Range</b>	CRC_NOT_SUPPORTED
	CRC_SUPPORTED
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynGlobalTimeTxPeriod</b>
<b>Description</b>	This represents configuration of the TX period. Unit: seconds.
<b>Multiplicity</b>	1..1
<b>Type</b>	FLOAT
<b>Default value</b>	0.125
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynImmediateTimeSync</b>
<b>Description</b>	Enables/Disables the cyclic polling of StbM_GetTimeBaseUpdateCounter() within EthTSyn_MainFunction().
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>EthTSynTLVFollowUpOFSSubTLV</b>
<b>Description</b>	This represents the configuration of whether an AUTOSAR Follow_Up TLV OFS Sub-TLV is used or not.
<b>Multiplicity</b>	1..1
<b>Type</b>	BOOLEAN
<b>Default value</b>	false
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

Parameter Name	EthTSynTLVFollowUpStatusSubTLV	
Description	This represents the configuration of whether an AUTOSAR Follow_Up TLV Status Sub-TLV is used or not.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynTLVFollowUpTimeSubTLV	
Description	This represents the configuration of whether an AUTOSAR Follow_Up TLV Time Sub-TLV is used or not.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynTLVFollowUpUserDataSubTLV	
Description	This represents the configuration of whether an AUTOSAR Follow_Up TLV UserData Sub-TLV is used or not.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynTxTmacCalculated	
Description	This parameter controls whether or not TMAC calculation shall be supported. Tags: atp.Status=draft	
Multiplicity	1..1	
Type	ENUMERATION	
Range	TMAC_CALCULATED	
	TMAC_NOT_CALCULATED	

<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynSwtPortIdxInCorrField</b>	
<b>Description</b>	If this parameter is set, then the feature which allows to save in the fractional ns part of the correction field, the SwitchIdx (in most significant byte) and PortIdx (in least significant byte), is enabled.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

### 5.3.1.11. EthTSynCrcTimeFlagsTxSecured

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynCrcCorrectionField</a>	1..1
<a href="#">EthTSynCrcDomainNumber</a>	1..1
<a href="#">EthTSynCrcMessageLength</a>	1..1
<a href="#">EthTSynCrcPreciseOriginTimestamp</a>	1..1
<a href="#">EthTSynCrcSequenceld</a>	1..1
<a href="#">EthTSynCrcSourcePortIdentity</a>	1..1

<b>Parameter Name</b>	<b>EthTSynCrcCorrectionField</b>	
<b>Description</b>	The correctionField from the Follow_Up Message Header shall be included in CRC calculation.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynCrcDomainNumber</b>
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<b>Description</b>	The domainNumber from the Follow_Up Message Header shall be included in CRC calculation.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynCrcMessageLength</b>	
<b>Description</b>	The messageLength from the Follow_Up Message Header shall be included in CRC calculation.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynCrcPreciseOriginTimestamp</b>	
<b>Description</b>	The preciseOriginTimestamp from the Follow_Up Message Field shall be included in CRC calculation.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	true	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynCrcSequenceld</b>	
<b>Description</b>	The sequenceld from the Follow_Up Message Header shall be included in CRC calculation.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

Parameter Name	EthTSynCrcSourcePortIdentity	
Description	The sourcePortIdentity from the Follow_Up Message Header shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	<b>VariantPreCompile:</b>	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.3.1.12. EthTSynDemEventParameterRefs

Parameters included	
Parameter name	Multiplicity
<a href="#">ETHTSYN_E_UNEXPECTED_SYNC</a>	0..1

Parameter Name	ETHTSYN_E_UNEXPECTED_SYNC
Label	ETHTSYN_E_UNEXPECTED_SYNC
Description	<p>Reference to the configured DEM event to report the unexpected reception of SYNC frames.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ EthTSynUnexpectedSyncReportToDem: Select DEM to enable the reporting of ETHTSYN_E_UNEXPECTED_SYNC.</li> </ul> <p>Further notes:</p> <ul style="list-style-type: none"> <li>▶ Activation: Thrown, if a SYNC frame is received by a port configured as EthTSynPortRole to EthTSynGlobalTimeMaster.</li> <li>▶ Healing: Will not be healed.</li> <li>▶ Trigger debounce: None. The error is reported on first occurrence.</li> <li>▶ Rate of diagnostic checks: Checked everytime a SYNC frame is received.</li> </ul>
Multiplicity	0..1
Type	SYMBOLIC-NAME-REFERENCE
Configuration class	<b>PreCompile:</b> VariantPreCompile
Origin	Elektrobit Automotive GmbH

### 5.3.1.13. EthTSynGlobalTimeSlave

Containers included		
Container name	Multiplicity	Description
<a href="#">EthTSynCrcFlagsRxValidated</a>	0..1	This container collects definitions which parts of the Follow_Up message elements shall be included in CRC validation.
<a href="#">EthTSynDemEventParameterRefs</a>	0..1	<b>Label:</b> Dem Events Container for the references to DemEventParameter elements which shall be invoked using the API Dem_ReportErrorStatus API in case the corresponding error occurs. The EventId is taken from the referenced DemEventParameter's DemEventId value. The standardized errors are provided in the container and can be extended by vendor specific error references.

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynGlobalTimeFollowUpTimeout</a>	1..1
<a href="#">EthTSynRxCrcValidated</a>	1..1
<a href="#">EthTSynRxTmacValidated</a>	1..1
<a href="#">EthTSynPdelayFilter</a>	1..1
<a href="#">EthTSynReceiveSyncFupPairsPeriod</a>	1..1
<a href="#">EthTSynReceivePdelayRespFupPairsPeriod</a>	1..1

Parameter Name	EthTSynGlobalTimeFollowUpTimeout	
Description	Timeout value of the Follow_Up message (of the subsequent Sync message). Unit: seconds.  <b>Note: This parameter is only relevant for configured EthTSyn slaves of this time domain.</b>	
Multiplicity	1..1	
Type	FLOAT	
Default value	0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynRxCrcValidated
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<b>Description</b>	Definition of whether or not validation of the CRC is supported.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	ENUMERATION	
<b>Default value</b>	CRC_IGNORED	
<b>Range</b>	CRC_IGNORED	
	CRC_NOT_VALIDATED	
	CRC_OPTIONAL	
	CRC_VALIDATED	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynRxTmacValidated</b>	
<b>Description</b>	This parameter controls whether or not TMAC validation shall be supported. Tags: atp.Status=draft	
<b>Multiplicity</b>	1..1	
<b>Type</b>	ENUMERATION	
<b>Range</b>	TMAC_NOT_VALIDATED	
	TMAC_VALIDATED	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>EthTSynPdelayFilter</b>	
<b>Description</b>	<p>This parameter allows to filter the measured peer delays. Filtering measured values will reduce big impacts of wrong values and makes the peer delay steady.</p> <p>The filtered peer delay is calculated based on the formular below. The filter performs shift operations to reduce the impact of the peer delay delta between old and new value.</p> $Pdelay = PdelayOld + [(PdelayOld - PdelayNew) / 2^{EthTSynPdelayFilter}]$ <p><b>Note: Setting this parameter to zero will disable any filtering. Setting the filter too high will filter away all deltas causing peer delay to be zero.</b></p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Default value</b>	0	



<b>Configuration class</b>	<b>PreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynReceiveSyncFupPairsPeriod</b>	
<b>Description</b>	<p>This parameter contains the timeout of an unrecieved Sync/Fup pair.</p> <p>Note: This parameter is closely related to the Sync period of the master (EthTSynGlobalTimeTxPeriod) and the propagation delay of the frames, must be bigger then EthTSynGlobalTimeTxPeriod + Pdelay. <b>Note: This parameter is only relevant if EthTSynSyncFailedReportToDem is not equal with DISABLE.</b></p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	FLOAT	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>EthTSynReceivePdelayRespFupPairsPeriod</b>	
<b>Description</b>	<p>This parameter contains the timeout of an unrecieved PdelayResp/Fup frame/pair.</p> <p>Note: This parameter is closely related to the Sync period of the master (EthTSynGlobalTimeTxPeriod) and the propagation delay of the frames, must be bigger then EthTSynGlobalTimeTxPeriod + Pdelay. <b>Note: This parameter is only relevant if EthTSynPdelayFailedReportToDem is not equal with DISABLE.</b></p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	FLOAT	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

#### 5.3.1.14. EthTSynCrcFlagsRxValidated

<b>Parameters included</b>	
<b>Parameter name</b>	<b>Multiplicity</b>

Parameters included	
<a href="#">EthTSynCrcCorrectionField</a>	1..1
<a href="#">EthTSynCrcDomainNumber</a>	1..1
<a href="#">EthTSynCrcMessageLength</a>	1..1
<a href="#">EthTSynCrcPreciseOriginTimestamp</a>	1..1
<a href="#">EthTSynCrcSequenceld</a>	1..1
<a href="#">EthTSynCrcSourcePortIdentity</a>	1..1

Parameter Name	EthTSynCrcCorrectionField	
Description	The correctionField from the Follow_Up Message Header shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynCrcDomainNumber	
Description	The domainNumber from the Follow_Up Message Header shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynCrcMessageLength	
Description	The messageLength from the Follow_Up Message Header shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynCrcPreciseOriginTimestamp	
Description	The preciseOriginTimestamp from the Follow_Up Message Field shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	true	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynCrcSequenceld	
Description	The sequenceld from the Follow_Up Message Header shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	EthTSynCrcSourcePortIdentity	
Description	The sourcePortIdentity from the Follow_Up Message Header shall be included in CRC calculation.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

### 5.3.1.15. EthTSynDemEventParameterRefs

Parameters included		
Parameter name	Multiplicity	
<a href="#">ETHTSYN_E_PDELAY_FAILED</a>	0..1	
<a href="#">ETHTSYN_E_SYNC_FAILED</a>	0..1	

<b>Parameter Name</b>	<b>ETHTSYN_E_PDELAY_FAILED</b>
<b>Label</b>	ETHTSYN_E_PDELAY_FAILED
<b>Description</b>	<p>Reference to the configured DEM event to report a time-out supervision error for Pdelay_Resp-/Pdelay_Resp_Follow_Up frames for this port.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ <code>EthTSynPdelayFailedReportToDem</code>: Select DEM to enable the reporting of ETHTSYN_E_PDELAY_FAILED.</li> </ul> <p>Further notes:</p> <ul style="list-style-type: none"> <li>▶ Activation: Thrown, if more than 6 responses of a Pdelay_Req to a Pdelay_Resp-/Pdelay_Resp_Follow_Up are missing on a port.</li> <li>▶ Healing: Will be healed, if a correct Pdelay_Resp-/Pdelay_Resp_Follow_Up pair is received.</li> <li>▶ Trigger debounce: 6 subsequent failures of Pdelay_Resp-/Pdelay_Resp_Follow_Up message pairs.</li> <li>▶ Rate of diagnostic checks: Checked everytime a Pdelay_Resp-/Pdelay_Resp_Follow_Up pair is received.</li> </ul>
<b>Multiplicity</b>	0..1
<b>Type</b>	SYMBOLIC-NAME-REFERENCE
<b>Configuration class</b>	<b>PreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>ETHTSYN_E_SYNC_FAILED</b>
<b>Label</b>	ETHTSYN_E_SYNC_FAILED
<b>Description</b>	<p>Reference to the configured DEM event to report a time-out supervision error for SYNC/FUP frames for this port.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ <code>EthTSynSyncFailedReportToDem</code>: Select DEM to enable the reporting of ETHTSYN_E_SYNC_FAILED.</li> </ul> <p>Further notes:</p> <ul style="list-style-type: none"> <li>▶ Activation: Thrown, if more than 12 Sync-/Follow_Up messages in a row are dropped on a port configured as EthTSynGlobalTimeSlave.</li> <li>▶ Healing: Will be healed, if a correct SYNC/FUP pair is received.</li> <li>▶ Trigger debounce: 12 subsequent failures of SYNC/FUP message pairs.</li> </ul>

	► Rate of diagnostic checks: Checked everytime a SYNC/FUP pair is received.	
<b>Multiplicity</b>	0..1	
<b>Type</b>	SYMBOLIC-NAME-REFERENCE	
<b>Configuration class</b>	<b>PreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

### 5.3.1.16. ReportToDem

Parameters included	
Parameter name	Multiplicity
<a href="#">EthTSynSyncFailedReportToDem</a>	1..1
<a href="#">EthTSynSyncFailedReportToDemDetErrorId</a>	1..1
<a href="#">EthTSynPdelayFailedReportToDem</a>	1..1
<a href="#">EthTSynPdelayFailedReportToDemDetErrorId</a>	1..1
<a href="#">EthTSynUnexpectedSyncReportToDem</a>	1..1
<a href="#">EthTSynUnexpectedSyncReportToDemDetErrorId</a>	1..1

Parameter Name	EthTSynSyncFailedReportToDem
<b>Label</b>	Timeout supervision for SYNC/FUP Frames error
<b>Description</b>	<p>Selects the handling of the production error: <i>Timeout supervision for SYNC/FUP Frames error</i></p> <ul style="list-style-type: none"> <li>► <b>DEM:</b> All errors are reported to the Diagnostics Event Manager (Dem).</li> <li>► <b>DET:</b> All errors are reported to the Development Error Tracer (Det) if enabled.</li> <li>► <b>DISABLE:</b> Production errors are not reported at all.</li> </ul> <p><b>Optimization Effect:</b></p> <ul style="list-style-type: none"> <li>► <b>ROM reduction (code):</b> Setting this parameter to a value of DISABLE reduces the ROM consumption of the module code.</li> <li>► <b>Execution time reduction (code):</b> Setting this parameter to a value of DISABLE reduces the execution time of the module code.</li> </ul>
<b>Multiplicity</b>	1..1
<b>Type</b>	ENUMERATION

<b>Default value</b>	DISABLE
<b>Range</b>	DEM
	DET
	DISABLE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynSyncFailedReportToDemDetErrorId</b>
<b>Label</b>	Timeout supervision for SYNC/FUP Frames error Det error ID
<b>Description</b>	<p>If a production error is reported towards the Det, this parameter defines the error id of the production errors ETHTSYN_E_SYNC_FAILED for all controllers.</p> <p>The Det instance id is the EthIf controller ID (parameter EthIfCtrlIdx of the EthIf controller referenced by parameter EthTSynGlobalTimeEthIfRef).</p>
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Default value</b>	255
<b>Configuration class</b>	<b>PreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynPdelayFailedReportToDem</b>
<b>Label</b>	Timeout supervision for Pdelay_Resp-/Pdelay_Resp_Follow_Up Frames error
<b>Description</b>	<p>Selects the handling of the production error: <i>Timeout supervision for Pdelay_Resp-/Pdelay_Resp_Follow_Up error</i></p> <ul style="list-style-type: none"> <li>▶ <b>DEM:</b> All errors are reported to the Diagnostics Event Manager (Dem).</li> <li>▶ <b>DET:</b> All errors are reported to the Development Error Tracer (Det) if enabled.</li> <li>▶ <b>DISABLE:</b> Production errors are not reported at all.</li> </ul> <p><b>Optimization Effect:</b></p> <ul style="list-style-type: none"> <li>▶ <b>ROM reduction (code):</b> Setting this parameter to a value of DISABLE reduces the ROM consumption of the module code.</li> <li>▶ <b>Execution time reduction (code):</b> Setting this parameter to a value of DISABLE reduces the execution time of the module code.</li> </ul>
<b>Multiplicity</b>	1..1

Type	ENUMERATION	
Default value	DISABLE	
Range	DEM	
	DET	
	DISABLE	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	Elektrobit Automotive GmbH	

Parameter Name	<b>EthTSynPdelayFailedReportToDemDetErrorId</b>	
Label	Timeout supervision for Pdelay_Resp-/Pdelay_Resp_Follow_Up Frame error Det error ID	
Description	<p>If a production error is reported towards the Det, this parameter defines the error id of the production errors ETHTSYN_E_PDELAY_FAILED for all controllers.</p> <p>The Det instance id is the EthIf controller ID (parameter EthIfCtrlIdx of the EthIf controller referenced by parameter EthTSynGlobalTimeEthIfRef).</p>	
Multiplicity	1..1	
Type	INTEGER	
Default value	255	
Configuration class	PreCompile:	VariantPreCompile
Origin	Elektrobit Automotive GmbH	

Parameter Name	<b>EthTSynUnexpectedSyncReportToDem</b>	
Label	Unexpected reception of SYNC frames error	
Description	<p>Selects the handling of the production error: <i>Unexpected reception of SYNC frames error</i></p> <ul style="list-style-type: none"> <li>▶ DEM: All errors are reported to the Diagnostics Event Manager (Dem).</li> <li>▶ DET: All errors are reported to the Development Error Tracer (Det) if enabled.</li> <li>▶ DISABLE: Production errors are not reported at all.</li> </ul> <p><b>Optimization Effect:</b></p> <ul style="list-style-type: none"> <li>▶ <b>ROM reduction (code):</b> Setting this parameter to a value of DISABLE reduces the ROM consumption of the module code.</li> <li>▶ <b>Execution time reduction (code):</b> Setting this parameter to a value of DISABLE reduces the execution time of the module code.</li> </ul>	

<b>Multiplicity</b>	1..1
<b>Type</b>	ENUMERATION
<b>Default value</b>	DISABLE
<b>Range</b>	DEM DET DISABLE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>EthTSynUnexpectedSyncReportToDemDetErrorId</b>
<b>Label</b>	Unexpected reception of SYNC frames error Det error ID
<b>Description</b>	<p>If a production error is reported towards the Det, this parameter defines the error id of the production errors ETHTSYN_E_UNEXPECTED_SYNC for all controllers.</p> <p>The Det instance id is the EthIf controller ID (parameter EthIfCtrlIdx of the EthIf controller referenced by parameter EthTSynGlobalTimeEthIfRef).</p> <p>If EthTSynMasterSlaveConflictDetection is enabled, in case an EthTSyn master receives a sync frame, two DETs shall be reported. One having the static ErrorId specified in AUTOSAR, one the configured EthTSynUnexpectedSyncReportToDemDetErrorId.</p>
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Default value</b>	255
<b>Configuration class</b>	<b>PreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

### 5.3.1.17. PublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">PbcfgMSupport</a>	1..1

<b>Parameter Name</b>	<b>PbcfgMSupport</b>
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<b>Label</b>	PbcfgM support	
<b>Description</b>	Specifies whether or not the EthTSyn can use the PbcfgM module for post-build support.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

## 5.3.2. Application programming interface (API)

### 5.3.2.1. Type definitions

#### 5.3.2.1.1. EthTSyn\_PtrUInt8

<b>Purpose</b>	The data pointer used to get rid of MISRA violation.
<b>Type</b>	uint8 *

### 5.3.2.2. Macro constants

#### 5.3.2.2.1. ETHTSYN\_CFGPTR

<b>Purpose</b>	Define macro for the configuration pointer according to SWS_BSW_00215.
<b>Value</b>	&EthTSyn_Config

#### 5.3.2.2.2. ETHTSYN\_E\_CTRL\_IDX

<b>Purpose</b>	
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<b>Value</b>	0x22U
<b>Description</b>	DET error code: Invalid controller index

#### 5.3.2.2.3. ETHTSYN\_E\_PARAM

<b>Purpose</b>	
<b>Value</b>	0x24U
<b>Description</b>	DET error code: Invalid parameter

#### 5.3.2.2.4. ETHTSYN\_E\_PARAM\_POINTER

<b>Purpose</b>	
<b>Value</b>	0x23U
<b>Description</b>	DET error code: Invalid pointer (NULL_PTR)

#### 5.3.2.2.5. ETHTSYN\_E\_UNINIT

<b>Purpose</b>	
<b>Value</b>	0x20U
<b>Description</b>	DET error code: Module not initialized

#### 5.3.2.2.6. ETHTSYN\_INSTANCE\_ID

<b>Purpose</b>	Module instance ID.
<b>Value</b>	0U
<b>Description</b>	Defines the instance number of this module. Since multiple instances are not supported this ID is always zero.

#### 5.3.2.2.7. ETHTSYN\_INTERNAL\_SVCID

<b>Purpose</b>	Defines API id of internal functions.
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<b>Value</b>	0xFFU
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#### 5.3.2.2.8. ETHTSYN\_SID\_ETHSWTPTPRXINDICATION

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_EthSwtPtpRxIndication()</a> .
<b>Value</b>	0xE1U

#### 5.3.2.2.9. ETHTSYN\_SID\_ETHSWTPPTPTIMESTAMPINDICATION

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_EthSwtPtpTimeStampIndication()</a> .
<b>Value</b>	0xE0U

#### 5.3.2.2.10. ETHTSYN\_SID\_GETVERSIONINFO

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_GetVersionInfo()</a> .
<b>Value</b>	0x02U

#### 5.3.2.2.11. ETHTSYN\_SID\_INIT

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_Init()</a> .
<b>Value</b>	0x01U

#### 5.3.2.2.12. ETHTSYN\_SID\_MAINFUNCTION

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_MainFunction()</a> .
<b>Value</b>	0x09U

#### 5.3.2.2.13. ETHTSYN\_SID\_RXINDICATION

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_RxIndication()</a> .
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<b>Value</b>	0x06U
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#### 5.3.2.2.14. ETHTSYN\_SID\_SETTRANSMISSIONMODE

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_SetTransmissionMode()</a> .
<b>Value</b>	0x05U

#### 5.3.2.2.15. ETHTSYN\_SID\_TRCVLINKSTATECHG

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_TrcvLinkStateChg()</a> .
<b>Value</b>	0x08U

#### 5.3.2.2.16. ETHTSYN\_SID\_TXCONFIRMATION

<b>Purpose</b>	Defines API id of function <a href="#">EthTSyn_TxConfirmation()</a> .
<b>Value</b>	0x07U

### 5.3.2.3. Functions

#### 5.3.2.3.1. EthTSyn\_EthSwtPtpRxIndication

<b>Purpose</b>	EthTSyn SwtRxIndication function.	
<b>Synopsis</b>	<pre>boolean <b>EthTSyn_EthSwtPtpRxIndication</b> ( uint8 EthIfC- trlIdx , const EthSwt_MgmtInfoType * MgmtInfoPtr , uint32 UniqueId , Eth_DataType * DataPtr , uint16 Len );</pre>	
<b>Return Value</b>		

#### 5.3.2.3.2. EthTSyn\_EthSwtPtpTimeStampIndication

<b>Purpose</b>	EthTSyn TimeStampIndication function.	
<b>Synopsis</b>	<pre>void <b>EthTSyn_EthSwtPtpTimeStampIndication</b> ( uint8 EthIfCtrlIdx , EthSwt_MgmtInfoType MgmtInfo , uint32 UniqueId , Eth_TimeStampType * PortTimeStampPtr );</pre>	

#### 5.3.2.3.3. EthTSyn\_GetVersionInfo

<b>Purpose</b>	API to get the module version information.	
<b>Synopsis</b>	<pre>void EthTSyn_GetVersionInfo ( Std_                              VersionInfoType * VersionInfo );</pre>	
<b>Service ID</b>	0x02	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (out)</b>	VersionInfo	- Pointer to return the module version information.
<b>Description</b>	This service returns the version information of this module.	

#### 5.3.2.3.4. EthTSyn\_Init

<b>Purpose</b>	Initializes the EthTSyn module.	
<b>Synopsis</b>	<pre>void EthTSyn_Init ( const EthTSyn_ConfigType * CfgPtr );</pre>	
<b>Service ID</b>	0x01	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	CfgPtr	- Address of the configuration data structure.
<b>Description</b>	This service initializes the EthTSyn module. It shall be the first function of the module to be called.	

#### 5.3.2.3.5. EthTSyn\_MainFunction

<b>Purpose</b>	EthTSyn module main function.	
<b>Synopsis</b>	<pre>void EthTSyn_MainFunction ( void );</pre>	
<b>Service ID</b>	0x09	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Production Errors</b>	► <a href="#">ETHTSYN_E_SYNC_FAILED</a> : thrown, if more than 12 pairs of Sync-/Follow_Up messages in a row are dropped.	

	► <a href="#">ETHTSYN_E_PDELAY_FAILED</a> : thrown, if more than 6 pairs of Pdelay_Resp/Pdelay_Resp_Follow_Up messages in a row are dropped.
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#### 5.3.2.3.6. EthTSyn\_RxIndication

<b>Purpose</b>	Rx-Indication function.	
<b>Synopsis</b>	<pre>void <b>EthTSyn_RxIndication</b> ( uint8 CtrlIdx , Eth_     FrameType FrameType , boolean IsBroadcast , uint8     * PhysAddrPtr , uint8 * DataPtr , uint16 LenByte );</pre>	
<b>Service ID</b>	0x06	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Production Errors</b>	<ul style="list-style-type: none"> <li>► <a href="#">ETHTSYN_E_SYNC_FAILED</a>: thrown, if more than 12 pairs of Sync-/Follow_Up messages in a row are dropped.</li> <li>► <a href="#">ETHTSYN_E_PDELAY_FAILED</a>: thrown, if more than 6 pairs of Pdelay_Resp/Pdelay_Resp_Follow_Up messages in a row are dropped.</li> <li>► <a href="#">ETHTSYN_E_UNEXPECTED_SYNC</a>: thrown, if a SYNC frame is received on an Ethernet port configured as master.</li> </ul>	
<b>Parameters (in)</b>	CtrlIdx	- Index of the controller within the context of the EthIf.
	FrameType	- Ethernet Frame type.
	IsBroadcast	- Indicates whether Ethernet destination address is a broadcast address or not.
	PhysAddrPtr	- Pointer to Physical source address (MAC address in network byte order) of received Ethernet frame.
	DataPtr	- Address of the received payload.
	LenByte	- Length of the payload contained in the received Rx buffer.
<b>Description</b>	This service is called by EthIf in case a reception is indicated.	

#### 5.3.2.3.7. EthTSyn\_SetTransmissionMode

<b>Purpose</b>	This service enables/disables the transmission of frames for the whole module.
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<b>Synopsis</b>	<pre>void <b>EthTSyn_SetTransmissionMode</b> ( uint8 CtrlIdx , EthTSyn_TransmissionModeType Mode );</pre>	
<b>Service ID</b>	0x05	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	CtrlIdx	- Index of the EthTSyn controller.
	Mode	- Mode to indicate if frame shall be transmitted.

#### 5.3.2.3.8. EthTSyn\_TrcvLinkStateChg

<b>Purpose</b>	Transceiver link state change indication.	
<b>Synopsis</b>	<pre>void <b>EthTSyn_TrcvLinkStateChg</b> ( uint8 CtrlIdx , EthTrcv_LinkStateType LinkState );</pre>	
<b>Service ID</b>	0x08	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	CtrlIdx	- Index of the Ethlf controller associated with the EthTrcv.
	LinkState	- New state the transceiver link has changed to.
<b>Description</b>	This service indicates a change of the transceiver link change.	

#### 5.3.2.3.9. EthTSyn\_TxConfirmation

<b>Purpose</b>	Tx-Confirmation callback function.	
<b>Synopsis</b>	<pre>void <b>EthTSyn_TxConfirmation</b> ( uint8 CtrlIdx , Eth_BufIdxType BufIdx );</pre>	
<b>Service ID</b>	0x07	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	CtrlIdx	- Index of the controller within the context of the Ethlf.
	BufIdx	- Index of the transmitted buffer.

<b>Description</b>	This service is called by Ethlf in case a transmission is confirmed.
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## 5.3.3. Integration notes

### 5.3.3.1. Exclusive areas

This section describes the exclusive areas used by the `EthTSyn` module.

#### 5.3.3.1.1. SCHM\_ETHTSYN\_EXCLUSIVE\_AREA\_0

<b>Protected data structures</b>	<p>The exclusive area protects the shared variable access off the <code>sourcePortIdentity</code> (see IEEE 802.1AS-2011, chapter 10.-2.2.1.3). This identity is used as unique identifier to find the corresponding response and response follow up frame of a peer delay request.</p> <p>Furthermore the initialization of all global variables is protected with this exclusive area.</p>
<b>Recommended locking mechanism</b>	<p>This exclusive area must always be protected by a locking mechanism. The options for locking are described in the <code>EB tresos AutoCore Generic</code> documentation. Refer to the section <code>Mapping exclusive areas in the basic software modules</code> in the <code>Integration notes</code> section for details.</p> <p>The locking mechanism can be disabled if it is ensured that:</p> <ul style="list-style-type: none"><li>▶ <code>EthTSyn_MainFunction()</code> does not preempt <code>EthTSyn_RxIndication()</code> and vice versa.</li><li>▶ No <code>EthTSyn</code> API function preempts <code>EthTSyn_Init()</code>.</li></ul>

#### 5.3.3.1.2. SCHM\_ETHTSYN\_EXCLUSIVE\_AREA\_1

<b>Protect precision of Virtual Local Time</b>	In order to provide enhanced precision of the Virtual Local Time the module <code>EthTSyn</code> requires this exclusive area to increase the precision of the Virtual Local Time.
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<b>Recommended locking mechanism</b>	<p>This exclusive area must always be protected by a locking mechanism. The options for locking are described in the <a href="#">EB tresos AutoCore Generic documentation</a>. Refer to the section <a href="#">Mapping exclusive areas in the basic software modules</a> in the <a href="#">Integration notes</a> section for details.</p> <p>The locking mechanism can be disabled if the Time Base that is referenced in <code>StbM</code> uses an <code>OsCounter</code> as Hardware reference.</p>
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### 5.3.3.2. Production errors

<a href="#">ETHTSYN_E_PDELAY_FAILED</a>	<ul style="list-style-type: none"> <li>▶ <a href="#">EthTSyn_MainFunction</a></li> <li>▶ <a href="#">EthTSyn_RxIndication</a></li> </ul>
<a href="#">ETHTSYN_E_SYNC_FAILED</a>	<ul style="list-style-type: none"> <li>▶ <a href="#">EthTSyn_MainFunction</a></li> <li>▶ <a href="#">EthTSyn_RxIndication</a></li> </ul>
<a href="#">ETHTSYN_E_UNEXPECTED_SYNC</a>	<ul style="list-style-type: none"> <li>▶ <a href="#">EthTSyn_RxIndication</a></li> </ul>

### 5.3.3.3. Memory mapping

General information about memory mapping is provided in the [EB tresos AutoCore Generic documentation](#). Refer to the section [Memory mapping and compiler abstraction](#) in the [Integration notes](#) section for details.

The following table provides the list of sections that may be mapped for this module:

Memory section
CONFIG_DATA_UNSPECIFIED
VAR_INIT_8
VAR_INIT_16
VAR_INIT_UNSPECIFIED
VAR_CLEARED_UNSPECIFIED
CONST_8
CONST_UNSPECIFIED
CODE

#### 5.3.3.4. Integration requirements

##### WARNING



##### Integration requirements list is not exhaustive

The following list of integration requirements helps you to integrate your product. However, this list is not exhaustive. You also require information from the user's guide, release notes, and EB tresos AutoCore known issues to successfully integrate your product.

##### 5.3.3.4.1. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0001

<b>Description</b>	The reinitialization process shall not interrupt other module functions. If reinitialization of the module is required, the call of EthTSyn_Init() shall not interrupt other module functions.
<b>Rationale</b>	The reinitialization process resets all internal variables. Continuing an interrupted module function after reinitialization can lead to undefined module behavior.

##### 5.3.3.4.2. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0002

<b>Description</b>	EthTSyn_RxIndication() and EthTSyn_TxConfirmation() shall not preempt each other. The module functions EthTSyn_RxIndication() and EthTSyn_TxConfirmation() shall not preempt each other.
<b>Rationale</b>	A preemption of these two function can be easily avoided during integration. This limitation allows to reduce the number of interrupt locks to protect shared variables and therefore increases the module performance.

##### 5.3.3.4.3. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0003

<b>Description</b>	EthTSyn_TxConfirmation() shall be non reentrant The module functions EthTSyn_TxConfirmation() shall not interrupt itself.
<b>Rationale</b>	This preemption can be easily avoided during integration. This limitation allows to reduce the number of interrupt locks to protect shared variables and therefore increases the module performance.

##### 5.3.3.4.4. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0004

<b>Description</b>	EthTSyn_MainFunction must not preempt or be preempted by EthIf_MainFunction-Rx/Tx(). The integrator must assure that EthIf_MainFunctionRx/Tx() can not preempt
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	EthTSyn_MainFunction(). The integrator also must assure that EthTSyn_MainFunction() does not preempt EthIf_MainFunctionRx/Tx().
<b>Rationale</b>	This limitation reduces code size and execution time by eliminating the need for extensive use of exclusive areas.

#### 5.3.3.4.5. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0005

<b>Description</b>	Invalid value for BufIdx. EthTSyn_TxConfirmation() shall not be called parameter BufIdx set to 0xFFFFFFFFU.
<b>Rationale</b>	0xFFFFFFFFU is used as invalid value internally. If Eth_BufIdxType is below uint32, this limitation is always fulfilled.

#### 5.3.3.4.6. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0006

<b>Description</b>	VLAN tags in synchronization frames require custom switch behavior to compensate the switch processing delay equal to IEEE 802.1AS time aware switches. This is necessary to reach the same synchronization accuracy.
<b>Rationale</b>	IEEE 802.1AS does not allow the usage of VLAN tags and therefore, time aware switches following this standard can not be used. Not time aware switches block the default IEEE 802.1AS MAC address and decrease synchronization accuracy if another MAC address is used.

#### 5.3.3.4.7. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0007

<b>Description</b>	If bridge is used over switch and TimeSecured Sub-TLV is received from GTM, the slave port and all master ports where the Sync Follow-Up frame is forwarded need to have the same flags configured in EthTSynCrcFlagsRxValidated as the GTM where the Sync Follow-Up originated.
<b>Rationale</b>	Not using the same configuration for all ports shall result in different CRC, therefore the Sync Follow-Up frame shall be dropped.

#### 5.3.3.4.8. lim.EthTSyn.EB\_INTREQ\_EthTSyn\_0008

<b>Description</b>	If the time synchronization over Ethernet is used, there should be maximum one slave per TimeDomain.
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<b>Rationale</b>	Possible scenarios: If a master is configured and no slave -> the master is the GTM for that TimeDomain. If a slave and multiple masters are configured for a TimeDomain -> the ECU is a gateway. The slave is used to receive the time from the GTM. The masters will send this time to all other nodes from that TimeDomain. If just slave is configured the TimeDomain shall synchronize with the received time from GTM.
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## 5.4. FrTSyn

### 5.4.1. Configuration parameters

Containers included		
Container name	Multiplicity	Description
<a href="#">CommonPublishedInformation</a>	1..1	<b>Label:</b> Common Published Information Common container, aggregated by all modules. It contains published information about vendor and versions.
<a href="#">FrTSynGeneral</a>	1..1	This container holds the general parameters of the Flexray-specific Synchronized Time-base Manager.
<a href="#">FrTSynGlobalTimeDomain</a>	1..254	This represents the existence of a global time domain on Flexray. The FrTSyn module can administrate several global time domains at the same time that in itself form a hierarchy of domains and sub-domains.
<a href="#">PublishedInformation</a>	1..1	<b>Label:</b> EB Published Information Additional published parameters not covered by Common-PublishedInformation container.

Parameters included	
Parameter name	Multiplicity
<a href="#">IMPLEMENTATION_CONFIG_VARIANT</a>	1..1

Parameter Name	IMPLEMENTATION_CONFIG_VARIANT
<b>Label</b>	Config Variant
<b>Multiplicity</b>	1..1
<b>Type</b>	ENUMERATION
<b>Default value</b>	VariantPreCompile

<b>Range</b>	VariantPreCompile	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile

#### 5.4.1.1. CommonPublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">ArMajorVersion</a>	1..1
<a href="#">ArMinorVersion</a>	1..1
<a href="#">ArPatchVersion</a>	1..1
<a href="#">SwMajorVersion</a>	1..1
<a href="#">SwMinorVersion</a>	1..1
<a href="#">SwPatchVersion</a>	1..1
<a href="#">ModuleId</a>	1..1
<a href="#">VendorId</a>	1..1
<a href="#">Release</a>	1..1

Parameter Name	ArMajorVersion
<b>Label</b>	AUTOSAR Major Version
<b>Description</b>	Major version number of AUTOSAR specification on which the appropriate implementation is based on.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	4
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

Parameter Name	ArMinorVersion
<b>Label</b>	AUTOSAR Minor Version
<b>Description</b>	Minor version number of AUTOSAR specification on which the appropriate implementation is based on.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL

<b>Default value</b>	4
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>ArPatchVersion</b>
<b>Label</b>	AUTOSAR Patch Version
<b>Description</b>	Patch level version number of AUTOSAR specification on which the appropriate implementation is based on.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwMajorVersion</b>
<b>Label</b>	Software Major Version
<b>Description</b>	Major version number of the vendor specific implementation of the module.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	2
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwMinorVersion</b>
<b>Label</b>	Software Minor Version
<b>Description</b>	Minor version number of the vendor specific implementation of the module. The numbering is vendor specific.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwPatchVersion</b>
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<b>Label</b>	Software Patch Version	
<b>Description</b>	Patch level version number of the vendor specific implementation of the module. The numbering is vendor specific.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	0	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>ModuleId</b>	
<b>Label</b>	Numeric Module ID	
<b>Description</b>	Module ID of this module from Module List	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	163	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>VendorId</b>	
<b>Label</b>	Vendor ID	
<b>Description</b>	Vendor ID of the dedicated implementation of this module according to the AUTOSAR vendor list	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER_LABEL	
<b>Default value</b>	1	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>Release</b>	
<b>Label</b>	Release Information	
<b>Multiplicity</b>	1..1	
<b>Type</b>	STRING_LABEL	
<b>Default value</b>		
<b>Configuration class</b>	<b>PublishedInformation:</b>	

<b>Origin</b>	Elektrobit Automotive GmbH
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#### 5.4.1.2. FrTSynGeneral

Parameters included	
Parameter name	Multiplicity
<a href="#">FrTSynDevErrorDetect</a>	1..1
<a href="#">FrTSynMainFunctionPeriod</a>	1..1
<a href="#">FrTSynTimeValidationSupport</a>	1..1
<a href="#">FrTSynVersionInfoApi</a>	1..1

Parameter Name	FrTSynDevErrorDetect	
<b>Description</b>	Switches the Default Error Tracer (Det) detection and notification ON or OFF.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

Parameter Name	FrTSynMainFunctionPeriod	
<b>Description</b>	Schedule period of the main function FrTSyn_MainFunction. Unit: [s].	
<b>Multiplicity</b>	1..1	
<b>Type</b>	FLOAT	
<b>Range</b>	<=65535	
	>=0.0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

Parameter Name	FrTSynTimeValidationSupport	
<b>Description</b>	Switches support for Time Validation on or off.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	



<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>FrTSynVersionInfoApi</b>	
<b>Description</b>	Activate/Deactivate the version information API (FrTSyn_GetVersionInfo). True: version information API activated False: version information API deactivated.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.4.1.3. FrTSynGlobalTimeDomain

Containers included		
Container name	Multiplicity	Description
<a href="#">FrTSynGlobalTimeMaster</a>	0..1	Configuration of the global time master. Each global time domain is required to have exactly one global time master. This master may or may not exist on the configured ECU. Configuration of the global time master. Each global time domain is required to have exactly one global time master. This master may or may not exist on the configured ECU.
<a href="#">FrTSynGlobalTimeSlave</a>	0..1	This represents the time slave for the enclosing global time domain. This represents the time slave for the enclosing global time domain.
<a href="#">FrTSynGlobalTimeOfs-DataIDList</a>	0..1	The DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process. The DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.
<a href="#">FrTSynGlobalTimeSync-DataIDList</a>	0..1	The DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process. The DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.

Parameters included	
Parameter name	Multiplicity

Parameters included	
<a href="#">FrTSynEnableTimeValidation</a>	0..1
<a href="#">FrTSynGlobalTimeDomainId</a>	1..1
<a href="#">FrTSynSynchronizedTimeBaseRef</a>	1..1

Parameter Name	FrTSynEnableTimeValidation	
Description	Enables/disables time recording for Time Validation for a specific Time Domain.	
Multiplicity	0..1	
Type	BOOLEAN	
Configuration class	PreCompile:	VariantPreCompile
Origin	Elektrobit Automotive GmbH	

Parameter Name	FrTSynGlobalTimeDomainId	
Description	The global time domain ID.	
Multiplicity	1..1	
Type	INTEGER	
Range	<=31	
	>=0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	FrTSynSynchronizedTimeBaseRef	
Description	Mandatory reference to the required synchronized time-base.	
Multiplicity	1..1	
Type	REFERENCE	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

#### 5.4.1.4. FrTSynGlobalTimeMaster

Containers included		
Container name	Multiplicity	Description

Containers included		
<a href="#">FrTSynGlobalTimeMasterPdu</a>	1..1	This container carries all properties required to configure the PDU sent by the global time master for the given global time domain.

Parameters included	
Parameter name	Multiplicity
<a href="#">FrTSynGlobalTimeTxPeriod</a>	1..1
<a href="#">FrTSynGlobalTimeTxCrcSecured</a>	1..1
<a href="#">FrTSynCyclicMsgResumeTime</a>	1..1
<a href="#">FrTSynGlobalTimeDebounceTime</a>	1..1
<a href="#">FrTSynImmediateTimeSync</a>	1..1

Parameter Name	FrTSynGlobalTimeTxPeriod	
Description	This represents the TX period. Unit: seconds.	
Multiplicity	1..1	
Type	FLOAT	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	FrTSynGlobalTimeTxCrcSecured	
Description	This represents the configuration of whether or not CRC is supported.	
Multiplicity	1..1	
Type	ENUMERATION	
Range	CRC_NOT_SUPPORTED CRC_SUPPORTED	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	FrTSynCyclicMsgResumeTime	
Description	Defines the time where the 1st regular cycle time based message transmission takes place, after an immediate transmission before. Unit: seconds	
Multiplicity	1..1	
Type	FLOAT	
Configuration class	VariantPreCompile:	VariantPreCompile

<b>Origin</b>	AUTOSAR_ECUC	
<b>Parameter Name</b>	<b>FrTSynGlobalTimeDebounceTime</b>	
<b>Description</b>	This represents the configuration of a TX debounce time for SYNC and OFS messages compared to a message before with the same PDU. Unit: seconds	
<b>Multiplicity</b>	1..1	
<b>Type</b>	FLOAT	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>FrTSynImmediateTimeSync</b>	
<b>Description</b>	Enables/Disables the cyclic polling of StbM_GetTimeBaseUpdateCounter() within FrTSyn_MainFunction().	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.4.1.5. FrTSynGlobalTimeMasterPdu

Parameters included	
Parameter name	Multiplicity
<a href="#">FrTSynGlobalTimeMasterHandleId</a>	1..1
<a href="#">FrTSynGlobalTimePduRef</a>	1..1

<b>Parameter Name</b>	<b>FrTSynGlobalTimeMasterHandleId</b>	
<b>Description</b>	This represents the handle ID of the PDU that contains the global time information.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Range</b>	<=65535	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile

<b>Origin</b>	AUTOSAR_ECUC	
<b>Parameter Name</b>	<b>FrTSynGlobalTimePduRef</b>	
<b>Description</b>	This represents the reference to the Pdu taken to transmit the global time information. The global time master of a global time domain acts as the sender of the Pdu while all the time slaves are supposed to receive the Pdu.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	REFERENCE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.4.1.6. FrTSynGlobalTimeSlave

Containers included		
Container name	Multiplicity	Description
<a href="#">FrTSynGlobalTimeSlavePdu</a>	1..1	This container carries all properties required to configure the PDU received by the time slave for the given global time domain.

Parameters included	
Parameter name	Multiplicity
<a href="#">FrTSynRxCrcValidated</a>	1..1
<a href="#">FrTSynGlobalTimeSequenceCounterJumpWidth</a>	1..1

<b>Parameter Name</b>	<b>FrTSynRxCrcValidated</b>	
<b>Description</b>	This parameter controls whether or not CRC validation shall be supported.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	ENUMERATION	
<b>Default value</b>	CRC_IGNORED	
<b>Range</b>	CRC_IGNORED	
	CRC_NOT_VALIDATED	
	CRC_OPTIONAL	
	CRC_VALIDATED	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile

<b>Origin</b>	AUTOSAR_ECUC	
<b>Parameter Name</b>	<b>FrTSynGlobalTimeSequenceCounterJumpWidth</b>	
<b>Description</b>	The SequenceCounterJumpWidth specifies the maximum allowed gap of the Sequence Counter between two SYNC resp. two OFS messages.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Range</b>	<=15	
	>=1	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.4.1.7. FrTSynGlobalTimeSlavePdu

Parameters included		
Parameter name	Multiplicity	
<a href="#">FrTSynGlobalTimeSlaveHandleId</a>	1..1	
<a href="#">FrTSynGlobalTimePduRef</a>	1..1	

<b>Parameter Name</b>	<b>FrTSynGlobalTimeSlaveHandleId</b>	
<b>Description</b>	This represents the handle ID of the PDU that contains the global time information.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Range</b>	<=65535	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>FrTSynGlobalTimePduRef</b>	
<b>Description</b>	This represents the reference to the Pdu taken to transmit the global time information. The global time master of a global time domain acts as the sender of the Pdu while all the time slaves are supposed to receive the Pdu.	
<b>Multiplicity</b>	1..1	

Type	REFERENCE	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

#### 5.4.1.8. FrTSynGlobalTimeOfsDataIDList

Containers included		
Container name	Multiplicity	Description
<a href="#">FrTSynGlobalTimeOfs-DataIDListElement</a>	16..16	Element of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process. Element of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.

#### 5.4.1.9. FrTSynGlobalTimeOfsDataIDListElement

Parameters included	
Parameter name	Multiplicity
<a href="#">FrTSynGlobalTimeOfsDataIDListIndex</a>	1..1
<a href="#">FrTSynGlobalTimeOfsDataIDListValue</a>	1..1

Parameter Name	FrTSynGlobalTimeOfsDataIDListIndex	
Description	Index of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process. Index of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.	
Multiplicity	1..1	
Type	INTEGER	
Range	<=15	
	>=0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	
Parameter Name	FrTSynGlobalTimeOfsDataIDListValue	

<b>Description</b>	Value of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process. Value of the DataIDList for OFS messages ensures the identification of data elements due to CRC calculation process.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Range</b>	<=255	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.4.1.10. FrTSynGlobalTimeSyncDataIDList

Containers included		
Container name	Multiplicity	Description
<a href="#">FrTSynGlobalTimeSync-DataIDListElement</a>	16..16	Element of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process. Element of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.

#### 5.4.1.11. FrTSynGlobalTimeSyncDataIDListElement

Parameters included	
Parameter name	Multiplicity
<a href="#">FrTSynGlobalTimeSyncDataIDListIndex</a>	1..1
<a href="#">FrTSynGlobalTimeSyncDataIDListValue</a>	1..1

Parameter Name	FrTSynGlobalTimeSyncDataIDListIndex
<b>Description</b>	Index of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process. Index of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.
<b>Multiplicity</b>	1..1



<b>Type</b>	INTEGER	
<b>Range</b>	<=15	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>FrTSynGlobalTimeSyncDataIDListValue</b>	
<b>Description</b>	Value of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process. Value of the DataIDList for SYNC messages ensures the identification of data elements due to CRC calculation process.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Range</b>	<=255	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.4.1.12. PublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">PbcfgMSupport</a>	1..1

<b>Parameter Name</b>	<b>PbcfgMSupport</b>	
<b>Label</b>	PbcfgM support	
<b>Description</b>	Specifies whether or not the FrTSyn can use the PbcfgM module for post-build support.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

## 5.4.2. Application programming interface (API)

### 5.4.2.1. Macro constants

#### 5.4.2.1.1. FRTSYN\_E\_INIT\_FAILED

<b>Purpose</b>	
<b>Value</b>	0x22U
<b>Description</b>	DET error code: FrTSyn initialization failed

#### 5.4.2.1.2. FRTSYN\_E\_INVALID\_PDUID

<b>Purpose</b>	
<b>Value</b>	0x01U
<b>Description</b>	DET error code: Module called with wrong PDU or SDU ID

#### 5.4.2.1.3. FRTSYN\_E\_INV\_CTRL\_IDX

<b>Purpose</b>	
<b>Value</b>	0x24U
<b>Description</b>	DET error code: Invalid Controller index

#### 5.4.2.1.4. FRTSYN\_E\_NULL\_POINTER

<b>Purpose</b>	
<b>Value</b>	0x21U
<b>Description</b>	DET error code: Invalid pointer (NULL_PTR)

#### 5.4.2.1.5. FRTSYN\_E\_PARAM

<b>Purpose</b>	
<b>Value</b>	0x23U

<b>Description</b>	DET error code: API called with invalid parameter
--------------------	---

#### 5.4.2.1.6. FRTSYN\_E\_UNINIT

<b>Purpose</b>	
<b>Value</b>	0x20U
<b>Description</b>	DET error code: API service used in un-initialized state

#### 5.4.2.1.7. FRTSYN\_GET\_DELTA\_DIFF

<b>Purpose</b>	
<b>Value</b>	$((\text{delta}) > (\text{deltaMax})) ? ((\text{delta}) - (\text{deltaMax})) : ((\text{deltaMax}) - (\text{delta}))$

#### 5.4.2.1.8. FRTSYN\_GET\_NEW\_SEQ\_COUNTER

<b>Purpose</b>	
<b>Value</b>	$((\text{seqCounter}) < \text{FRTSYN\_MAX\_SEQ\_COUNTER}) ? ((\text{seqCounter}) + 1U) : (0U)$

#### 5.4.2.1.9. FRTSYN\_INSTANCE\_ID

<b>Purpose</b>	Module instance ID.
<b>Value</b>	0U
<b>Description</b>	Defines the instance number of this module. Since multiple instances are not supported this ID is always zero.

#### 5.4.2.1.10. FRTSYN\_IS\_CRC\_SUPPORTED

<b>Purpose</b>	
<b>Value</b>	$((\text{FrTSyn\_MasterConfig}[(\text{index})].\text{txCrcSecured} == \text{FRTSYN\_CRC\_SUPPORTED}) ? \text{TRUE} : \text{FALSE})$

#### 5.4.2.1.11. FRTSYN\_IS\_MESSAGE\_TYPE\_VALID

<b>Purpose</b>	
----------------	--

<b>Value</b>	<pre> ((((uint8)(value) == (uint8)FrTSyn_SlaveConfig[(index)].rxCrcValidated) \ &amp;&amp; (((uint8)(value) != (uint8)(FRTSYN_CRC_IGNORED)) &amp;&amp; ((uint8)(value) != (uint8)(FRTSYN_CRC_OPTIONAL)))) \    (((uint8)(FRTSYN_CRC_IGNORED) == (uint8)FrTSyn_SlaveConfig[(index)].rxCrcValidated)    ((uint8)(FRTSYN_ CRC_OPTIONAL) == (uint8)FrTSyn_SlaveConfig[(index)].rxCrcValidated)) \ &amp;&amp; (((FrTSyn_SlaveConfig[(index)].timeDomainId &lt; (uint8)0x10) &amp;&amp; (((uint8)(val- ue) == (uint8)FRTSYN_SYNC_CRC_NOT_VALIDATED)    ((uint8)(value) == (uint8)FRTSYN_SYNC_CRC_VALIDATED)))) \    (((FrTSyn_SlaveConfig[(index)].time- DomainId &gt; (uint8)0x0F) &amp;&amp; (((uint8)(value) == (uint8)FRTSYN_OFS_CRC_NOT_ VALIDATED)    ((uint8)(value) == (uint8)FRTSYN_OFS_CRC_VALIDATED)))))) </pre>
--------------	---

#### 5.4.2.1.12. FRTSYN\_MAX\_SEQ\_COUNTER

<b>Purpose</b>	
<b>Value</b>	15U

#### 5.4.2.1.13. FRTSYN\_SID\_GETVERSIONINFO

<b>Purpose</b>	Defines API id of function <a href="#">FrTSyn_GetVersionInfo()</a> .
<b>Value</b>	0x02U

#### 5.4.2.1.14. FRTSYN\_SID\_INIT

<b>Purpose</b>	Defines API id of function <a href="#">FrTSyn_Init()</a> .
<b>Value</b>	0x01U

#### 5.4.2.1.15. FRTSYN\_SID\_MAINFUNCTION

<b>Purpose</b>	Defines API id of function <a href="#">FrTSyn_MainFunction()</a> .
<b>Value</b>	0x04U

#### 5.4.2.1.16. FRTSYN\_SID\_RXINDICATION

<b>Purpose</b>	Defines API id of function <a href="#">FrTSyn_RxIndication()</a> .
<b>Value</b>	0x42U

#### 5.4.2.1.17. FRTSYN\_SID\_SETTRANSMISSIONMODE

<b>Purpose</b>	Defines API id of function <a href="#">FrTSyn_SetTransmissionMode()</a> .
<b>Value</b>	0x03U

#### 5.4.2.1.18. FRTSYN\_SID\_TRIGGERTRANSMIT

<b>Purpose</b>	Defines API id of function <a href="#">FrTSyn_TriggerTransmit()</a> .
<b>Value</b>	0x41U

### 5.4.2.2. Functions

#### 5.4.2.2.1. FrTSyn\_GetVersionInfo

<b>Purpose</b>	API to get the module version information.	
<b>Synopsis</b>	<pre>void <b>FrTSyn_GetVersionInfo</b> ( Std_                              VersionInfoType * versioninfo );</pre>	
<b>Service ID</b>	0x02	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (out)</b>	versioninfo	- Pointer to return the module version information.
<b>Description</b>	This service returns the version information of this module.	

#### 5.4.2.2.2. FrTSyn\_Init

<b>Purpose</b>	Initializes the FrTSyn module.	
<b>Synopsis</b>	<pre>void <b>FrTSyn_Init</b> ( const FrTSyn_ConfigType * configPtr );</pre>	
<b>Service ID</b>	0x01	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	CfgPtr	- Address of the configuration data structure.

<b>Description</b>	This service initializes the FrTSyn module. It shall be the first function of the module to be called.
--------------------	--

#### 5.4.2.2.3. FrTSyn\_MainFunction

<b>Purpose</b>	FrTSyn module main function.
<b>Synopsis</b>	<pre>void <b>FrTSyn_MainFunction</b> ( void );</pre>
<b>Service ID</b>	0x04
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant

#### 5.4.2.2.4. FrTSyn\_RxIndication

<b>Purpose</b>	Rx-Indication function.	
<b>Synopsis</b>	<pre>void <b>FrTSyn_RxIndication</b> ( PduIdType Rx- PduId , PduInfoType * PduInfoPtr );</pre>	
<b>Service ID</b>	0x42	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant for different PduIds. Non Reentrant for the same PduId.	
<b>Parameters (in)</b>	RxPduId	- ID of the received I-PDU.
	PduInfoPtr	- Pointer to a buffer containing the I-PDU.
<b>Description</b>	This service is called by FrIf in case a reception is indicated.	

#### 5.4.2.2.5. FrTSyn\_SetTransmissionMode

<b>Purpose</b>	Initializes the FrTSyn module.
<b>Synopsis</b>	<pre>void <b>FrTSyn_SetTransmissionMode</b> ( uint8 Ctr- lIdx , FrTSyn_TransmissionModeType Mode );</pre>
<b>Service ID</b>	0x03
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant

<b>Parameters (in)</b>	CtrlIdx	- Index of the FlexRay channel.
	Mode	- FRTSYN_TX_OFF ► FRTSYN_TX_ON
<b>Description</b>	This API is used to turn on and off the TX capabilities of the FrTSyn.	

#### 5.4.2.2.6. FrTSyn\_TriggerTransmit

<b>Purpose</b>	Trigger-Transmit function.	
<b>Synopsis</b>	<pre>Std_ReturnType FrTSyn_TriggerTransmit ( PduId-  Type TxPduId , PduInfoType * PduInfoPtr );</pre>	
<b>Service ID</b>	0x41	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant for different PduIds. Non Reentrant for the same PduId.	
<b>Parameters (in)</b>	TxPduId	- ID of the received I-PDU.
	PduInfoPtr	- Pointer to a buffer containing the I-PDU.
<b>Return Value</b>	Result of operation	
	E_OK:	SDU has been copied and SduLength indicates the number of copied bytes.
	E_NOT_OK:	No SDU has been copied. PduInfoPtr must not be used since it may contain a NULL pointer or point to invalid data.
<b>Description</b>	This service is called by FrIf in case a triggered transmit.	

#### 5.4.2.2.7. FrTSyn\_TxConfirmation

<b>Purpose</b>	TxConfirmation dummy function.	
<b>Synopsis</b>	<pre>void FrTSyn_TxConfirmation ( PduIdType TxPduId );</pre>	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant for different PduIds. Non Reentrant for the same PduId.	
<b>Parameters (in)</b>	TxPduId	- ID of the received I-PDU.
<b>Description</b>	This service is called by FrIf in case of a Tx Confirmation. But since this is a dummy, this function does not provide any functionality.	

## 5.4.3. Integration notes

### 5.4.3.1. Exclusive areas

This section describes the exclusive areas used by the `FrTSyn` module.

#### 5.4.3.1.1. SCHM\_FRTSYN\_EXCLUSIVE\_AREA\_0

<b>Protected data structures</b>	The exclusive area protects the shared variable access of all global variables.
<b>Recommended locking mechanism</b>	<p>This exclusive area must always be protected by a locking mechanism. The options for locking are described in the <code>EB tresos AutoCore Generic</code> documentation. Refer to the section <code>Mapping exclusive areas in the basic software modules in the Integration notes</code> section for details.</p> <p>The locking mechanism can be disabled if it is ensured that:</p> <ul style="list-style-type: none"><li>▶ <code>FrTSyn_MainFunction()</code> does not preempt <code>FrTSyn_RxIndication()</code> and vice versa.</li><li>▶ No <code>FrTSyn</code> API function preempts <code>FrTSyn_Init()</code>.</li></ul>

#### 5.4.3.1.2. SCHM\_FRTSYN\_EXCLUSIVE\_AREA\_1

<b>Protected data structures</b>	In order to provide enhanced precision of the Virtual Local Time the module <code>FrTSyn</code> requires this exclusive area to increase the precision of the Virtual Local Time.
<b>Recommended locking mechanism</b>	<p>This exclusive area must always be protected by a locking mechanism. The options for locking are described in the <code>EB tresos AutoCore Generic</code> documentation. Refer to the section <code>Mapping exclusive areas in the basic software modules in the Integration notes</code> section for details.</p> <p>The locking mechanism can be disabled if the Time Base that is referenced in <code>StbM</code> uses an <code>OsCounter</code> as Hardware reference.</p>



### 5.4.3.2. Production errors

Production errors information is not available for this module.

### 5.4.3.3. Memory mapping

General information about memory mapping is provided in the EB tresos AutoCore Generic documentation. Refer to the section `Memory mapping and compiler abstraction` in the `Integration notes` section for details.

The following table provides the list of sections that may be mapped for this module:

Memory section
CONFIG_DATA_UNSPECIFIED
CONFIG_DATA_8
CONST_UNSPECIFIED
VAR_INIT_8
VAR_CLEARED_UNSPECIFIED
VAR_CLEARED_8
CODE

### 5.4.3.4. Integration requirements

#### WARNING



#### Integration requirements list is not exhaustive

The following list of integration requirements helps you to integrate your product. However, this list is not exhaustive. You also require information from the user's guide, release notes, and EB tresos AutoCore known issues to successfully integrate your product.

#### 5.4.3.4.1. `lim.FrTSyn.EB_INTREQ_FrTSyn_0001`

Description	Limitation on order of invocation of <code>FrTSyn_Init</code> function. The invocations of <code>FrTSyn_Init</code> , should be called after <code>FrIf_Init</code> is called.
Rationale	The calls to <code>FrIf_GetMacrotickDuration()</code> and <code>FrIf_GetMacroticksPerCycle()</code> will raise a DET, because these functions are called during initialization of the <code>FrTSyn</code> module.

#### 5.4.3.4.2. lim.FrTSyn.EB\_INTREQ\_FrTSyn\_0002

<b>Description</b>	It shall be assured that the TxPeriod is configured in a way that a second transmission does not interrupt the TriggerTransmit for the first one (on the same TimeDomain).
<b>Rationale</b>	FrTSyn can not handle this scenario since it has no control over TriggerTransmit.

## 5.5. StbM

### 5.5.1. Configuration parameters

Containers included		
Container name	Multiplicity	Description
<a href="#">CommonPublishedInformation</a>	1..1	<b>Label:</b> Common Published Information Common container, aggregated by all modules. It contains published information about vendor and versions.
<a href="#">PublishedInformation</a>	1..1	<b>Label:</b> EB Published Information Additional published parameters not covered by Common-PublishedInformation container.
<a href="#">StbMDefensiveProgramming</a>	1..1	<b>Label:</b> Defensive Programming Options Parameters for defensive programming
<a href="#">StbMGeneral</a>	1..1	Container holding the general parameters for the Synchronized Time-base Manager.
<a href="#">StbMSynchronizedTimeBase</a>	1..n	Container holding the list of Synchronized time-base providers. The Synchronized time-base provider collects the information about specific time-base/s within the system.
<a href="#">StbMTriggeredCustomer</a>	0..n	The triggered customer is directly triggered by the Synchronized Timebase Manager by getting synchronized with the current (global) definition of time and passage of time.
<a href="#">StbMBswModules</a>	0..n	Defines the schemaNode path of an adjacent BSW module.  Each container describes a specific BSW module adjacent to and controlled by the StbM.  There are three preconditions to fully integrate a BSW module to the StbM:

Containers included		
		<ul style="list-style-type: none"> <li>▶ The BSW module shall provide a property file defining specific parameters.</li> <li>▶ This property file shall be registered at startup of tresos Studio.</li> <li>▶ The BWM module shall be added to this list (by its schemaNode path).</li> </ul> <p>The StbM considers the property files of all BSW module defined here. Modules without property file must not be defined in this list.</p> <p>A BSW module without a property file is not fully integrated and suffers the following limitations:</p> <ul style="list-style-type: none"> <li>▶ StbM can not control a master time domain of this BSW module.</li> <li>▶ StbM can not use a possible hardware timestamp capability of this BSW module.</li> <li>▶ The StbM configuration must contain a reserved time base for this BSW module.</li> <li>▶ Parameter StbMDevErrorDetect must be disabled.</li> </ul> <p>A BSW module with a property file shall define the following parameters for successful integration:</p> <ul style="list-style-type: none"> <li>▶ Name of module config.</li> <li>▶ List of header files for inclusion.</li> <li>▶ List of time base references of master time domains.</li> <li>▶ List of time base references of slave time domains.</li> <li>▶ Support of hardware timestamps.</li> <li>▶ Name of time getter API.</li> <li>▶ Name of time setter API.</li> </ul>

Parameters included	
Parameter name	Multiplicity
<a href="#">IMPLEMENTATION_CONFIG_VARIANT</a>	1..1

Parameter Name	IMPLEMENTATION_CONFIG_VARIANT
----------------	-------------------------------

<b>Multiplicity</b>	1..1
<b>Type</b>	ENUMERATION
<b>Default value</b>	VariantPreCompile
<b>Range</b>	VariantPreCompile
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile

#### 5.5.1.1. CommonPublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">ArMajorVersion</a>	1..1
<a href="#">ArMinorVersion</a>	1..1
<a href="#">ArPatchVersion</a>	1..1
<a href="#">SwMajorVersion</a>	1..1
<a href="#">SwMinorVersion</a>	1..1
<a href="#">SwPatchVersion</a>	1..1
<a href="#">ModuleId</a>	1..1
<a href="#">VendorId</a>	1..1
<a href="#">Release</a>	1..1

<b>Parameter Name</b>	<b>ArMajorVersion</b>
<b>Label</b>	AUTOSAR Major Version
<b>Description</b>	Major version number of AUTOSAR specification on which the appropriate implementation is based on.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>ArMinorVersion</b>
<b>Label</b>	AUTOSAR Minor Version
<b>Description</b>	Minor version number of AUTOSAR specification on which the appropriate implementation is based on.

<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>ArPatchVersion</b>
<b>Label</b>	AUTOSAR Patch Version
<b>Description</b>	Patch level version number of AUTOSAR specification on which the appropriate implementation is based on.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwMajorVersion</b>
<b>Label</b>	Software Major Version
<b>Description</b>	Major version number of the vendor specific implementation of the module.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	3
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

<b>Parameter Name</b>	<b>SwMinorVersion</b>
<b>Label</b>	Software Minor Version
<b>Description</b>	Minor version number of the vendor specific implementation of the module. The numbering is vendor specific.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER_LABEL
<b>Default value</b>	0
<b>Configuration class</b>	<b>PublishedInformation:</b>
<b>Origin</b>	Elektrobit Automotive GmbH

Parameter Name	SwPatchVersion	
Label	Software Patch Version	
Description	Patch level version number of the vendor specific implementation of the module. The numbering is vendor specific.	
Multiplicity	1..1	
Type	INTEGER_LABEL	
Default value	0	
Configuration class	PublishedInformation:	
Origin	Elektrobit Automotive GmbH	

Parameter Name	ModuleId	
Label	Numeric Module ID	
Description	Module ID of this module from Module List	
Multiplicity	1..1	
Type	INTEGER_LABEL	
Default value	160	
Configuration class	PublishedInformation:	
Origin	Elektrobit Automotive GmbH	

Parameter Name	VendorId	
Label	Vendor ID	
Description	Vendor ID of the dedicated implementation of this module according to the AUTOSAR vendor list	
Multiplicity	1..1	
Type	INTEGER_LABEL	
Default value	1	
Configuration class	PublishedInformation:	
Origin	Elektrobit Automotive GmbH	

Parameter Name	Release	
Label	Release Information	
Multiplicity	1..1	
Type	STRING_LABEL	
Default value		

<b>Configuration class</b>	<b>PublishedInformation:</b>	
<b>Origin</b>	Elektrobit Automotive GmbH	

### 5.5.1.2. PublishedInformation

Parameters included	
Parameter name	Multiplicity
<a href="#">PbcfgMSupport</a>	1..1

Parameter Name	PbcfgMSupport	
Label	PbcfgM support	
Description	Specifies whether or not the StbM can use the PbcfgM module for post-build support.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	PublishedInformation:	
Origin	Elektrobit Automotive GmbH	

### 5.5.1.3. StbMDefensiveProgramming

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMDefProgEnabled</a>	1..1
<a href="#">StbMPrecondAssertEnabled</a>	1..1
<a href="#">StbMPostcondAssertEnabled</a>	1..1
<a href="#">StbMStaticAssertEnabled</a>	1..1
<a href="#">StbMUnreachAssertEnabled</a>	1..1
<a href="#">StbMInvariantAssertEnabled</a>	1..1

<b>Parameter Name</b>	<b>StbMDefProgEnabled</b>
<b>Label</b>	Enable Defensive Programming
<b>Description</b>	Enables or disables the defensive programming feature for the module StbM.

	<p>Note: This feature is dependent on the use of the development error detection module. To use the defensive programming feature, proceed as follows:</p> <ol style="list-style-type: none"> <li>1. Enable development error detection</li> <li>2. Enable defensive programming</li> <li>3. Enable assertions as required</li> </ol>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMPrecondAssertEnabled</b>	
<b>Label</b>	Enable Precondition Assertions	
<b>Description</b>	<p>Enables handling of precondition assertion checks reported from the module StbM.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (<code>StbMDevErrorDetect</code>): must be enabled</li> <li>▶ Enable Defensive Programming (<code>StbMDefProgEnabled</code>): must be enabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMPostcondAssertEnabled</b>	
<b>Label</b>	Enable Postcondition Assertions	
<b>Description</b>	<p>Enables handling of postcondition assertion checks reported from the module StbM.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (<code>StbMDevErrorDetect</code>): must be enabled</li> </ul>	



	▶ Enable Defensive Programming ( <code>StbMDefProgEnabled</code> ): must be enabled	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMStaticAssertEnabled</b>	
<b>Label</b>	Enable Static Assertions	
<b>Description</b>	<p>Enables handling of static assertion checks reported from the module <code>StbM</code>.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (<code>StbMDevErrorDetect</code>): must be enabled</li> <li>▶ Enable Defensive Programming (<code>StbMDefProgEnabled</code>): must be enabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMUnreachAssertEnabled</b>	
<b>Label</b>	Enable Unreachable Code Assertions	
<b>Description</b>	<p>Enables handling of unreachable code assertion checks reported from the module <code>StbM</code>.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (<code>StbMDevErrorDetect</code>): must be enabled</li> <li>▶ Enable Defensive Programming (<code>StbMDefProgEnabled</code>): must be enabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	

<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMInvariantAssertEnabled</b>	
<b>Label</b>	Enable Invariant Assertions	
<b>Description</b>	<p>Enables handling of invariant assertion checks reported from functions of the module StbM.</p> <p>Dependency on parameter(s):</p> <ul style="list-style-type: none"> <li>▶ Enable Development Error Detection (<code>StbMDevErrorDetect</code>): must be enabled</li> <li>▶ Enable Defensive Programming (<code>StbMDefProgEnabled</code>): must be enabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

#### 5.5.1.4. StbMGeneral

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMDevErrorDetect</a>	1..1
<a href="#">StbMGetCurrentTimeExtendedAvailable</a>	1..1
<a href="#">StbMMainFunctionPeriod</a>	1..1
<a href="#">StbMTimeRecordingSupport</a>	1..1
<a href="#">StbMTimerStartThreshold</a>	1..1
<a href="#">StbMVersionInfoApi</a>	1..1
<a href="#">StbMGptTimerRef</a>	1..1
<a href="#">StbMRteUsage</a>	1..1
<a href="#">StbMTimeValidationSupport</a>	1..1
<a href="#">StbMTimerStartMaxNumberOfCalls</a>	1..1

<b>Parameter Name</b>	<b>StbMDevErrorDetect</b>
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<b>Description</b>	<p>Enables and disables the development error detection and notification mechanism.</p> <ul style="list-style-type: none"> <li>▶ True: Enabled</li> <li>▶ False: Disabled</li> </ul> <p><b>Optimization Effect:</b></p> <ul style="list-style-type: none"> <li>▶ <b>ROM increase (code):</b> Enabling this parameter increases the ROM consumption of the module code.</li> <li>▶ <b>Execution time increase (code):</b> Enabling this parameter increases the execution time of the module code.</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	true	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>StbMGetCurrentTimeExtendedAvailable</b>	
<b>Description</b>	<p><i>The functionality related to this parameter is not supported by the current implementation.</i></p> <p>Using long long datatypes violates the C90 standard.</p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>StbMMainFunctionPeriod</b>	
<b>Description</b>	Schedule period of the main function StbM_MainFunction. Unit: [s].	
<b>Multiplicity</b>	1..1	
<b>Type</b>	FLOAT	
<b>Default value</b>	0.01	
<b>Range</b>	<=1000	
	>=0.000001	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile

Origin	AUTOSAR_ECUC	
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Parameter Name	<b>StbMTimeRecordingSupport</b>	
Description	Enables/Disables the usage of the recording functionality for Synchronized and Offset timebases for Global Time precision measurement purpose.	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>StbMTimerStartThreshold</b>	
Description	<p>EN: This interval defines, when a GPT Timer shall be started for Time Notification Customers for which the corresponding Customer Timer is running [unit: seconds].</p> <p>This parameter is enabled only if there are StbMNotificationCostumers configured.</p>	
Multiplicity	1..1	
Type	FLOAT	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>StbMVersionInfoApi</b>	
Description	<p>Enables and disables the API StbM_GetVersionInfo().</p> <ul style="list-style-type: none"> <li>▶ True: Enabled</li> <li>▶ False: Disabled</li> </ul> <p><b>Optimization Effect:</b></p> <ul style="list-style-type: none"> <li>▶ <b>ROM increase (code):</b> Enabling this parameter increases the ROM consumption of the module code.</li> </ul>	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMGptTimerRef	
Description	<p>EN: This represents an optional sub-container in case any Time Notification Customer is configured.</p> <p>This parameter is enabled only if there are StbMNotificationCostumers configured.</p> <p>If StbMGptTimerRef is configured, please make sure that GptNotification is enabled and configured!</p> <p>The referenced GptChannel shall not be used for other purposes, this is the only place it shall be configured!</p>	
Multiplicity	1..1	
Type	REFERENCE	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMRteUsage	
Description	<p>Enables RTE Usage.</p> <p>If enabled, the StbM will generate an SWCD and supply the specified software component interfaces.</p>	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	Elektrobit Automotive GmbH	

Parameter Name	StbMTimeValidationSupport	
Description	<p>Enables/Disables the usage of the time recording functionality for Synchronized timebases for Time Validation purpose.</p> <ul style="list-style-type: none"> <li>▶ True: Enabled</li> <li>▶ False: Disabled</li> </ul>	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	false	
Configuration class	VariantPreCompile:	VariantPreCompile

<b>Origin</b>	Elektrobit Automotive GmbH	
<b>Parameter Name</b>	<b>StbMTimerStartMaxNumberOfCalls</b>	
<b>Description</b>	EN: This defines the maximum number of StbM_StartTimer() function calls that StbM can handle at once during runtime. If this is exceeded, StbM_StartTimer() will return E_NOT_OK.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	INTEGER	
<b>Range</b>	<4294967295	
	>0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

#### 5.5.1.5. StbMSynchronizedTimeBase

Containers included		
Container name	Multiplicity	Description
<a href="#">StbMLocalTimeClock</a>	0..1	References the hardware reference clock of this Synchronized Time Base.
<a href="#">StbMNotificationCustomer</a>	0..n	EN: This container holds the configuration of a notification customer, which is notified is informed about the occurrence of a Time-base related event.
<a href="#">StbMTimeCorrection</a>	0..1	Collects the information relevant for the rate- and offset correction of a Time Base.
<a href="#">StbMTimeRecording</a>	0..1	Collects the information relevant for configuration of the precision measurement of a Time Base.

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMAllowSystemWideGlobalTimeMaster</a>	0..1
<a href="#">StbMIsSystemWideGlobalTimeMaster</a>	1..1
<a href="#">StbMNotificationInterface</a>	1..1
<a href="#">StbMStoreTimebaseNonVolatile</a>	0..1
<a href="#">StbMSyncLossTimeout</a>	0..1
<a href="#">StbMSynchronizedTimeBaseIdentifier</a>	1..1

Parameters included	
<a href="#">StbMOffsetTimeBase</a>	0..1
<a href="#">StbMClearTimeleapCount</a>	0..1
<a href="#">StbMTimeLeapFutureThreshold</a>	0..1
<a href="#">StbMTimeLeapPastThreshold</a>	0..1
<a href="#">StbMStatusNotificationCallback</a>	1..1
<a href="#">StbMStatusNotificationMask</a>	1..1
<a href="#">StbMGlobalNvMBlockDescriptor</a>	1..1
<a href="#">StbMUseOSGetTimeStamp</a>	1..1
<a href="#">StbMProvideDataInSharedMemory</a>	1..1

Parameter Name	StbMAllowSystemWideGlobalTimeMaster	
Description	<p>The functionality related to this parameter is not supported by the current implementation.</p> <p>EN: For postbuild variant of the StbM this parameter has to be set to true for a Global Time Master that may act as a system-wide source of time. Otherwise no corresponding service ports/interfaces are provided.</p>	
Multiplicity	0..1	
Type	BOOLEAN	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMIsSystemWideGlobalTimeMaster	
Description	<p>This parameter shall be set to true for a global time master that acts as a system-wide source of time information with respect to global time. It is possible that several global time masters exist that have set this parameter set to true because the global time masters exist once per global time domain and one ECU may start several global time domains on different busses it is connected to.</p>	
Multiplicity	1..1	
Type	BOOLEAN	
Default value	true	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMNotificationInterface
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<b>Description</b>	The parameter defines what type of interface shall be used to notify a customer of a status event.	
<b>Multiplicity</b>	1..1	
<b>Type</b>	ENUMERATION	
<b>Default value</b>	NO_NOTIFICATION	
<b>Range</b>	NO_NOTIFICATION	
	CALLBACK	
	SR_INTERFACE	
	CALLBACK_AND_SR_INTERFACE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>StbMStoreTimebaseNonVolatile</b>	
<b>Description</b>	This allows for specifying that the timebase shall be stored in the NvRam.	
<b>Multiplicity</b>	0..1	
<b>Type</b>	ENUMERATION	
<b>Range</b>	NO_STORAGE	
	STORAGE_AT_SHUTDOWN	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>StbMSyncLossTimeout</b>	
<b>Description</b>	This attribute describes the timeout for the situation that the time synchronization gets lost in the scope of the time domain. Unit: seconds	
<b>Multiplicity</b>	0..1	
<b>Type</b>	FLOAT	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>StbMSynchronizedTimeBaseIdentifier</b>	
<b>Description</b>	ID of a synchronized time-base via a unique identifier.	
	The value for this parameter can be calculated automatic or manually entered. Allowed ranges are: 0..15 for Synchronized Time Bases 16..31 for Offset Time Bases 32..127 for Pure Local Time Bases 123..65535 Reserved	



<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMOffsetTimeBase</b>
<b>Description</b>	Reference to another time base.  In this case this reference is used, this time base is treated as an offset time base.
<b>Multiplicity</b>	0..1
<b>Type</b>	REFERENCE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMClearTimeleapCount</b>
<b>Description</b>	This attribute describes the required number of updates to the Time Base where the time difference to the previous value has to remain below StbMTimeLeap-PastThreshold/StbMTimeLeapFutureThreshold until the TIMELEAP_PAST/ TIMELEAP_FUTURE bit within timeBaseStatus of the Time Base is cleared.
<b>Multiplicity</b>	0..1
<b>Type</b>	INTEGER
<b>Default value</b>	1
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMTimeLeapFutureThreshold</b>
<b>Description</b>	This represents the maximum allowed positive difference between a newly received Global Time Base value and the current Local Time Base value [unit: seconds].
<b>Multiplicity</b>	0..1
<b>Type</b>	FLOAT
<b>Default value</b>	0.0
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

Parameter Name	StbMTimeLeapPastThreshold	
Description	This represents the maximum allowed negative difference between the current Local Time Base value and a newly received Global Time Base value [unit: seconds].	
Multiplicity	0..1	
Type	FLOAT	
Default value	0.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMStatusNotificationCallback	
Description	<p>Name of the customer specific status notification callback function, which shall be called, if a non-masked status event occurs.</p> <p>Naming example: <code>StbM_StatusNotificationCallback</code></p> <p>If the name of the Time Base is <code>StbMSync1</code>, the generated function name will be:</p> <p><code>StbM_StatusNotificationCallbackStbMSync1</code></p>	
Multiplicity	1..1	
Type	FUNCTION-NAME	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMStatusNotificationMask	
Description	The parameter defines the initial value for NotificationMask mask, which defines the events for which the event notification callback function shall be called.	
Multiplicity	1..1	
Type	INTEGER	
Default value	0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMGlobalNvMBlockDescriptor	
Label	Global NVRAM Block Descriptor	
Description	Reference to NVRAM block containing the non volatile data.	

	Index of the NvMBlockDescriptor will be used by the StbM module for the identification of the NvM block	
<b>Multiplicity</b>	1..1	
<b>Type</b>	SYMBOLIC-NAME-REFERENCE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMUseOSGetTimeStamp</b>	
<b>Description</b>	<p>The time source of this Time Base will be given by calling OS_GetTimeStamp.</p> <ul style="list-style-type: none"> <li>▶ True: Enabled</li> <li>▶ False: Disabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

<b>Parameter Name</b>	<b>StbMProvideDataInSharedMemory</b>	
<b>Description</b>	<p>The StbM provides the offset of the local time of this time base with respect to the Eth HwCounter. The value is provided to a shared location that should be mapped by the integrator in order for the value to be used by other 'user' modules.</p> <p>MemMap section: VAR_STBM_SHARED_TIME_DATA</p> <p>IMPORTANT : this must be activated only for Synchronized Time Bases that have a reference to a EthTSynGlobalTimeDomain (an Eth Driver), or for Offset Time Bases that have a reference to a Synchronized Time Base as described above.</p> <ul style="list-style-type: none"> <li>▶ True: Enabled</li> <li>▶ False: Disabled</li> </ul>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	BOOLEAN	
<b>Default value</b>	false	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH	

### 5.5.1.6. StbMLocalTimeClock

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMClockFrequency</a>	1..1
<a href="#">StbMClockPrescaler</a>	1..1
<a href="#">StbMLocalTimeHardware</a>	1..1

Parameter Name	StbMClockFrequency
Description	<p>Represents the frequency [Hz] of the HW reference clock used by the StbM.</p> <p>In case StbMLocalTimeHardware has a reference to Os or StbMUseOSGet-TimeStamp is enabled for this time base, StbMClockFrequency will not be used when converting Os ticks to nanoseconds, since Os provides an own macro to do this.</p> <p>StbMClockFrequency shall be configured to a value equal to Os frequency, in order to be mapped to the Header Element HWfrequency of the record table belonging to the Synchronized Time Base (if Time Recording is activated on the Time Base). Otherwise, it does not matter what value it has.</p> <p>In case StbMLocalTimeHardware has a reference to EthTSyn, StbMClockFrequency will not be used when converting, because no conversion from ticks to nanoseconds will take place at StbM level. It does not matter what value it has, StbM will always use a value of 1GHz.</p> <p>In case StbMLocalTimeHardware has a reference to Gpt, StbMClockFrequency/StbMClockPrescaler factor will be used when converting Gpt ticks to nanoseconds, and it is mandatory to configure both parameters. Typically the resulting frequency from the StbMClockFrequency/StbMClockPrescaler division should be the same as the one from the Gpt channel.</p> <p>For the following frequencies: 10 kHz, 16 kHz, 1,001675 MHz, 2 Mhz, 2.08 Mhz, 3 MHz, 3.25 MHz, 3.5 MHz, 4 MHz, 5 MHz, 6.25 MHz, 8 MHz, 10 MHz, 12.5 MHz, 15 MHz, 16 MHz, 20 MHz, 24 Mhz, 24.55 Mhz, 25 MHz, 26 MHz, 32 MHz, 33,3 MHz, 37.5 MHz, 40 MHz, 45 MHz, 48 MHz, 50 MHz, 55 MHz, 56 MHz, 60 MHz, 62.5 MHz, 64 MHz, 70 MHz, 75 MHz, 80 MHz, 90 MHz, 96 MHz, 100 MHz, 110 MHz, 120 MHz, 132 MHz, 133 MHz, 140 MHz, 125 MHz, 150 MHz, 160 MHz, 180 MHz, 200 MHz, 240 MHz, 250 MHz, 264 MHz, 300 MHz, 330 MHz, 400 MHz, 800 MHz. the conversion is done in a more precise way. For other frequencies, a more general conversion takes place, which is less precise.</p>
Multiplicity	1..1

Type	INTEGER	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	<b>StbMClockPrescaler</b>	
Description	<p>Represents the prescaler to calculate the resulting frequency of the HW reference clock used by the StbM.</p> <p>In case StbMLocalTimeHardware has a reference to Os or StbMUseOSGetTimeStamp is enabled for this time base, StbMClockPrescaler will not be used when converting Os ticks to nanoseconds, since Os provides an own macro to do this.</p> <p>StbMClockPrescaler shall be configured, in order to be mapped to the Header Element HWfrequency of the record table belonging to the Synchronized Time Base (if Time Recording is activated on the Time Base). Otherwise, it does not matter what value it has.</p> <p>In case StbMLocalTimeHardware has a reference to EthTSyn, StbMClockPrescaler will not be used when converting, because no conversion from ticks to nanoseconds will take place at StbM level. It does not matter what value it has, StbM will always use a value of 1.</p> <p>In case StbMLocalTimeHardware has a reference to Gpt, StbMClockFrequency/StbMClockPrescaler factor will be used when converting Gpt ticks to nanoseconds, and it is mandatory to configure both parameters. Typically StbMClockPrescaler shall be configured in such a manner that the resulting frequency from the StbMClockFrequency/StbMClockPrescaler division should be the same as the one from the Gpt channel.</p> <p>For the following frequencies: 10 kHz, 16 kHz, 1,001675 MHz, 2 Mhz, 2.08 Mhz, 3 MHz, 3.25 MHz, 3.5 MHz, 4 MHz, 5 MHz, 6.25 MHz, 8 MHz, 10 MHz, 12.5 MHz, 15 MHz, 16 MHz, 20 MHz, 24 Mhz, 24.55 Mhz, 25 MHz, 26 MHz, 32 MHz, 33,3 MHz, 37.5 MHz, 40 MHz, 45 MHz, 48 MHz, 50 MHz, 55 MHz, 56 MHz, 60 MHz, 62.5 MHz, 64 MHz, 70 MHz, 75 MHz, 80 MHz, 90 MHz, 96 MHz, 100 MHz, 110 MHz, 120 MHz, 132 MHz, 133 MHz, 140 MHz, 125 MHz, 150 MHz, 160 MHz, 180 MHz, 200 MHz, 240 MHz, 250 MHz, 264 MHz, 300 MHz, 330 MHz, 400 MHz, 800 MHz. the conversion is done in a more precise way. For other frequencies, a more general conversion takes place, which is less precise.</p>	
Multiplicity	1..1	
Type	INTEGER	
Configuration class	VariantPreCompile:	VariantPreCompile

<b>Origin</b>	AUTOSAR_ECUC	
<b>Parameter Name</b>	<b>StbMLocalTimeHardware</b>	
<b>Description</b>	<p>Reference to the local time hardware.</p> <p>In case a reference to Os is used, the designated OS counter has to be configured properly:</p> <ol style="list-style-type: none"> <li>the counter is directly driven by a HW timer</li> <li>the counter's <code>OsCounterTicksPerBase</code> is one tick in x nanoseconds [ns]</li> </ol> <p>In case a reference to EthTSyn is used, the following shall happen: the underlying Eth driver shall support hardware timestamping.</p> <p>In case a reference to a Gpt is used, the frequency shall be configured in such a manner, that the resulting frequency to be equal to the Gpt Channel Frequency.</p> <p>Attention (EthTSyn): This reference must point to a time domain which is connected to this time base. In detail this means that the time domain referenced by this parameter must refer to this time base in turn.</p> <p>Attention (for SYNC time bases): StbMLocalTimeHardware can be disabled for SYNC time bases, if and only if, StbMUseOSGetTimeStamp is enabled.</p>	
<b>Multiplicity</b>	1..1	
<b>Type</b>	CHOICE-REFERENCE	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

### 5.5.1.7. StbMNotificationCustomer

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMNotificationCustomerId</a>	1..1
<a href="#">StbMTimeNotificationCallback</a>	0..1

<b>Parameter Name</b>	<b>StbMNotificationCustomerId</b>
<b>Description</b>	EN: Identification of a event notification customer.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER

<b>Range</b>	<=65535	
	>=0	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

<b>Parameter Name</b>	<b>StbMTimeNotificationCallback</b>	
<b>Description</b>	<p>EN: Name of the customer specific notification callback function, which shall be called, if the time previously set by the customer is reached.</p> <p>The name of the StbMTimeNotificationCallback shall be configured to: TimeNotificationCallback</p> <p>The callback will be generated like this: [Customer]_TimeNotificationCallback[TimeBase]</p> <p>If the name of the Time Base is StbMSynchronizedTimeBase_0_Sync, and the name of the Notification Customer is NotificationCustomer_1 the generated function name will be:</p> <p>NotificationCustomer_1_TimeNotificationCallbackStbMSynchronizedTimeBase_0_Sync</p>	
<b>Multiplicity</b>	0..1	
<b>Type</b>	FUNCTION-NAME	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

#### 5.5.1.8. StbMTimeCorrection

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMAllowMasterRateCorrection</a>	0..1
<a href="#">StbMMasterRateDeviationMax</a>	0..1
<a href="#">StbMOffsetCorrectionAdaptionInterval</a>	0..1
<a href="#">StbMOffsetCorrectionJumpThreshold</a>	0..1
<a href="#">StbMRateCorrectionMeasurementDuration</a>	0..1
<a href="#">StbMRateCorrectionsPerMeasurementDuration</a>	0..1

Parameter Name	StbMAllowMasterRateCorrection
Description	<p>EN: This attribute describes whether the rate correction value of a Time Base can be set by StbM_SetRateCorrection():</p> <ul style="list-style-type: none"> <li>- false: the rate correction value can not be set by StbM_SetRateCorrection()</li> <li>- true: the rate correction value can be set by StbM_SetRateCorrection()</li> </ul>
Multiplicity	0..1
Type	BOOLEAN
Default value	false
Configuration class	VariantPreCompile: VariantPreCompile
Origin	AUTOSAR_ECUC

Parameter Name	StbMMasterRateDeviationMax
Description	This attribute describes the maximum allowed absolute value of the rate deviation value to be set by StbM_SetRateCorrection() [unit: ppm].
Multiplicity	0..1
Type	INTEGER
Default value	0
Range	<p>&lt;=32000</p> <p>&gt;=0</p>
Configuration class	VariantPreCompile: VariantPreCompile
Origin	AUTOSAR_ECUC

Parameter Name	StbMOffsetCorrectionAdaptionInterval
Description	<p>EN: Defines the interval during which the adaptive rate correction cancels out the rate- and time deviation [unit: seconds].</p> <p>Note: If the StbMOffsetCorrectionJumpThreshold parameter is disabled, or it's value is 0, StbMOffsetCorrectionAdaptionInterval is not used.</p>
Multiplicity	0..1
Type	FLOAT
Range	<p>&lt;=14</p> <p>&gt;=0.000001</p>
Configuration class	VariantPreCompile: VariantPreCompile
Origin	AUTOSAR_ECUC



Parameter Name	StbMOffsetCorrectionJumpThreshold	
Description	Threshold for the correction method. Deviations below this value will be corrected by a linear reduction over a defined timespan. Values equal- and greater than this value will be corrected by immediately setting the correct time- and rate in form of a jump [unit: seconds].	
Multiplicity	0..1	
Type	FLOAT	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMRateCorrectionMeasurementDuration	
Description	<p>EN: Definition of the time span [s] which is used to calculate the rate deviation.</p> <p>The StbMRateCorrectionMeasurementDuration parameter, and the resynchronization time of the StbM should be configured in a way that:</p> <ul style="list-style-type: none"> <li>- the difference (TGstop - TGstart)</li> </ul> <p>and</p> <ul style="list-style-type: none"> <li>- the difference (TVstop - Tvstart),</li> </ul> <p>do not exceed the value of 15 seconds.</p> <p>These are part of the rate correction calculation formula, (<math>rrc = (TGStop - TGStart) / (TVStop - TVStart)</math>). If they do exceed the above value, an overflow could emerge when calculating the Rate Correction.</p>	
Multiplicity	0..1	
Type	FLOAT	
Default value	1.0	
Configuration class	VariantPreCompile:	VariantPreCompile
Origin	AUTOSAR_ECUC	

Parameter Name	StbMRateCorrectionsPerMeasurementDuration	
Description	Number of simultaneous rate measurements to determine the current rate deviation.	
Multiplicity	0..1	
Type	INTEGER	
Default value	1	

<b>Range</b>	<=65535	
	>=1	
<b>Configuration class</b>	<b>VariantPreCompile:</b>	VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC	

### 5.5.1.9. StbMTimeRecording

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMOffsetTimeRecordBlockCallback</a>	0..1
<a href="#">StbMOffsetTimeRecordTableBlockCount</a>	1..1
<a href="#">StbMSyncTimeRecordBlockCallback</a>	0..1
<a href="#">StbMSyncTimeRecordTableBlockCount</a>	1..1
<a href="#">StbMEnableTimeValidation</a>	0..1

<b>Parameter Name</b>	<b>StbMOffsetTimeRecordBlockCallback</b>
<b>Description</b>	Name of the customer specific callback function, which shall be called, if a measurement data for a Offset Time Base are available.
<b>Multiplicity</b>	0..1
<b>Type</b>	FUNCTION-NAME
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMOffsetTimeRecordTableBlockCount</b>
<b>Description</b>	Represents the number of Blocks used for queing time measurement events for the Offset Time Base Record Table.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMSyncTimeRecordBlockCallback</b>
<b>Description</b>	Name of the customer specific callback function, which shall be called, if a measurement data for a Synchronized Time Base are available.

<b>Multiplicity</b>	0..1
<b>Type</b>	FUNCTION-NAME
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMSyncTimeRecordTableBlockCount</b>
<b>Description</b>	Represents the number of Blocks used for queuing time measurement events for the Synchronized Time Base Record Table.
<b>Multiplicity</b>	1..1
<b>Type</b>	INTEGER
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMEnableTimeValidation</b>
<b>Description</b>	Enables/disables time recording for Time Validation for a specific Time Base.
<b>Multiplicity</b>	0..1
<b>Type</b>	BOOLEAN
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	Elektrobit Automotive GmbH

#### 5.5.1.10. StbMTriggeredCustomer

Parameters included	
Parameter name	Multiplicity
<a href="#">StbMTriggeredCustomerPeriod</a>	1..1
<a href="#">StbMOSScheduleTableRef</a>	1..1
<a href="#">StbMSynchronizedTimeBaseRef</a>	1..1

<b>Parameter Name</b>	<b>StbMTriggeredCustomerPeriod</b>
<b>Description</b>	Triggering period of the triggered customer called by the StbM_MainFunction.  Note: The Triggering period value is configured in [us].
<b>Multiplicity</b>	1..1

<b>Type</b>	INTEGER
<b>Default value</b>	0
<b>Range</b>	<div>&lt;=4294967295</div> <div>&gt;=1</div>
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMOSScheduleTableRef</b>
<b>Description</b>	Reference to synchronized OS ScheduleTables.
<b>Multiplicity</b>	1..1
<b>Type</b>	REFERENCE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

<b>Parameter Name</b>	<b>StbMSynchronizedTimeBaseRef</b>
<b>Description</b>	Reference to the mandatory required synchronized time-base.
<b>Multiplicity</b>	1..1
<b>Type</b>	REFERENCE
<b>Configuration class</b>	<b>VariantPreCompile:</b> VariantPreCompile
<b>Origin</b>	AUTOSAR_ECUC

#### 5.5.1.11. StbMBswModules

## 5.5.2. Application programming interface (API)

### 5.5.2.1. Type definitions

#### 5.5.2.1.1. StbM\_ConfigType

<b>Purpose</b>	StbM configuration data type.
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<b>Type</b>	struct	
<b>Members</b>	uint8 ConfigSet	

#### 5.5.2.1.2. StbM\_CustomerIdType

<b>Purpose</b>	Unique identifier of a notification customer.	
<b>Type</b>	uint16	

#### 5.5.2.1.3. StbM\_MeasurementType

<b>Purpose</b>	Structure which contains additional measurement data.	
<b>Type</b>	struct	
<b>Members</b>	uint32 pathDelay	Propagation delay in nanoseconds

#### 5.5.2.1.4. StbM\_OffsetRecordTableBlockType

<b>Purpose</b>	Offset Time Base Record Table Block.	
<b>Type</b>	struct	
<b>Members</b>	uint32 GlbSeconds	Seconds of the Offset Time Base
	uint32 GlbNanoSeconds	Nanoseconds of the Offset Time Base
	StbM_TimeBaseStatusType Time-BaseStatus	Time Base Status of the Local Time Base directly after synchronization with the Global Time Base

#### 5.5.2.1.5. StbM\_OffsetRecordTableHeadType

<b>Purpose</b>	Offset Time Base Record Table Header.	
<b>Type</b>	struct	
<b>Members</b>	uint8 OffsetTimeDomain	Time Domain 16..31

#### 5.5.2.1.6. StbM\_RateDeviationType

<b>Purpose</b>	Variables of this type are used to express a rate deviation in ppm.	
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<b>Type</b>	sint16
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#### 5.5.2.1.7. StbM\_SyncRecordTableBlockType

<b>Purpose</b>	Synchronized Time Base Record Table Block.	
<b>Type</b>	struct	
<b>Members</b>	uint32 GlbSeconds	Seconds of the Local Time Base directly after synchronization with the Global Time Base
	uint32 GlbNanoSeconds	Nanoseconds of the Local Time Base directly after synchronization with the Global Time Base
	StbM_TimeBaseStatusType TimeBaseStatus	Time Base Status of the Local Time Base directly after synchronization with the Global Time Base
	uint32 VirtualLocalTimeLow	HW counter reference value directly after synchronization with the Global Time Base
	StbM_RateDeviationType RateDeviation	Calculated Rate Deviation directly after rate deviation measurement
	uint32 LocSeconds	Seconds of the Local Time Base directly before synchronization with the Global Time Base
	uint32 LocNanoSeconds	Nanoseconds of the Local Time Base directly before synchronization with the Global Time Base
	uint32 PathDelay	Current propagation delay in nanoseconds

#### 5.5.2.1.8. StbM\_SyncRecordTableHeadType

<b>Purpose</b>	Synchronized Time Base Record Table Header.	
<b>Type</b>	struct	
<b>Members</b>	uint8 SynchronizedTimeDomain	Time Domain 0..15
	uint32 HWfrequency	HW Frequency in Hz

	uint32 HWprescaler	Prescaler value
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#### 5.5.2.1.9. StbM\_SynchronizedTimeBaseType

<b>Purpose</b>	Represent the kind of synchronized time-base.
<b>Type</b>	uint16
<b>Description</b>	Variables of this type are used to represent the kind of synchronized time-base.

#### 5.5.2.1.10. StbM\_TimeBaseNotificationType

<b>Purpose</b>	Represents the time base notification type.
<b>Type</b>	uint32
<b>Description</b>	Variables of this type are used to represent the number of global time related events. The type definition is used for storing the events in the status variable Notification-Events and for setting the mask variable NotificationMask which defines a subset of events for which an interrupt request shall be raised.

#### 5.5.2.1.11. StbM\_TimeBaseStatusType

<b>Purpose</b>	Represents the time base status.
<b>Type</b>	uint8
<b>Description</b>	<p>Bit 6 and 7 are always 0 (reserved for future usage)</p> <p>Variables of this type are used to express if and how a Local Time Base is synchronized to the Global Time Master. The type is a bit field of individual status bits, although not every combination is possible, i.e. any of the bits TIMEOUT, TIMELEAP_FUTURE, TIMELEAP_PAST and SYNC_TO_GATEWAY can only be set if the GLOBAL_TIME_BASE bit is set.</p>

#### 5.5.2.1.12. StbM\_TimeDiffType

<b>Purpose</b>	Offset Time Base Record Table Header.
<b>Type</b>	sint32

#### 5.5.2.1.13. StbM\_TimeStampType

<b>Purpose</b>	Type to represent long time intervals.	
<b>Type</b>	struct	
<b>Members</b>	<code>StbM_TimeBaseStatusType timeBaseStatus</code>	status of the time base
	<code>uint32 nanoseconds</code>	Nanoseconds part of the time
	<code>uint32 seconds</code>	32 bit LSB of the 48 bits Seconds part of the time
	<code>uint16 secondsHi</code>	16 bit MSB of the 48 bits Seconds part of the time
<b>Description</b>	Variables of this type are used for expressing time stamps including relative time and absolute calendar time. The absolute time starts from 1970-01-01 acc. to "[17], Annex C/C1" as specified for PTP. 0 to 281474976710655s == 3257812230d [0xFFFF FFFF FFFF] 0 to 999999999ns [0x3B9A C9FF] invalid value in nanoseconds: [0x3B9A CA00] to [0x3FFF FFFF] Bit 30 and 31 reserved, default: 0	

#### 5.5.2.1.14. StbM\_TimeTupleType

<b>Purpose</b>	Represent a Time Tuple.	
<b>Type</b>	struct	
<b>Members</b>	<code>StbM_TimeStampType globalTime</code>	Global Time
	<code>StbM_VirtualLocalTimeType virtualLocalTime</code>	Associated Virtual Local Time
<b>Description</b>	Variables of this type store a Time Tuple containing the Global Time and the associated Virtual Local Time.	

#### 5.5.2.1.15. StbM\_UserDataType

<b>Purpose</b>	Current user data of the time base.	
<b>Type</b>	struct	
<b>Members</b>	<code>uint8 userDataLength</code>	User Data Length in bytes
	<code>uint8 userByte0</code>	User Byte 0
	<code>uint8 userByte1</code>	User Byte 1
	<code>uint8 userByte2</code>	User Byte 2



#### 5.5.2.1.16. StbM\_VirtualLocalTimeType

<b>Purpose</b>	Represent the kind of synchronized time-base.	
<b>Type</b>	struct	
<b>Members</b>	<code>uint32 nanosecondsLo</code>	Least significant 32 bits of the 64 bit Virtual Local Time
	<code>uint32 nanosecondsHi</code>	Most significant 32 bits of the 64 bit Virtual Local Time
<b>Description</b>	Variables of this type store time stamps of the Virtual Local Time. The unit is nanoseconds.	

### 5.5.2.2. Macro constants

#### 5.5.2.2.1. RTE\_TYPE\_StbM\_CustomerIdType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_CustomerIdType" type.
<b>Value</b>	

#### 5.5.2.2.2. RTE\_TYPE\_StbM\_OffsetRecordTableBlockType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_OffsetRecordTableBlockType" type.
<b>Value</b>	

#### 5.5.2.2.3. RTE\_TYPE\_StbM\_OffsetRecordTableHeadType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_OffsetRecordTableHeadType" type.
<b>Value</b>	

#### 5.5.2.2.4. RTE\_TYPE\_StbM\_RateDeviationType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_RateDeviationType" type.
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<b>Value</b>	
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#### 5.5.2.2.5. RTE\_TYPE\_StbM\_SyncRecordTableBlockType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_SyncRecordTableBlockType" type.
<b>Value</b>	

#### 5.5.2.2.6. RTE\_TYPE\_StbM\_SyncRecordTableHeadType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_SyncRecordTableHeadType" type.
<b>Value</b>	

#### 5.5.2.2.7. RTE\_TYPE\_StbM\_SynchronizedTimeBaseType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_SynchronizedTimeBaseType" type.
<b>Value</b>	

#### 5.5.2.2.8. RTE\_TYPE\_StbM\_TimeBaseNotificationType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_TimeBaseNotificationType" type.
<b>Value</b>	

#### 5.5.2.2.9. RTE\_TYPE\_StbM\_TimeBaseStatusType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_TimeBaseStatusType" type.
<b>Value</b>	

#### 5.5.2.2.10. RTE\_TYPE\_StbM\_TimeDiffType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_TimeDiffType" type.
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<b>Value</b>	
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#### 5.5.2.2.11. RTE\_TYPE\_StbM\_TimeStampType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_TimeStampType" type.
<b>Value</b>	

#### 5.5.2.2.12. RTE\_TYPE\_StbM\_UserDataType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_UserDataType" type.
<b>Value</b>	

#### 5.5.2.2.13. RTE\_TYPE\_StbM\_VirtualLocalTimeType

<b>Purpose</b>	Enables the use of StbM's own definition for "StbM_VirtualLocalTimeType" type.
<b>Value</b>	

#### 5.5.2.2.14. STBM\_ALL\_TIME\_LEAP\_FLAGS\_MASK

<b>Purpose</b>	TIMELEAP_FUTURE bit (Bit 4) and TIMELEAP_PAST bit (Bit 5) in StbM_TimeBaseStatusType.
<b>Value</b>	0x30U
<b>Description</b>	0x30: Mask for both the time leap future and time leap past bits set

#### 5.5.2.2.15. STBM\_API\_BUSGETCURRENTTIME

<b>Purpose</b>	Service ID for <a href="#">StbM_BusGetCurrentTime()</a> function.
<b>Value</b>	0x1FU

#### 5.5.2.2.16. STBM\_API\_BUSSETGLOBALTIME

<b>Purpose</b>	Service ID for <a href="#">StbM_BusSetGlobalTime()</a> function.
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<b>Value</b>	0x0fU
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#### 5.5.2.2.17. STBM\_API\_GETCURRENTTIME

<b>Purpose</b>	Service ID for <a href="#">StbM_GetCurrentTime()</a> function.
<b>Value</b>	0x07U

#### 5.5.2.2.18. STBM\_API\_GETCURRENTVIRTUALLOCALTIME

<b>Purpose</b>	Service ID for <a href="#">StbM_GetCurrentVirtualLocalTime()</a> function.
<b>Value</b>	0x1EU

#### 5.5.2.2.19. STBM\_API\_GETOFFSET

<b>Purpose</b>	Service ID for <a href="#">StbM_GetOffset()</a> function.
<b>Value</b>	0x0eU

#### 5.5.2.2.20. STBM\_API\_GETOFFSETTIMERRECORDHEAD

<b>Purpose</b>	Service ID for <a href="#">StbM_GetOffsetTimeRecordHead()</a> function.
<b>Value</b>	0x17U

#### 5.5.2.2.21. STBM\_API\_GETRATEDEVIATION

<b>Purpose</b>	Service ID for <a href="#">StbM_GetRateDeviation()</a> function.
<b>Value</b>	0x11U

#### 5.5.2.2.22. STBM\_API\_GETSYNCTIMERRECORDHEAD

<b>Purpose</b>	Service ID for <a href="#">StbM_GetSyncTimeRecordHead()</a> function.
<b>Value</b>	0x16U

#### 5.5.2.2.23. STBM\_API\_GETTIMEBASESTATUS

<b>Purpose</b>	Service ID for <a href="#">StbM_GetTimeBaseStatus()</a> function.
<b>Value</b>	0x14U

#### 5.5.2.2.24. STBM\_API\_GETTIMEBASEUPDATECOUNTER

<b>Purpose</b>	Service ID for <a href="#">StbM_GetTimeBaseUpdateCounter()</a> function.
<b>Value</b>	0x1bU

#### 5.5.2.2.25. STBM\_API\_GETVERSIONINFO

<b>Purpose</b>	Service ID for <a href="#">StbM_GetVersionInfo()</a> function.
<b>Value</b>	0x05U

#### 5.5.2.2.26. STBM\_API\_INIT

<b>Purpose</b>	Service ID for <a href="#">StbM_Init()</a> function.
<b>Value</b>	0x00U

#### 5.5.2.2.27. STBM\_API\_MAINFUNCTION

<b>Purpose</b>	Service ID of <a href="#">StbM_MainFunction()</a> .
<b>Value</b>	0x04U

#### 5.5.2.2.28. STBM\_API\_SETGLOBALTIME

<b>Purpose</b>	Service ID for <a href="#">StbM_SetGlobalTime()</a> function.
<b>Value</b>	0x0bU

#### 5.5.2.2.29. STBM\_API\_SETOFFSET

<b>Purpose</b>	Service ID for <a href="#">StbM_SetOffset()</a> function.
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<b>Value</b>	0x0dU
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#### 5.5.2.2.30. STBM\_API\_SETRATECORRECTION

<b>Purpose</b>	Service ID for <a href="#">StbM_SetRateCorrection()</a> function.
<b>Value</b>	0x12U

#### 5.5.2.2.31. STBM\_API\_SETUSERDATA

<b>Purpose</b>	Service ID for <a href="#">StbM_SetUserData()</a> function.
<b>Value</b>	0x0cU

#### 5.5.2.2.32. STBM\_API\_STARTTIMER

<b>Purpose</b>	Service ID for <a href="#">StbM_StartTimer()</a> function.
<b>Value</b>	0x15U

#### 5.5.2.2.33. STBM\_API\_TRIGGERTIMETRANSMISSION

<b>Purpose</b>	Service ID for <a href="#">StbM_TriggerTimeTransmission()</a> function.
<b>Value</b>	0x1cU

#### 5.5.2.2.34. STBM\_API\_UPDATEGLOBALTIME

<b>Purpose</b>	Service ID for <a href="#">StbM_UpdateGlobalTime()</a> function.
<b>Value</b>	0x10U

#### 5.5.2.2.35. STBM\_EV\_GLOBAL\_TIME

<b>Purpose</b>	Status notification event EV_GLOBAL_TIME.
<b>Value</b>	0x01U

<b>Description</b>	Bit 0 (LSB): 0: synchronization to global time master not changed 1: GLOBAL_TIME_BASE in Stbm_TimeBaseStatusType has changed from 0 to 1
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#### 5.5.2.2.36. STBM\_EV\_RATECORRECTION

<b>Purpose</b>	Status notification event STBM_EV_RATECORRECTION.
<b>Value</b>	0x0400U
<b>Description</b>	Bit 10 1: A valid rate correction has been calculated (not beyond limits) 0: No rate correction calculated

#### 5.5.2.2.37. STBM\_EV\_RESYNC

<b>Purpose</b>	Status notification event STBM_EV_RESYNC.
<b>Value</b>	0x0200U
<b>Description</b>	Bit 9 1: A synchronization of the local time to the valid Global Time value has occurred 0: No resynchronization event occurred

#### 5.5.2.2.38. STBM\_EV\_SYNC\_TO\_GLOBAL\_MASTER

<b>Purpose</b>	Status notification event EV_SYNC_TO_GLOBAL_MASTER.
<b>Value</b>	0x100U
<b>Description</b>	Bit 8 1: SYNC_TO_GATEWAY bit of Time Domain changes from 1 to 0 0: otherwise

#### 5.5.2.2.39. STBM\_EV\_SYNC\_TO\_SUBDOMAIN

<b>Purpose</b>	Status notification event EV_SYNC_TO_SUBDOMAIN.
<b>Value</b>	0x80U
<b>Description</b>	Bit 7 1: SYNC_TO_GATEWAY bit in timeBaseStatus has changed from 0 to 1 0: otherwise

#### 5.5.2.2.40. STBM\_EV\_TIMELEAP\_FUTURE

<b>Purpose</b>	Status notification event EV_TIMELEAP_FUTURE.
<b>Value</b>	0x08U

<b>Description</b>	Bit 3 1: TIMELEAP_FUTURE bit in timeBaseStatus has changed from 0 to 1 0: otherwise
--------------------	---

#### 5.5.2.2.41. STBM\_EV\_TIMELEAP\_FUTURE\_REMOVED

<b>Purpose</b>	Status notification event EV_TIMELEAP_FUTURE_REMOVED.
<b>Value</b>	0x10U
<b>Description</b>	Bit 4 1: TIMELEAP_FUTURE bit in timeBaseStatus has changed from 1 to 0 0: otherwise

#### 5.5.2.2.42. STBM\_EV\_TIMELEAP\_PAST

<b>Purpose</b>	Status notification event EV_TIMELEAP_PAST.
<b>Value</b>	0x20U
<b>Description</b>	Bit 5 1: TIMELEAP_PAST bit in timeBaseStatus has changed from 0 to 1 0: otherwise

#### 5.5.2.2.43. STBM\_EV\_TIMELEAP\_PAST\_REMOVED

<b>Purpose</b>	Status notification event EV_TIMELEAP_PAST_REMOVED.
<b>Value</b>	0x40U
<b>Description</b>	Bit 6 1: TIMELEAP_PAST bit in timeBaseStatus has changed from 1 to 0 0: otherwise

#### 5.5.2.2.44. STBM\_EV\_TIMEOUT\_OCCURRED

<b>Purpose</b>	Status notification event EV_TIMEOUT_OCCURRED.
<b>Value</b>	0x02U
<b>Description</b>	Bit 1 1: TIMEOUT bit in timeBaseStatus has changed from 0 to 1 0: otherwise

#### 5.5.2.2.45. STBM\_EV\_TIMEOUT\_REMOVED

<b>Purpose</b>	Status notification event EV_TIMEOUT_REMOVED.
<b>Value</b>	0x04U
<b>Description</b>	Bit 2 1: TIMEOUT bit in timeBaseStatus has changed from 1 to 0 0: otherwise



#### 5.5.2.2.46. STBM\_E\_INIT\_FAILED

<b>Purpose</b>	StbM DET error code for initialization failure during StbM_Init.
<b>Value</b>	0x11U

#### 5.5.2.2.47. STBM\_E\_PARAM

<b>Purpose</b>	StbM DET error code for API call with invalid parameter value.
<b>Value</b>	0x0aU

#### 5.5.2.2.48. STBM\_E\_PARAM\_POINTER

<b>Purpose</b>	StbM DET error code for API call with invalid pointer address.
<b>Value</b>	0x10U

#### 5.5.2.2.49. STBM\_E\_SERVICE\_DISABLED

<b>Purpose</b>	StbM DET error code for API disabled by configuration.
<b>Value</b>	0x12U

#### 5.5.2.2.50. STBM\_E\_UNINIT

<b>Purpose</b>	StbM DET error code for API call before module initialization.
<b>Value</b>	0x0bU

#### 5.5.2.2.51. STBM\_GLOBAL\_TIME\_BASE\_FLAG

<b>Purpose</b>	GLOBAL_TIME_BASE bit (Bit 3) in StbM_TimeBaseStatusType.
<b>Value</b>	0x8U
<b>Description</b>	0x00: Local Time Base is based on Local Time Base reference clock only (never synchronized with Global Time Base) 0x01: Local Time Base was at least synchronized with Global Time Base one time

#### 5.5.2.2.52. STBM\_INSTANCE\_ID

<b>Purpose</b>	StbM instance id.
<b>Value</b>	0U

#### 5.5.2.2.53. STBM\_SYNC\_TO\_GATEWAY\_FLAG

<b>Purpose</b>	SYNC_TO_GATEWAY bit (Bit 2) in StbM_TimeBaseStatusType.
<b>Value</b>	0x4U
<b>Description</b>	0x00: Local Time Base is synchronous to Global Time Master 0x01: Local Time Base updates are based on a Time Gateway below the Global Time Master

#### 5.5.2.2.54. STBM\_TIMEOUT\_FLAG

<b>Purpose</b>	TIMEOUT bit (Bit 0) in StbM_TimeBaseStatusType.
<b>Value</b>	0x1U
<b>Description</b>	0x00: No Timeout on receiving Synchronization Messages 0x01: Timeout on receiving Synchronization Messages

#### 5.5.2.2.55. STBM\_TIME\_LEAP\_FUTURE\_FLAG

<b>Purpose</b>	TIMELEAP_FUTURE bit (Bit 4) in StbM_TimeBaseStatusType.
<b>Value</b>	0x10U
<b>Description</b>	0x00: No leap within the received time 0x10: Leap within the received time that exceeds a configured threshold in time leap future

#### 5.5.2.2.56. STBM\_TIME\_LEAP\_PAST\_FLAG

<b>Purpose</b>	TIMELEAP_PAST bit (Bit 5) in StbM_TimeBaseStatusType.
<b>Value</b>	0x20U
<b>Description</b>	0x00: No leap within the received time 0x20: Leap within the received time that exceeds a configured threshold in time leap past

### 5.5.2.3. Objects

#### 5.5.2.3.1. StbM\_TimeStamps

<b>Purpose</b>	Actual time tuple of all synchronized and offset time bases.
<b>Type</b>	<a href="#">StbM_TimeTupleType</a>

### 5.5.2.4. Functions

#### 5.5.2.4.1. StbM\_BusGetCurrentTime

<b>Purpose</b>	Service to get current Time Tuple.	
<b>Synopsis</b>	<pre>Std_ReturnType <b>StbM_BusGetCurrentTime</b> ( StbM_Syn- chronizedTimeBaseType timeBaseId , StbM_TimeStamp- Type * globalTimePtr , StbM_VirtualLocalTimeType * localTimePtr , StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x0A	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Parameters (out)</b>	globalTimePtr	- Value of the local instance of the Global Time, which is sampled when the function is called.
	localTimePtr	- Value of the Virtual Local Time, which is sampled when the function is called.
	userData	- User data of the time base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Returns the Time Tuple (Global Time, Virtual Local Time) taken when the function is called.	

#### 5.5.2.4.2. StbM\_BusSetGlobalTime

<b>Purpose</b>	Service to set global time by bus.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_BusSetGlobalTime ( StbM_Synchro- nizedTimeBaseType timeBaseId , const StbM_TimeStamp- Type * globalTimePtr , const StbM_UserDataType * user- DataPtr , const StbM_MeasurementType * measureDataP- tr , const StbM_VirtualLocalTimeType * localTimePtr );</pre>	
<b>Service ID</b>	0x0f	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
	globalTimePtr	- New Global Time value.
	userDataPtr	- User data of the time base.
	measureDataPtr	- New measurement data.
	localTimePtr	- Value of the Virtual Local Time associat- ed to the new Global Time.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the func- tion.
<b>Description</b>	Allows the Time Provider Modules to set the new Global Time tuple (i.e. the Received Time Tuple) to the StbM, which has been received on a bus.	

#### 5.5.2.4.3. StbM\_GetCurrentTime

<b>Purpose</b>	Service to get current time.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetCurrentTime ( StbM_Syn- chronizedTimeBaseType timeBaseId , StbM_TimeStamp- Type * timeStamp , StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x07	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Parameters (out)</b>	timeStamp	- Time stamp containing the current time.

	userData	- User data of the time base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Returns a time value - Local Time derived from Global Time.	

#### 5.5.2.4.4. StbM\_GetCurrentVirtualLocalTime

<b>Purpose</b>	Service to return the Virtual Local Time.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetCurrentVirtualLocal- Time ( StbM_SynchronizedTimeBaseType timeBaseId , StbM_VirtualLocalTimeType * localTimePtr );</pre>	
<b>Service ID</b>	0x09	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Parameters (out)</b>	localTimePtr	- Current Virtual Local Time value.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Returns the Virtual Local Time of the referenced Time Base.	

#### 5.5.2.4.5. StbM\_GetOffset

<b>Purpose</b>	Service to get the value of a offset time base.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetOffset ( StbM_Synchro- nizedTimeBaseType timeBaseId , StbM_TimeStamp- Type * timeStamp , StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x0e	
<b>Sync/Async</b>	Synchronous	

<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Parameters (out)</b>	timeStamp	- Time stamp containing the current offset time.
	userData	- The current user data.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Allows the Timebase Provider Modules to get the currentoffset time.	

#### 5.5.2.4.6. StbM\_GetOffsetTimeRecordHead

<b>Purpose</b>	Service to get Offset Header Time Record information.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetOffsetTimeRecordHead ( StbM_SynchronizedTimeBaseType timeBaseId , StbM_OffsetRecordTableHeadType * offsetRecordTableHead );</pre>	
<b>Service ID</b>	0x17	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	timeBaseId	- Time Base reference.
	offsetRecordTableHead	- Header of the table.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	Table access done.
	E_NOT_OK	Table contains no data or access invalid.
<b>Description</b>	Accesses to the recorded snapshot data Header of the table belonging to the Offset Time Base.	

#### 5.5.2.4.7. StbM\_GetRateDeviation

<b>Purpose</b>	Service to return the value of the current rate deviation of a Time Base.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetRateDeviation ( StbM_SynchronizedTimeBaseType timeBaseId , StbM_RateDeviationType * rateDeviation );</pre>	

<b>Service ID</b>	0x11	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	timeBaseId	- Time Base reference.
<b>Parameters (out)</b>	rateDeviation	- Value of the current rate deviation of a Time Base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Returns value of the current rate deviation of a Time Base	

#### 5.5.2.4.8. StbM\_GetSyncTimeRecordHead

<b>Purpose</b>	Service to get Sync Header Time Record information.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetSyncTimeRecordHead ( StbM_SynchronizedTimeBaseType timeBaseId , StbM_SyncRecordTableHeadType * syncRecordTableHead );</pre>	
<b>Service ID</b>	0x16	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	timeBaseId	- Time Base reference.
	syncRecordTableHead	- Header of the table.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	Table access done.
	E_NOT_OK	Table contains no data or access invalid.
<b>Description</b>	Accesses to the recorded snapshot data Header of the table belonging to the Synchronized Time Base.	

#### 5.5.2.4.9. StbM\_GetTimeBaseStatus

<b>Purpose</b>	Service to return the default status of the time base.
----------------	--

<b>Synopsis</b>	<pre>Std_ReturnType StbM_GetTimeBaseStatus ( StbM_SynchronizedTimeBaseType timeBaseId , StbM_TimeBaseStatusType * syncTimeBaseStatus , StbM_TimeBaseStatusType * offsetTimeBaseStatus );</pre>	
<b>Service ID</b>	0x14	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Parameters (out)</b>	syncTimeBaseStatus	- Status of the Synchronized Time Base.
	offsetTimeBaseStatus	- Status of the Offset Time Base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Returns the detailed status of the Time Base. For Offset Time Bases the status of the Offset Time Base itself and the status of the underlying Synchronized Time Base is returned.	

#### 5.5.2.4.10. StbM\_GetTimeBaseUpdateCounter

<b>Purpose</b>	Service to get the counter value of the time base.	
<b>Synopsis</b>	<pre>uint8 StbM_GetTimeBaseUpdateCounter ( StbM_SynchronizedTimeBaseType timeBaseId );</pre>	
<b>Service ID</b>	0x1b	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Return Value</b>	Counter value belonging to the Time Base, that indicates a Time Base update to the TimeSync Modules.	
<b>Description</b>	Allows the TimeSync Modules to detect, whether a Time Base should be transmitted immediately in the subsequent [Bus]TSyn_MainFunction() cycle.	

#### 5.5.2.4.11. StbM\_GetVersionInfo

<b>Purpose</b>	Get module version information.
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<b>Synopsis</b>	<code>void StbM_GetVersionInfo ( Std_VersionInfoType * versioninfo );</code>	
<b>Service ID</b>	0x05	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (out)</b>	<code>versioninfo</code>	Version information of the StbM module
<b>Description</b>	Returns the version information of the StbM module	

#### 5.5.2.4.12. StbM\_Init

<b>Purpose</b>	Initialize the StbM module.	
<b>Synopsis</b>	<code>void StbM_Init ( const StbM_ConfigType * ConfigPtr );</code>	
<b>Service ID</b>	0x00	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	<code>ConfigPtr</code>	Pointer to the selected configuration set.
<b>Description</b>	This function initializes the StbM module	

#### 5.5.2.4.13. StbM\_MainFunction

<b>Purpose</b>	StbM Mainfunction.	
<b>Synopsis</b>	<code>void StbM_MainFunction ( void );</code>	
<b>Service ID</b>	0x04	
<b>Description</b>	This function will be called cyclically by a task body provided by the BSW Scheduler. It will invoke the triggered customers and synchronize the referenced OS ScheduleTables.  Timing: FIXED_CYCLIC.	

#### 5.5.2.4.14. StbM\_SetGlobalTime

<b>Purpose</b>	Service to set global time.
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<b>Synopsis</b>	<pre>Std_ReturnType StbM_SetGlobalTime ( StbM_Synchronized-     TimeBaseType timeBaseId , const StbM_TimeStampType     * timeStamp , const StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x0b	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
	timeStamp	- Time stamp containing the current time.
	userData	- User data of the time base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Allows the Customers to set the new global time that has to be valid for the system, which will be sent to the busses and modify HW registers behind the providers, if supported. This function will be used if a Time Master is present in this ECU.	

#### 5.5.2.4.15. StbM\_SetOffset

<b>Purpose</b>	Service to set the value of a offset time base.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_SetOffset ( StbM_Synchronized-     TimeBaseType timeBaseId , const StbM_TimeStampType     * timeStamp , const StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x0d	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
	timeStamp	- Time stamp containing the current offset time.
	userData	- User data of the time base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.

<b>Description</b>	Allows the Customers and the Timebase Provider Modules to set the offset time that has to be valid for the system.
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#### 5.5.2.4.16. StbM\_SetRateCorrection

<b>Purpose</b>	Service to set the Rate Correction for a Time Base.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_SetRateCorrection ( StbM_SynchronizedTime-BaseType timeBaseId , StbM_RateDeviationType rateDeviation );</pre>	
<b>Service ID</b>	0x12	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	timeBaseId	- Time Base reference.
	rateDeviation	- Value of the applied rate deviation.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Allows to set the rate of a Synchronized Time Base (being either a Pure Local Time Base or not).	

#### 5.5.2.4.17. StbM\_SetUserData

<b>Purpose</b>	Service to set user specific data.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_SetUserData ( StbM_SynchronizedTime-BaseType timeBaseId , const StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x0c	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
	userData	- User data of the time base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.

	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Allows the Customers to set the new user data that has to be valid for the system, which will be sent to the busses.	

#### 5.5.2.4.18. StbM\_StartTimer

<b>Purpose</b>	Service to set a time value, which the Time Base value is compared against.	
<b>Synopsis</b>	<pre>Std_ReturnType <b>StbM_StartTimer</b> ( StbM_SynchronizedTimeBaseType timeBaseId , StbM_CustomerIdType customerId , const StbM_TimeStampType * expireTime );</pre>	
<b>Service ID</b>	0x15	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- Time Base reference
	customerId	- Status of the Synchronized Time Base
	expireTime	- Time value relative to current Time Base value of the Notification Customer, when the Timer shall expire
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Allows the Customers to set an expire time (through StartTimer C-S Interface), which the Time Base value is compared against.	

#### 5.5.2.4.19. StbM\_TriggerTimeTransmission

<b>Purpose</b>	Service to force the TimeSync Modules to transmit the current Time Base.	
<b>Synopsis</b>	<pre>Std_ReturnType <b>StbM_TriggerTimeTransmission</b> ( StbM_SynchronizedTimeBaseType timeBaseId );</pre>	
<b>Service ID</b>	0x1c	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	

<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Called by the [Upper Layer] to force the TimeSync Modules to transmit the current Time Base again due to an incremented timeBaseUpdateCounter[timeBaseId].	

#### 5.5.2.4.20. StbM\_UpdateGlobalTime

<b>Purpose</b>	Service to update global time.	
<b>Synopsis</b>	<pre>Std_ReturnType StbM_UpdateGlobalTime ( StbM_Synchro- nizedTimeBaseType timeBaseId , const StbM_TimeStamp- Type * timeStamp , const StbM_UserDataType * userData );</pre>	
<b>Service ID</b>	0x10	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant	
<b>Parameters (in)</b>	timeBaseId	- ID of the synchronized time-base.
	timeStamp	- Time stamp containing the current time.
	userData	- User data of the time base.
<b>Return Value</b>	the success/failure of the function call	
	E_OK	In case of successful call of the function.
	E_NOT_OK	In case of unsuccessful call of the function.
<b>Description</b>	Allows the Customers to set the Global Time that will be sent to the buses. This function will be used if a Time Master is present in this ECU. Using UpdateGlobalTime will not lead to an immediate transmission of the Global Time.	

### 5.5.3. Integration notes

#### 5.5.3.1. Exclusive areas

This section describes the exclusive areas used by the `StbM` module.

#### 5.5.3.1.1. SCHM\_STBM\_EXCLUSIVE\_AREA\_0

<b>Protected data structures</b>	All shared data that shall be protected from mutual access.
<b>Recommended locking mechanism</b>	The exclusive area shall be protected by a locking mechanism. The options for locking are described in the EB tresos AutoCore Generic documentation. Refer to the section Mapping exclusive areas in the basic software modules in the Integration notes section for details.

#### 5.5.3.1.2. SCHM\_STBM\_EXCLUSIVE\_AREA\_1

<b>Protected data structures</b>	StbM requires this exclusive area in order to provide enhanced precision of synchronizing of an OsScheduleTable.
<b>Recommended locking mechanism</b>	<p>This exclusive area must always be assigned to an Os resource that is shared with a high priority task. The options for locking are described in the EB tresos AutoCore Generic documentation. Refer to the section Mapping exclusive areas in the basic software modules in the Integration notes section for details.</p> <p>This exclusive area is not available if Tiggered Costumers are not used by StbM.</p>

#### 5.5.3.2. Production errors

Production errors are not reported by the StbM module.

#### 5.5.3.3. Memory mapping

General information about memory mapping is provided in the EB tresos AutoCore Generic documentation. Refer to the section Memory mapping and compiler abstraction in the Integration notes section for details.

The following table provides the list of sections that may be mapped for this module:

<b>Memory section</b>
CODE

VAR_INIT_8
VAR_CLEARED_32
VAR_CLEARED_8
VAR_CLEARED_UNSPECIFIED
CONST_UNSPECIFIED
CONFIG_DATA_8
CONFIG_DATA_UNSPECIFIED
VAR_SHARED_TIME_DATA

#### 5.5.3.4. Integration requirements

##### WARNING



##### Integration requirements list is not exhaustive

The following list of integration requirements helps you to integrate your product. However, this list is not exhaustive. You also require information from the user's guide, release notes, and EB tresos AutoCore known issues to successfully integrate your product.

##### 5.5.3.4.1. lim.StbM.EB\_INTREQ\_StbM\_0001

<b>Description</b>	<p>StbM needs module property files in adjacent modules. For auto detection and full control of adjacent modules, the StbM depends on the existence of a adequate module property file in this adjacent module. A module without module property file suffers the following limitations:</p> <ul style="list-style-type: none"> <li>- StbM can not control a master time domain of this BSW module.</li> <li>- StbM can not use a possible hardware timestamp capability of this BSW module.</li> <li>- The StbM configuration must contain a reserved time base for this BSW module.</li> <li>- Parameter StbMDevErrorDetect must be disabled (if at least one such module is used)</li> </ul>
<b>Rationale</b>	<p>The mechanism of module property files allows the StbM to handle adjacent modules in a generic way. Adjacent modules often do not follow a common guideline for their module configuration and interfaces. In addition the StbM does not need to know how many and which modules shall be handled at configuration time.</p>

#### 5.5.3.4.2. lim.StbM.EB\_INTREQ\_StbM\_0002

<b>Description</b>	<p>Limitations on synchronization of schedule tables. To guarantee fault-free synchronization of schedule tables it is necessary to consider the following configuration constraints: Os counter interval</p> <ul style="list-style-type: none"><li>- The Os counter interval (depends on OsCounterMaxAllowedValue and the tick time) must be greater than the MainFunction period of StbM.</li></ul> <p>Schedule Table duration</p> <ul style="list-style-type: none"><li>- The duration of the synchronized schedule table (depends on OsScheduleTableDuration and the tick time) must be smaller than one second.</li><li>- In addition the value of OsScheduleTableDuration must not exceed 4294967296.</li><li>- In addition one second must be an integer multiple of the duration of the synchronized schedule table.</li></ul>
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#### 5.5.3.4.3. lim.StbM.EB\_INTREQ\_StbM\_0003

<b>Description</b>	<p>Call to StbM_BusSetGlobalTime() is mandatory. The StbM requires that any adjacent bus specific time synchronization module (e.g. EthTSyn) notifies updates of the global time by using the API StbM_BusSetGlobalTime() when acting as time consumer (time slave) or time distributor (time gateway).</p> <ul style="list-style-type: none"><li>- The StbM does not obtain the time by itself for any time base with an assigned slave time domain.</li></ul>
<b>Rationale</b>	<p>This mechanism allows a common implementation for different configurations when acting as time distributor (time gateway). StbM only needs to supply the time in the context of StbM_BusSetGlobalTime(). Without this limitation StbM needs to supply the time in the context of:</p> <ul style="list-style-type: none"><li>- StbM_BusSetGlobalTime() if the slave does not support hardware timestamping.</li><li>- StbM_GetCurrentTime() if the master(s) does not</li></ul>



	support hardware timestamping. - StbM_MainFunction() if both the slave and the master(s) support hardware timestamping.
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#### 5.5.3.4.4. lim.StbM.EB\_INTREQ\_StbM\_0004

<b>Description</b>	Limitation regarding the invocation of StbM_Init function. The invocation of StbM_Init, should be called after the EcuM module calls NvM_ReadAll.
<b>Rationale</b>	If the parameter StbMStoreTimebaseNonVolatile equals STORAGE_AT_SHUTDOWN and there exists a reference from a TimeBase to a NvMBlock, then whenever the TimeStamp will be changed, it will be stored in NvMBlock at SHUTDOWN phase and afterwards at INITIALIZATION phase (StbM_Init), the TimeStamp will be loaded from NvM module. If NvM_ReadAll is not called before StbM_Init, then StbM module will take as initial TimeStamp some garbage values.

#### 5.5.3.4.5. lim.StbM.EB\_INTREQ\_StbM\_0005

<b>Description</b>	Os counter with the highest resolution shall be used. The StbM provides the possibility to derive the current time from an Os counter if no hardware timestamp support is available. In this case it is recommended to select the Os counter via parameter StbMLocalTimeHardware with the highest resolution.
<b>Rationale</b>	The resolution of the Os counter determines the precision of the time base.

#### 5.5.3.4.6. lim.StbM.EB\_INTREQ\_StbM\_0006

<b>Description</b>	Exclusive access to Os counter used to derive local time. It shall be ensured that the Os counter used by StbM to derive the current time via parameter StbMLocalTimeHardware is not modified by any other basic software module or application.
<b>Rationale</b>	The StbM uses the Os counter to determine the current time if no hardware timestamp support is available. A leap in time of the respective Os counter results in a wrong time.

#### 5.5.3.4.7. lim.StbM.EB\_INTREQ\_StbM\_0007

<b>Description</b>	The exclusive areas which ensure that certain regions in the TSyn/StbM modules are not being preempted must not be configured to interrupt suspending/disabling in case OS counters are used as sources for the virtual local time.
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<b>Rationale</b>	StbM cannot call GetCounterValue() with interrupts disabled/suspended (according to SWS_Os_00093)
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#### 5.5.3.4.8. lim.StbM.EB\_INTREQ\_StbM\_0008

<b>Description</b>	StbM_MainFunction period must not exceed 3 sec.
<b>Rationale</b>	StbM needs to update the Main Tuple every 3 sec on the Main Function if no update happened before.

#### 5.5.3.4.9. lim.StbM.EB\_INTREQ\_StbM\_0009

<b>Description</b>	GptChannelMode of each Gpt Channel which is configured as Local hardware clock has to be configured to GPT_CH_MODE_CONTINUOUS.
<b>Rationale</b>	Gpt channel can be configured in "one-shot mode" or "continuous mode". Gpt Channel mode has to be configured to GPT_CH_MODE_CONTINUOUS, because when the timer reaches the target the timer shall continue running with the value "0" at next time tick, instead of stopping and maintaining its timer value unchanged.

#### 5.5.3.4.10. lim.StbM.EB\_INTREQ\_StbM\_0010

<b>Description</b>	GptChannelTickValueMax of each Gpt Channel which is configured as Local hardware clock has to be configured to the maximum value of UINT32.
<b>Rationale</b>	It determines the precision of the time base.

#### 5.5.3.4.11. lim.StbM.EB\_INTREQ\_StbM\_0011

<b>Description</b>	StbMClockFrequency and StbMClockPrescaler of each StbM TimeBase has to be different from zero and StbMClockFrequency/StbMClockPrescaler shall have a value equal with the value of the GptChannel Frequency from Gpt for a better precision.
<b>Rationale</b>	When calling Gpt_GetTimeElapsed() API, StbM obtains the time in GPT ticks. The time in Gpt ticks has to be converted into nanoseconds, using StbMClockFrequency/StbMClockPrescaler factor, that is why StbMClockFrequency and StbMClockPrescaler shall be configured to a value different from zero.

#### 5.5.3.4.12. lim.StbM.EB\_INTREQ\_StbM\_0012

<b>Description</b>	Limitation regarding the invocation of StbM_Init function. In case an StbM TimeBase uses Gpt as time source, the invocation of StbM_Init, should be called after the Gpt_Init. Please also make sure that Gpt is in NORMAL mode (not in SLEEP mode).
<b>Rationale</b>	If an StbM Time Base uses Gpt as time source for Virtual Local Time, the Gpt_Init function shall be called before StbM_Init, because Gpt module starts the hardware timers on the configured channels. The Gpt should be in NORMAL mode, because if Notification of customers is enabled, Gpt_EnableNotification() will be called.

#### 5.5.3.4.13. lim.StbM.EB\_INTREQ\_StbM\_0013

<b>Description</b>	Limitation regarding the usage of EthTSyn as a StbMLocalTimeHardware reference. An StbM time base can have as StbMLocalTimeHardware reference an EthTSyn Time Domain, only if EthTSyn module has EthTSynHardwareTimestampSupport parameter set to TRUE. This limitation applies to configuration parameter StbMLocalTimeHardware.
<b>Rationale</b>	The StbM module will not get the current value of the free running HW counter from the corresponding Ethernet Controller via EthIf_GetCurrentTime(), because the EthIf_GetCurrentTime() call will not be performed, if EthTSynHardwareTimestampSupport parameter is set to FALSE.

#### 5.5.3.4.14. lim.StbM.EB\_INTREQ\_StbM\_0014

<b>Description</b>	The GptChannelMode of the GptChannelConfiguration channel, configured as StbMGptTimerRef, shall be configured to GPT_CH_MODE_ONESHOT.
<b>Rationale</b>	Gpt channel can be configured in "one-shot mode" or "continuous mode". Gpt Channel mode has to be configured to GPT_CH_MODE_ONESHOT, because when the timer reaches the target the timer will expire and maintain its timer value unchanged, until the next Gpt_StartTimer() function call.

#### 5.5.3.4.15. lim.StbM.EB\_INTREQ\_StbM\_0015

<b>Description</b>	The GptChannelTickValueMax of the GptChannelConfiguration channel, configured as StbMGptTimerRef, shall be configured to a value greater or equal to the value of StbMTimerStartThreshold converted in ticks.
<b>Rationale</b>	For each Gpt channel a GptChannelTickValueMax can be configured. GptChannelTickValueMax parameter shall be configured to a value greater or equal to StbM-

	TimerStartThreshold converted into ticks, because the Gpt module shall be able to count the ticks until expiration time. Expiration time shall not exceed the maximum timer resolution.
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#### 5.5.3.4.16. lim.StbM.EB\_INTREQ\_StbM\_0016

<b>Description</b>	The GptChannelTickFrequency of the GptChannelConfiguration channel, configured as StbMGptTimerRef, shall be configured to have a tick duration of one micro second.
<b>Rationale</b>	For each Gpt channel a GptChannelTickFrequency can be configured. GptChannelTickFrequency parameter shall be configured to have a tick duration of one micro second. See ECUC_StbM_00039 requirement.

#### 5.5.3.4.17. lim.StbM.EB\_INTREQ\_StbM\_0017

<b>Description</b>	If Gpt_ValueType is defined to be of type uint16, StbMTimerStartThreshold shall be configured to a maximum value of 0.065535 seconds.
<b>Rationale</b>	If Gpt_ValueType is defined to uint16, StbMTimerStartThreshold is limited to 0.065535 seconds, in order for Gpt to be able to count the maximum difference of time with which it can be called (65535 ticks).

#### 5.5.3.4.18. lim.StbM.EB\_INTREQ\_StbM\_0018

<b>Description</b>	The channel reference of the GptChannelConfiguration channel, configured as StbMGptTimerRef, shall NOT be used for ANY other purposes within the ECU configuration!
<b>Rationale</b>	StbM uses this Gpt channel to monitor notification customers which can not be interrupted by any means.

#### 5.5.3.4.19. lim.StbM.EB\_INTREQ\_StbM\_0019

<b>Description</b>	The length of the NvM block used to store the StbM_TimeStamps[].globalTime variable should be double checked. The Service Needs Wizard automatically generates it to 16, which includes padding.
<b>Rationale</b>	Depending on compiler options, padding might not be included, so the length will differ.