

# End-to-End Protection Wrapper Generator

U M

V : 2.0.1  
D : 13.03.2015  
D : D-MSP-G-70-001

## TTTech Automotive GmbH

S S 7, A-1040 V , A , T . + 43 1 585 34 34-0, F +43 1 585 34 34-90, @ - .

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U . U TTT

A G H. TTT  
T . S  
2015 TTT A G H. A  
TTT A G H C P I

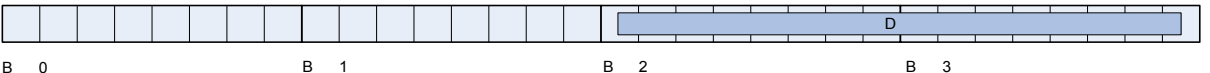
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T I-PDU signal

:

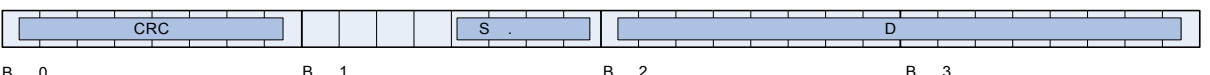


The diagram shows a horizontal bar representing an I-PDU. It is divided into four sections labeled B 0, B 1, B 2, and B 3. B 0 and B 1 are light blue. B 2 contains a darker blue rectangle labeled 'D'. B 3 is light blue.

B 0 B 1 B 2 B 3

T end-to-end communication protection

:



The diagram shows a horizontal bar representing end-to-end communication protection. It is divided into four sections labeled B 0, B 1, B 2, and B 3. B 0 contains a darker blue rectangle labeled 'CRC'. B 1 is light blue. B 2 contains a darker blue rectangle labeled 'S'. B 3 contains a darker blue rectangle labeled 'D'.

B 0 B 1 B 2 B 3

F , AUTOSAR E2Elib Specification

AS E2E SWS (68)

## 1.1 E2E Protection Wrapper Generator

Figure 1: E2E Protection Wrapper (E2EPW) Architecture

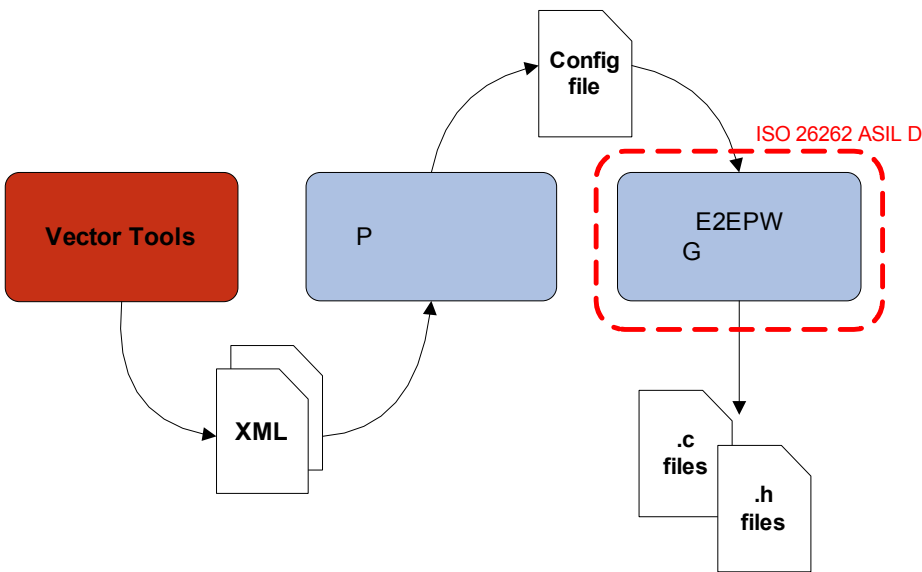
The E2E Protection Wrapper Generator (E2EPWG) is a tool that generates E2E protection code for the RTE. It is based on the AUTOSAR E2Elib Specification [AS E2E SWS](#) <sup>(68)</sup>, and the E2EConfig file.

**Note:** The E2EPWG is based on the ISO 26262 <sup>(68)</sup> End-to-End Protection Wrapper Safety Manual [TT E2EPW SM](#) <sup>(68)</sup>.

1.2 Tools Integration

The E2EPWG is integrated into the Vector tools environment. Example (integration into the Vector tools environment):

The E2EPWG is integrated into the Vector tools environment. The E2EPWG is a tool that generates E2E protection code for the RTE. It is based on the AUTOSAR E2Elib Specification [AS E2E SWS](#) <sup>(68)</sup>, and the E2EConfig file.



1.3 Use Cases

The E2EPWG is used to generate E2E protection code for the RTE. It is based on the AUTOSAR E2Elib Specification [AS E2E SWS](#) <sup>(68)</sup>, and the E2EConfig file.

**E2EPWG counter (SC)** checksum (CRC) sequence end-to-end communication protection.

**Use Cases:**

- AUTOSAR E2E P W RTE ( )
- AUTOSAR E2E P W RTE ( ) **AUTOSAR NO**

**RTE)**

- J1939 CAN E2E P W ( J1939 CAN)

C , AUTOSAR RTE AUTOSAR NO RTE  
T AUTOSAR RTE .

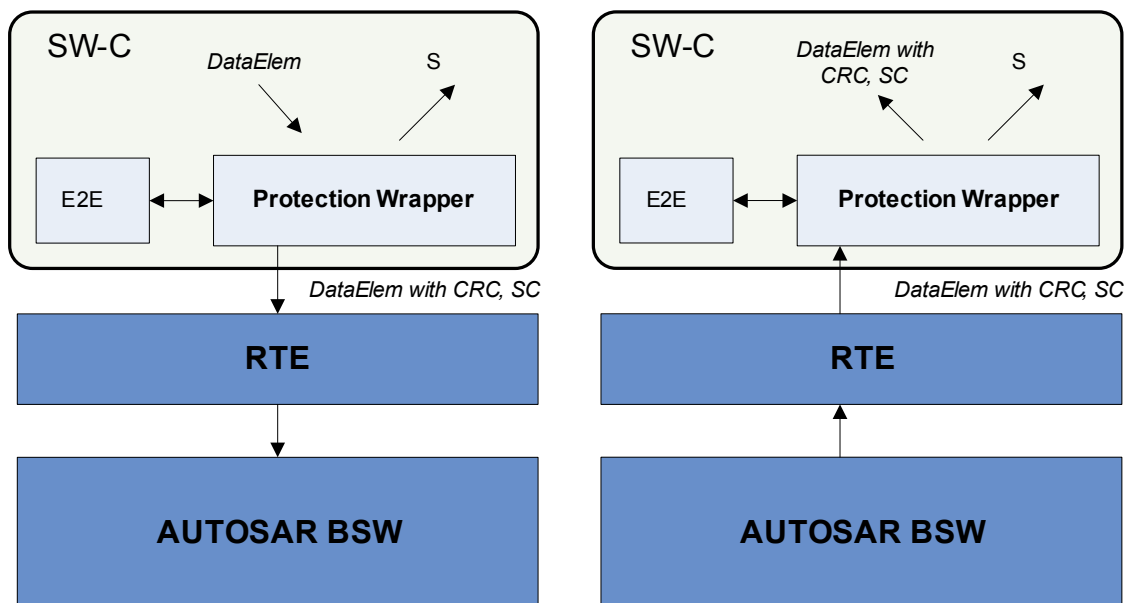
**Overview of Use Case AUTOSAR RTE**

I , SW-C / D E (complex data element  
AUTOSAR) , CRC SC  
T Protection Wrapper SW-C.

A transmission ( left ), P W CRC  
SC D E RTE.

A reception ( right ), P W CRC SC  
D E SW-C.

T  
D E .



## 2 Versions

T U M

- **Preprocessor Version 2.0.2**
- **Protection Wrapper Generator Version 2.0.1.**

## 3 Installation

T **Preprocessor** **E2EPWG** W . T

I **E2EPW** V BSW,

- E2EP M M .
  - E2EP C C .
- V BSW.

O E2EP C C . E2EP M M .  
**Preprocessor** **E2EPWG**

*AUTOSAR Specification of Compiler Abstraction* [AS COMABS SWS](#) <sup>(68)</sup>  
*AUTOSAR Specification of Memory Mapping* [AS MEM SWS](#) <sup>(68)</sup>

F , P  
 .P

**Note:** I P E2EPWG ,  
 T  
 E2EP C C . E2EP M M .  
 C C . M M .

T P 2 **Python 2.7.3** **lxml 2.2.8.**

T  
 LICENSE, P

T **DLLs** :

- SER32.
- SHELL32.
- SOCK32.
- AD API32.
- S2 32.
- KERNEL32.
- MS CR90.

**Note:** I DLL , . T  
 DLL :// . / / . ?  
 F ID=9 2 534-3 03-4391-8 4 -074 9 2 1 & =

## 4 Preprocessor

T P design ECU information .T P SW-C E2EConfig file ( E2EPWG 8

### 4.1 Preprocessor Help

T P C  
:  
E2EP G P P 2.0.2  
:  
S D O D P N S D C  
O :  
- , --  
- B EORDER, -- - =B EORDER  
S - - B EORDER.  
BIG ENDIAN, LI LE ENDIAN, HIGH B E FIRS ,  
LO B E FIRS .  
- FILE, -- 2 =FILE  
E E2EP G  
P P .  
- LE EL, -- =LE EL  
O ( LE EL  
) . L 1 .  
- , -- E  
-E FILE, -- =FILE A EC D F -

#### 4.1.1 Using the Preprocessor

T Preprocessor, command  
:  
.  
[<SystemDescriptionComm>] < > <ProjectName>  
<SystemDescription> <OutputDir>



T mandatory parameters:

Name	Meaning
<code>&lt;ProjectName&gt;</code>	T name . T generated configuration .
<code>[&lt;SystemDescriptionComment&gt;]</code>	T location name (ECU ) system description file. I  , . . . IPDU . T optional AUTOSAR 3 ,  S D AUTOSAR 4 .
<code>&lt;SystemDescription&gt;</code>	T system description location name ( ). T  , . ( ) I . , IPDU IPDU . F AUTOSAR 4 , T ECU ML AUTOSAR 3.1.4, 3.2.1, 3.2.2, 4.0.3, 4.1.2, 4.1.3. T V . T .
<code>&lt;OutputDir&gt;</code>	T path generated configuration .

T optional parameters:

Name	Meaning
-	S <u>8</u> .
- B EORDER, -- - - =B EORDER	T value attribute B O CP E2EConfig file. T CPU - -E.  <b>Possible values:</b> ▪ BIG ENDIAN (=HIGH B E FIRS ) ,

Name	Meaning
	<ul style="list-style-type: none"> <li>LI LE ENDIAN (=LO B E FIRS ).</li> </ul>
- FILE, -- 2 =FILE	<p>T E2EPWG. W</p> <p>P E2EConfig file.</p> <p>T ( E2EPWG)</p> <p>:</p> <p>&lt;FILE&gt; &lt;O D &gt; &lt;E P N &gt;.</p> <p>&lt;O D &gt;</p> <ul style="list-style-type: none"> <li>&lt;FILE&gt; <b>executable</b> FILE,</li> <li>&lt;O D &gt; OutputDir</li> <li>&lt;E P N &gt; EcuProjectName</li> </ul> <p>P</p>
- LE EL, -- =LE EL	<p>T reporting. T</p> <p>detailed error</p> <p>Possible values:</p> <ul style="list-style-type: none"> <li>L above 1 debugging. T default 0 (</li> <li>F level 1,</li> <li>ML (</li> <li>F level 2, PATH PATH PATH ML</li> </ul>
- , --	<p>T V P</p>
-E, --	<p>T ECUC CPU</p>

**Note:** G , E2EPWG  
 <OutputDir> .I E2EPWG  
 , .I  
 , <OutputDir>  
 P - .

#### 4.1.2 Behavior and Log Output

T P 1.6.1, 2.0.1  
 .P P  
 E2EC / AR ML  
 .  
 T -  
 AR ML  
 E2EC .T :  
 • A .T  
 (V D V ),  
 • W  
 • T  
 AR ML,  
 • T E2EC  
 E2EPW G .M E2EC AR ML  
 E2EC .H W  
 I  
 • E T E P  
 .T P A  
 E2EC  
 I , .

#### 4.1.3 Log Message Format

T V  
 D V .  
 T :  
 <Severity> E2E<ID> - <Summary>  
 - <Description>  
 W <Severity> :  
 • I - F ,  
 P .  
 • -D ,  
 " " "  
 / "

• E - F .T , -  
 , . . , , .  
 <ID> - .  
 <S > .  
 <Description> .

#### 4.1.4 Warning and Info Log Messages

T P ,  
 W I .  
 S I 0  
 ( - / -- ).  
 T W I  
 .S .

Message	Description
<b>[Info] E2E01004 -</b> - F M D C I 15 14 - E2E-	T M D C I SWS E2E , E2EPW G . B : M D C I M D C .T 14 (P 1) 15 (P 2). H , M D C E2E .T M D C I 13 14 P 1 (14 15 P 2). T E2EPW G , , .T , P I . A , P E2EC .
<b>[Info] E2E01100 -</b> C , , - -	O 0. I , .T . I I E2E01100 .
<b>[Info] E2E01100 -</b> S G 16 ( )	T I E2E01100 . I . P E2EPW G - P , B P

Message	Description
	<p>E2EC . T</p> <p>P A</p> <p>E2EC .</p>
<p><b>[Warning] E2E00210 -</b></p> <p>- C /</p> <p>( )</p> <p>'E R E C P 2 24 6</p> <p>7 'R E2E C</p> <p>B P</p> <p>S P</p>	<p>T W</p> <p>. T</p> <p>B P</p> <p>S B L ,</p> <p>(</p> <p>, E2EC</p> <p>). T E2EPW</p> <p>G</p>
<p><b>[Info] E2E01101 -</b></p> <p>- T /</p> <p>E -T -E -P</p> <p>( 'E -T -E -P SHORT-</p> <p>NAME'). N E2E</p> <p>E -T -E -</p> <p>P . H ,</p> <p>E -T -E -</p> <p>P .</p>	<p>T</p> <p>E -T -E -P . T</p> <p>P , A E -T -E -</p> <p>P . H ,</p> <p>E -T -E -P .</p>
<p><b>[Warning] E2E01003 -</b></p> <p>- P 'PROFILE 04'</p> <p>/ E2EPW</p> <p>- P</p> <p>E2E T (E2E )</p> <p>F E -T -E -P</p> <p>C 'PROFILE 04'</p> <p>E .</p>	<p>I P 4, 5, 6 , P</p> <p>P , . E -T -E -P</p> <p>E2E</p> <p>T (E2E ) .</p>
<p><b>[Warning] E2E00206 -</b></p> <p>- N E - -E</p>	<p>A -</p> <p>E2E01101 E2E01003. I E -T -E -</p> <p>P</p> <p>E2EC . A , "C</p> <p>&lt; &gt; ."</p>



5.2 E2EConfig file

T S

18

15

E2EConfig file

5.2.1 Syntax

T E2EConfig file 2.0.0 human-readable . T

ASCII.C C++- :

/\* - \*/

//

All keywords ( ) are case-sensitive.

Note: T

T syntax EBNF:

Symbol	Meaning
::=	A ::=
<>	A
	T choice. E
	T optional.
—	T underlined . T brackets literals " " " ".
< >	" "). ( . ,

```

T
:
<E2EP
E2EP

M = < > ;
M = < > ;
P = < > ;
P A < > _' < > _ ;
;

< > ::=

PDE N = < > ;
PDE = < > ;
N N = < > ;
D = < > ;
B O CP = < > > ;
B O = < > ;
B C = < > ;
C B = < > ;
C D S = < > ;
I H = < > ;
I C = < > ;
P < 01>
< 02>
S < > _' < > _ ;
P < >
< >
< 1939 >

< 01> ::=

C = P01 ;
D L = < > ;
D ID = < > ;
D ID M = < > ;
M D C I = < > > ;
CRC O = < > ;
C O = < > ;
D ID N O = < > ;
M N N O R D = < > > ;
S C I = < > ;
;

< 02> ::=

C = P02 ;
D L = < > ;
D ID L = < > 16> ;
M D C I = < > > ;
M N N O R D = < > > ;
S C I = < > ;
O = < > ;
;

< > ::=

S N = < > ;
S = < > ;
S ID = < > ;
S P = < > ;
B O = < > ;
B L = < > ;
B P = < > ;

```



```

<          > ::=
    E2EP          = A  OSAR R E ;
    P      N      = <          > ;
    DP N      = <          > ;
    I  O      = <          > ;
    C      B R    = <          > ;
    R E      = <          > ;
    R E I      = <          > ;
;

<          > ::=
    E2EP          = A  OSAR NO R E ;
    S      G      ID = <          > ;
    I  O      = <          > ;
;

< 1939      > ::=
    E2EP          = J1939 CAN ;
    PGN N      = <          > ;
    I  O      = <          > ;
;

<          > ::=
    R

<          > ::=
    LI  LE ENDIAN  BIG ENDIAN

<          > ::=
    DECREASING  INCREASING

<          > ::=
    SA  OO H      MONO ONE

<          > ::=
    NO      ES

<          > ::=
    <          > _,<          > _

<          > ::=
    BO H      AL      LO      NIBBLE

<          16> ::=
    <          > ,<          > ,<          > ,<          >
    ,<          > ,<          > ,<          > ,<          >
    ,<          > ,<          > ,<          > ,<          >
    ,<          > ,<          > ,<          > ,<          > ;

<          > ::=
    IN 8      IN 16      IN 32      SIN 8      SIN 16      SIN 32      BOOLEAN      IN 8N

<          > ::=
    NORMAL      CHK      SEQCN      NIBBLE

<          > ::=
    <          > _,<          > _

<          > ::=
    0      1      2      3      4      5      6      7      8      9

```

< > ::=  
< >< >\_< >\_  
  
< > ::=  
0 0  
  
< > ::=  
< > A B C D E F

5.2.2 Description of Elements

A syntax E2EConfig file defined 3 use cases  
, only AUTOSAR RTE  
D E2EPWG , T  
E2EPWG ,  
T E2E Protection Wrapper Safety Manual  
[TT E2EPW SM](#) <sup>(68)</sup> A ,  
T BNF  
  
A C-identifier limitations  
: | letter underscore  
, . | ANSI C T  
maximum length C- E2EConfig file 128  
A name identifier  
( . 128 ).

M	M E2EPWG
M	M E2EPWG
P	C E2EPWG

PDE N	T name identifier PDE. T 128 F AUTOSAR RTE, PDE N DP N
PDE	T data type PDE T C-identifier C- T C- 128 PDE

N N	T name identifier 128 . F A OSAR R E, SW-C ( ).
D	T direction ▪ PDE sent E2EPW write ▪ R PDE received, E2EPW read
B O CP	T byte order CPU. ▪ BIG ENDIAN ▪ LI LE ENDIAN
B O	T ordering bits . I AUTOSAR, ▪ DECREASING , . . ., 7, 6, 5, 4, 3, 2, 1, 0 ▪ INCREASING , . . ., 0,1,2,3,4,5,6,7
B C	T order of significance ▪ MONO ONE ▪ SA OO H O B O B C : ▪ DECREASING SA OO H ▪ INCREASING MONO ONE.
B	T value unused bits I- PDU . T 0 1.
C D S	I ES, deserialization check PDE T ES D R I O NO. I <a href="#">AS E2E SWS (68)</a> , ES D R I O NO.
I H	T external include files header . E 260 F A OSAR R E, R .
I C	T external include files

	<p><b>source</b> . E</p> <p>260</p> <p>F A OSAR R E,</p> <p>I H.</p>
--	--

C	<p>T U <b>name</b> <b>profile</b>, <b>P01</b>.</p> <p>E2EPWG.</p>
D L	<p>T <b>length</b> <b>I-PDU</b> . T</p> <p>16. T 240. T</p> <p><b>multiple of 8.</b></p>
D ID	<p>T D ID,</p> <p>CRC . I ,</p> <p>/ . T</p> <p>D ID <b>2 bytes.</b> F P01, D ID</p> <p>A ID <a href="#">BMW LAST KOMM</a> <sup>(68)</sup>.</p>
D ID M	<p>T D ID</p> <p>CRC</p> <p>▪ BO H ( ). D ID CRC</p> <p>▪ LO</p> <p>▪ AL</p> <p>▪ NIBBLE 8</p> <p>CRC , 4</p> <p>I-PDU</p>
M D C I	<p>T <b>initialization value</b></p> <p>M D C <a href="#">TT E2EPW SM</a> <sup>(68)</sup> . T</p> <p>[0...13].</p>
CRC O	<p>T I-PDU . I , , CRC</p> <p><b>multiple of 8.</b> T CRC O</p>
C O	<p>T I-PDU . I , , C</p> <p><b>multiple of 4.</b> T C O</p>
D ID N O	<p>D D ID N O D ID PDU .</p> <p>T D ID N O</p>
M N N O R D	<p>T</p> <p>E2E - . T AUTOSAR SWS</p>

	[0...15]. B - E2E 15.
S C I	A - AUTOSAR SWS E2E , S C I S NC T [0...255]. B - E2E 0.

C	T U name profile, P02. E2EPWG.
D L	T length I-PDU . T 16. T 2048. T multiple of 8.
D ID L	T list 16 values E 0 00...0 . T data IDs <a href="#">TT E2EPW SM</a> <sup>(68)</sup> .
M D C I	T initialization value M D C <a href="#">TT E2EPW SM</a> <sup>(68)</sup> . T [0...14].
M N N O R D	T - AUTOSAR SWS E2E . T [0...16]. B - E2E 16.
S C I	A - AUTOSAR SWS E2E , S C I S NC T [0...255]. B - E2E 0.
O	A CRC PDU . T multiple of 8. B - E2E 0.

S N	T unique name signal. T . T
-----	--------------------------------

S	T data type signal. I
S ID	T unique numeric identifier signal. F A OSAR R E, S ID [0...65535]
S P	T (S P NORMAL) normal special signal one signal S P CHK P01, P02 S P SEQCN B L , B P S B P B O
B O	T byte order B L B P mapped I-PDU.
B L	T length signal bits. ▪ I S BOOLEAN, B L 1. ▪ I S IN 8N, multiple of 8.
B P	T position signal I-PDU. ▪ I B O LI LE ENDIAN, B P ▪ I B O BIG ENDIAN, B P ▪ I S IN 8N,

T  
. H ,  
E2EPWG. T ,

▪ S I-PDU .

▪ T S ,  
IN 8.

[Profile 1](#) <sup>(20)</sup>

▪ T - ( . ,  
) . T B L 8.

▪ T 4

. T B L 4.

▪ T ID 4 D ID M NIBBLE . T

B L 4.

[Profile 2](#)<sup>(21)</sup>

▪ T 8

.  
F B O = BIG ENDIAN, B P 7.  
F B O = LI LE ENDIAN, B P 0.  
T B L 8.

▪ T 4

.  
F B O = BIG ENDIAN, B P 11.  
F B O = LI LE ENDIAN, B P 8.  
T B L 4.

E2EP	V A OSAR R E.
P N	T name identifier communication port. T
DP N	T name identifier VDP. T . T DP N D E RTE.
I O	T PDE I-PDU . I ES, DE. T DE . A , DE I-PDU.
C B R	F , RTE DE DE . I D R , RTE DE
SE R E	I ES, E2EPW RTE R I < > < > ( ) , < > < > D E . T NO, A OSAR R E .
R E I	M ES SW-C RTE ( ) . O , NO.

### 5.2.3 File Content Checks

**E2EConfig file,**

**E2E Protection Wrapper Safety Manual** [TT E2EPW SM](#) <sup>(68)</sup>.

▪ **T** PDE N , N N , P N  
D **E2EConfig file.** A ,  
DP N , N N , P N , D  
**E2EConfig file.**

▪ **T** PDE N , PA  
PDE N .

▪ **M** E2EPWG

▪ **M** W : U  
**260 characters,**  
T DOS .

▪ **T files** E2EPWG  
T :  
E2EP <Node\_Name>\_<Port\_Name>\_<PDE\_Name>\_<Direction>.  
E2EP <Node\_Name>\_<Port\_Name>\_<PDE\_Name>\_<Direction>.  
T :  
E2EP M <PDE N >.  
E2EP M <PDE N >.  
T :  
E2EP C D <PDE\_Name>.  
E2EP C D <PDE\_Name>.

▪ **I** overall file name length not exceed 260  
character absolute path . O  
E2EPWG .

▪ **T** memory mapping defines,  
MemMap.h . O , MemMap.h  
T

**three types** defines :  
1. D prefix , E2EPW\_MemMap.inc  
MemMap.h ,

**2. SW-C-specific** .  
T SW-C :  
- <swc> S AR SEC CODE  
- <swc> S OP SEC CODE  
- <swc> S AR SEC CONS NSPECIFIED  
- <swc> S OP SEC CONS NSPECIFIED



```

- <swc> S AR SEC AR INI NSPECIFIED
- <swc> S OP SEC AR INI NSPECIFIED
- <swc> S AR SEC AR NOINI NSPECIFIED
- <swc> S OP SEC AR NOINI NSPECIFIED
- <swc> S AR SEC AR ERO INI NSPECIFIED
- <swc> S OP SEC AR ERO INI NSPECIFIED

```

```

    <swc>

```

```

        N      N      .
    <      > M      M      . ,

```

```

T

```

```

RTE

```

```

3. T

```

```

(
-

```

```

) :

```

```

- E2EP S AR SEC CODE LIB
- E2EP S OP SEC CODE LIB.

```

## 6 Generated Code

### 6.1 API

T S API

**Note:** W byte number  
bytes of increasing order. Byte 0

T function names placeholders:

Placeholder	Config field	Description
< >	N N	T . A SW-C .
< >	DP N	T D P ( D E )
< >, < >	P N	T .
< >	PDE N	T PDE .
< >	C	P01 P02, E2E .
< - >	PDE	T PDE.
< >	D	T (R ) .

#### 6.1.1 Initialization

Syntax	E2EP I < > < > ( )
Reentrancy	
Parameters	
Return value	
Description	T < > < > E2E DE

<b>Syntax</b>	E2EP R I < > < > ( )
<b>Reentrancy</b>	
<b>Parameters</b>	
<b>Return value</b>	
<b>Description</b>	T E2E DE < > < > .

### 6.1.2 Status

<b>Syntax</b>	E2E < >P S * E2EP G P S < > < > ( )	
<b>Reentrancy</b>		
<b>Parameters</b>		
<b>Return value</b>	E2E < >P S *	E2E < >P S
<b>Description</b>	R E2E .	

<b>Syntax</b>	E2E < >C S * E2EP G C S < > < > ( )	
<b>Reentrancy</b>		
<b>Parameters</b>		
<b>Return value</b>	E2E < >C R S *	E2E < >C S
<b>Description</b>	R E2E .	

### 6.1.3 Transmission and Reception

T E2EPW:

<b>Syntax</b>	32 E2EP < > < >
---------------	-----------------

	( R I , < > * A D )	
<b>Reentrancy</b>		
<b>Parameters (in)</b>		T R < > < > (). T R E I .
	A D	T DE . I , < > , DE. T : ▪ <b>by value</b> (A D ) ▪ <b>by reference</b> ( A D ).
<b>Return value</b>	32	<b>Byte 0,</b> - E2E P (): ▪ E2E E INP ERR N LL ▪ E2E E INP ERR RONG ▪ E2E E OK ( ) <b>Byte 1,</b> - R < > < > (): ▪ R E E COM S OPPED ▪ R E E SEG FA L ▪ R E E OK ( ) <b>Byte 2,</b> A D =N LL : ▪ E2E E INP ERR N LL ▪ E2E E OK ( ) <b>Byte 3,</b> 0

**Note:** T ( . . , ). /

T

E2EPW:

Syntax	<pre> 32 E2EP R &lt; &gt; &lt; &gt; ( R I , &lt; &gt; * A D ) </pre>	
Reentrancy		
Parameters (in)		<pre> T R R &lt; &gt; &lt; &gt; (). T R E I . </pre>
	A D	<pre> T DE . I , &lt; &gt; , DE. </pre>
Return value	32	<p><b>Byte 0,</b> - E2E C ():</p> <ul style="list-style-type: none"> <li>▪ E2E E INP ERR N LL</li> <li>▪ E2E E INP ERR RONG</li> <li>▪ E2E E OK ( )</li> </ul> <p><b>Byte 1,</b> - R R &lt; &gt; &lt; &gt; ():</p> <ul style="list-style-type: none"> <li>▪ R E E IN ALID</li> <li>R E E MA AGE E CEEDED</li> <li>R E E NE ER RECEI ED</li> <li>R E E NCONNEC ED</li> <li>R E E OK ( )</li> </ul> <p><b>Byte 2,</b> A D =N LL :</p> <ul style="list-style-type: none"> <li>E2E E INP ERR N LL</li> <li>E2E E OK</li> </ul> <p><b>Byte 3/Bit 7,</b> :</p> <ul style="list-style-type: none"> <li>▪ 1 (E2EP DESERIAL ERR)</li> <li>▪ 0 ( )</li> </ul> <p><b>Byte 3/Bit 0...6, S -&gt;S :</b></p> <ul style="list-style-type: none"> <li>▪ E2E &lt; &gt;S A S OK: 0 00</li> <li>▪ E2E &lt; &gt;S A S NONE DA A: 0 01</li> <li>▪ E2E &lt; &gt;S A S RONGCRC: 0 02</li> <li>▪ E2E &lt; &gt;S A S S NC: 0 03</li> <li>▪ E2E &lt; &gt;S A S INI IAL: 0 04</li> <li>▪ E2E &lt; &gt;S A S REPEA ED: 0 08</li> <li>▪ E2E &lt; &gt;S A S OKSOMELOS : 0 20</li> <li>▪ E2E &lt; &gt;S A S RONGSEQ ENCE 0 40</li> </ul>

Note: T

( . , ) .

/

## 6.1.4 Usage Example Code

### 6.1.4.1 Application Sample Code

T

2<sup>(21)</sup>
AUTOSAR RTE<sup>(23)</sup>

P 30

T

.I ,

T

N

```
# "E2EP < > < > < > . "
```

## Convenience Code

```
# RE RNCODE E2E ( ) (( 32) ( ) & 0 FF)
# RE RNCODE R E ( ) ((( 32) ( ) & 0 FF00) >> 8)
# RE RNCODE APPDA A ( ) ((( 32) ( ) & 0 FF0000) >> 16)
# RE RNCODE E2ES A S ( ) ((( 32) ( ) & 0 7F000000) >> 24)
# RE RNCODE DESER ( ) ((( 32) ( ) & 0 80000000) >> 31)
```

```
32 2 32 =
(0<<31) /* D -C */
((E2E P02S A S OK & 0 7F)<<24) /* R S */
(E2E E OK<<16) /* P */
(R E E OK<<8) /* R R /R */
(E2E E OK); /* E2E P02C /E2E P02P */
32 2 32 =
(0<<31) /* D -C */
(E2E E OK<<16) /* P */
(R E E OK<<8) /* R R /R */
(E2E E OK); /* E2E P02C /E2E P02P */
```

## Code for Initialization

```
/* */
E2EP I < > < > ();

/* */
E2EP R I < > < > ();
```

## Code for Transmission and Check of Return Values

```
32 32;
R I ;
< > A D ;
< > * A D P = &A D ;

/* A D */
...

/* A D */
32 = E2EP < > < > ( , A D P );

( 32 != 2 32)

/* - */
(RE RNCODE APPDA A ( 32) != E2E E OK)

/* A D P N LL */
```

```

(RE  RNCODE E2E (      32) != E2E E OK)

/* E2E
                                     */

(RE  RNCODE R E (      32) != R E E OK)

/* R E
                                     */

..

```

## Code for Reception and Check of Return Values

```

      32      32;
R  I      ;
<  >      A  D      ;
<  > *      A  D  P  = &A  D      ;
...

/*      A  D      */
      32 = E2EP  R      < > < > (      , A  D  P  );

(      32 != 2      32)

/*      -      */
(RE  RNCODE APPDA A (      32) != E2E E OK)

/* A  D  P      N LL */

(RE  RNCODE E2E (      32) != E2E E OK)

/* E2E
                                     */

(RE  RNCODE R E (      32) != R E E OK)

/* R E
                                     */

(RE  RNCODE DESER (      32) != 0)

/* E2EP                                     COM */

(RE  RNCODE E2ES A  S (      32) != E2E P02S A  S OK)

/* E2E                                     */
      (RE  RNCODE E2ES A  S (      32))

      E2E P02S A  S NONE DA A:      /*                                     */
      ;
      E2E P02S A  S RONGCRC:      /* CRC                                     */
      ;
      E2E P02S A  S S NC:      /*                                     */
      ;
      E2E P02S A  S INI IAL:      /*                                     */
      ;
      E2E P02S A  S REPEA ED:      /*                                     */
      ;
      E2E P02S A  S OKSOMELOS :      /*                                     , '
*/
      ;
      E2E P02S A  S RONGSEQ ENCE:      /*
*/
      ;

```

**Note:** F , E2E P02C S ( )  
 .T E2EP G C S < > < > ( )  
 .

### 6.1.5 Differences to SW-C End-to-End Communication Protection Library

T E2EPW [AS E2E SWS](#) <sup>68</sup>,  
 A B.  
 H ,  
 D / :  
 • I AUTOSAR R 4.0.1/3.2.1,  
 • E E2EPW API,  
 • B - E2EPW TTT .  
 T :

Title	API Extension
<b>AUTOSAR 3.2.1/4.0.1</b>	AUTOSAR API E2E
<b>TTTech E2EPW 1.3</b>	A : E2EP I < > < > ( ) E2EP I < > < > ( )
<b>AUTOSAR 4.2.1</b>	I F : S R E2EP I < > < > ( R I < > )
<b>TTTech E2EPW 2.0</b>	R AUTOSAR R : 4.2.1: E2EP R I < > < > ( ) E2EP I < > < > ( )
<b>Reason</b>	<b>API extension:</b> I R AUTOSAR . H , AUTOSAR .



Title	API Extension
<b>AUTOSAR 3.2.1/4.0.1</b>	AUTOSAR E2E API .
<b>TTTech E2EPW 1.3</b>	<p>A :</p> <p>E2E &lt; &gt;S S *</p> <p>E2EP G S S &lt; &gt; &lt; &gt; ( )</p> <p>E2E &lt; &gt;R S *</p> <p>E2EP G R S &lt; &gt; &lt; &gt; ( )</p> <p>W &lt; &gt; .</p>
<b>AUTOSAR 4.2.1</b>	-
<b>TTTech E2EPW 2.0</b>	<p>R</p> <p>E2E :</p> <p>E2E &lt; &gt;P S *</p> <p>E2EP G P S &lt; &gt; &lt; &gt; ( )</p> <p>E2E &lt; &gt;C S *</p> <p>E2EP G C S &lt; &gt; &lt; &gt; ( )</p> <p>W &lt; &gt; .</p>
<b>Reason</b>	<p><b>API extension:</b> T AUTOSAR API .</p> <p><b>Note:</b> T S .</p> <p>T S ,</p>

Title	Communication State state.
<b>AUTOSAR 3.2.1/4.0.1</b>	T - ( E2EP R / < > < > ( ) ).
<b>TTTech E2EPW 1.3</b>	T .
<b>AUTOSAR 4.2.1</b>	T .
<b>TTTech E2EPW 2.0</b>	T .

Title	Communication State state.
Reason	T C S , - M M AUTOSAR.

Title	Deserialization return value of E2EPW_Read_<p>_<o> () (see E2E0265)
AUTOSAR 3.2.1/4.0.1	AUTOSAR byte 3 , 0 (OK) 1 ( ).
TTTech E2EPW 1.3	T bit 7 byte 3. U bits 0-6 S ->S .
AUTOSAR 4.2.1	T AUTOSAR . N - . D byte 1.
TTTech E2EPW 2.0	T - TTT E2EPW 1.3.
Reason	Usage: W S ->S E2EP R < > < > ( ), . A E2EP G R S < > < > ( ) S - >L D S ->S E2E < >S A S OKSOMELOS , < > .

Title	Return value layout of E2EPW_Write_<p>_<o> () and E2EPW_Read_<p>_<o> ()
AUTOSAR 3.2.1/4.0.1	AUTOSAR E2EP < > < > ( ): byte 0 E2E < >P ( ). byte 1 R < > < > ( ). byte 2 E2EP < > < > ( ) . byte 3 E2E E OK ( ). E2EP R < > < > ( ): byte 0 E2E < >C ( ).

Title	Return value layout of E2EPW_Write_<p>_<o> () and E2EPW_Read_<p>_<o> ()
	<p>byte 1 R R &lt; &gt; &lt; &gt; ().</p> <p>byte 2 E2EP R &lt; &gt; &lt; &gt; ()</p> <p>byte 3 ( )</p>
TTTech E2EPW 1.3	T 3. U 0-6 S ->S . 7
AUTOSAR 4.2.1	<p>T AUTOSAR . N -</p> <p>T E2EP &lt; &gt; &lt; &gt; ():</p> <p>byte 0 R &lt; &gt; &lt; &gt; ().</p> <p>byte 1 E2EP &lt; &gt; &lt; &gt; ()</p> <p>byte 2 E2E &lt; &gt; P ().</p> <p>byte 3 E2E E OK ( ).</p> <p>E2EP R &lt; &gt; &lt; &gt; ():</p> <p>byte 0 R R &lt; &gt; &lt; &gt; ().</p> <p>byte 1 E2EP R &lt; &gt; &lt; &gt; ()</p> <p>byte 2 E2E &lt; &gt; C ().</p> <p>byte 3 (E2E &lt; &gt; C S ).</p>
TTTech E2EPW 2.0	T - TTT E2EPW 1.3.
Reason	I , AUTOSAR . N , - TTT E2EPW .

Title	Abortion in case of errors
AUTOSAR 3.2.1/4.0.1	AUTOSAR E2EP R / < > < > () .
TTTech E2EPW 1.3	I , . T :

Title	Abortion in case of errors
	<ul style="list-style-type: none"> <li>• N L L A D ,</li> <li>• E2E &lt; &gt; P / C ( ) ,</li> <li>• R E &lt; &gt; &lt; &gt; ( )</li> <li>•</li> </ul> <p>W &lt; &gt; .</p> <p>N - R E R &lt; &gt; &lt; &gt; ( )</p> <p>(</p> <p>E2EP R &lt; &gt; &lt; &gt; ( ) ).</p>
<b>AUTOSAR 4.2.1</b>	C , TTT E2EPW 1.3
<b>TTTech E2EPW 2.0</b>	B TTT E2EPW 1.3 AUTOSAR 4.2.1.
<b>Reason</b>	<b>Safer code:</b> C C

Title	Return Code Interpretation for E2EPW_Read/Write_<p>_<o>
<b>AUTOSAR 3.2.1/4.0.1</b>	A E2EP R / < > < > ( ) . T , <b>byte 0...3</b>
<b>TTTech E2EPW 1.3</b>	<p>I , E2EP R / &lt; &gt; &lt; &gt; ( )</p> <p>T :</p> <p><b>E2EPW_Read_&lt;p&gt;_&lt;o&gt; ( ):</b></p> <p>1.   <b>byte 0</b> E2E E OK (0), E2E &lt; &gt; C ( ) . A</p> <p>2.   <b>byte 2</b> E2E E OK (0), P W . A</p> <p>3.   <b>bit 7 byte 3 1,</b> . A</p> <p>4.   <b>byte 0 byte 2</b> E2E E OK <b>bit 7 byte 3 0,</b></p> <p>. <b>byte 1</b> R R &lt; &gt; &lt; &gt; ( )</p> <p>. <b>bits 0...6 byte 3</b></p>

Title	Return Code Interpretation for E2EPW_Read/Write_<p>_<o>
	<p>E2E &lt; &gt;C ().</p> <p>B</p> <p>E2EPW_Write_&lt;p&gt;_&lt;o&gt; ():</p> <p>1.   byte 0 E2E E OK (0), E2E &lt; &gt;P (). A</p> <p>2.   byte 2 E2E E OK (0), P W . A</p> <p>3.   byte 0 byte 2 E2E E OK, byte 1 R E &lt; &gt; &lt; &gt; (),</p> <p>4. Byte 3 0.</p>
AUTOSAR 4.2.1	C , TTT E2EPW 1.3.
TTTech E2EPW 2.0	B TTT E2EPW 1.3 AUTOSAR 4.2.1.
Reason	I

Title	Variables ret0...ret3 in E2EPW_Read/Write_<p>_<o> ()
AUTOSAR 3.2.1/4.0.1	AUTOSAR /
TTTech E2EPW 1.3	T 32 , I 0.. 3.
AUTOSAR 4.2.1	AUTOSAR - . C E ,
TTTech E2EPW 2.0	A TTT E2EPW 1.3.
Reason	tca ref .

Title	NULL_PTR check at begin of E2EPW_Read/Write_<p>_<o> ()
AUTOSAR 3.2.1/4.0.1	AUTOSAR N L L P R A D .
TTTech E2EPW 1.3	T N L L .
AUTOSAR 4.2.1	C A D , TTT E2EPW 1.3.
TTTech E2EPW 2.0	B TTT E2EPW 1.3 AUTOSAR 4.2.1.
Reason	Safer code: A A D N L L P R .

Title	E2E_USING_RTE_ISUPDATED
AUTOSAR 3.2.1/4.0.1	AUTOSAR # S ->N D A .
TTTech E2EPW 1.3	T S ->N D A E2EC . A , S ->N D A = R I < > < > () S ->N D A = R E T # .
AUTOSAR 4.2.1	R I < > < > () ( 4.1.1), R R < > < > () ( - ). I R E E OK, S - >N D A FALSE.
TTTech E2EPW 2.0	B - TTT E2EPW 1.3. R R < > < > () E2EPW . T , AUTOSAR 4.2.1 RTE " , R I U R I < > < > () .
Reason	A E2EC . S .

Title	Encapsulation of marshaling in separate function.
<b>AUTOSAR 3.2.1/4.0.1</b>	AUTOSAR .
<b>TTTech E2EPW 1.3</b>	E2EP R / < > < > () E2EP M < > ().
<b>AUTOSAR 4.2.1</b>	N AUTOSAR 3.2.1/4.0.1.
<b>TTTech E2EPW 2.0</b>	B - TTT E2EPW 1.3.
<b>Reason</b>	S .I .C - S G ( . . R ) .

Title	Encapsulation of deserialization check in separate function.
<b>AUTOSAR 3.2.1/4.0.1</b>	AUTOSAR .
<b>TTTech E2EPW 1.3</b>	E2EP R / < > < > () E2EP C D < > ().
<b>AUTOSAR 4.2.1</b>	N AUTOSAR 3.2.1/4.0.1.
<b>TTTech E2EPW 2.0</b>	B - TTT E2EPW 1.3.
<b>Reason</b>	S .I .C - S G ( . . R ) .

Title	Variants for parameters of E2EPW_Read/Write_<p>_<o> ()
<b>AUTOSAR 3.2.1/4.0.1</b>	AUTOSAR I A D ( ).
<b>TTTech E2EPW 1.3</b>	T : I . H , E2EPW R R / < > < > (). A D call by value call by reference. F E2EP R < > < > (), call by reference.
<b>AUTOSAR 4.2.1</b>	P I API ,

Title	Variants for parameters of E2EPW_Read/Write_<p>_<o> ()
	I E2E.
TTTech E2EPW 2.0	B - TTT E2EPW 1.3.
Reason	C E2EP R / < > < > () R R / < > < > () AUTOSAR RTE .

Title	Variables Config and ConfigVal in E2EPW_Read_<p>_<o> () and E2EPW_Write_<p>_<o> () are 'const'.
AUTOSAR 3.2.1/4.0.1	T C C - .
TTTech E2EPW 1.3	C C .
AUTOSAR 4.2.1	C C < > < > . C 4.2.1 .
TTTech E2EPW 2.0	B - TTT E2EPW 1.3.
Reason	<ul style="list-style-type: none"> <li>AS E2E SWS<sup>68</sup>.</li> <li>( ) RAM ROM.</li> </ul> <p><b>Note:</b> T C &lt; &gt; &lt; &gt; C &lt; &gt; &lt; &gt; MISRA . T E2EPW API.</p>

Title	Redundant Wrapper not implemented
AUTOSAR	S AUTOSAR.
TTTech E2EPW 1.3	R W (E2EP 1/2 < > < > ()), E2EP R 1/2 < > < > ()), O .
AUTOSAR 4.2.1	N .
TTTech E2EPW 2.0	B - TTT E2EPW 1.3.



Title	Redundant Wrapper not implemented
Reason	<p>           T R W - ASIL D . A ( . . ,            ASIL D HW) . H ,            SW-C .         </p>

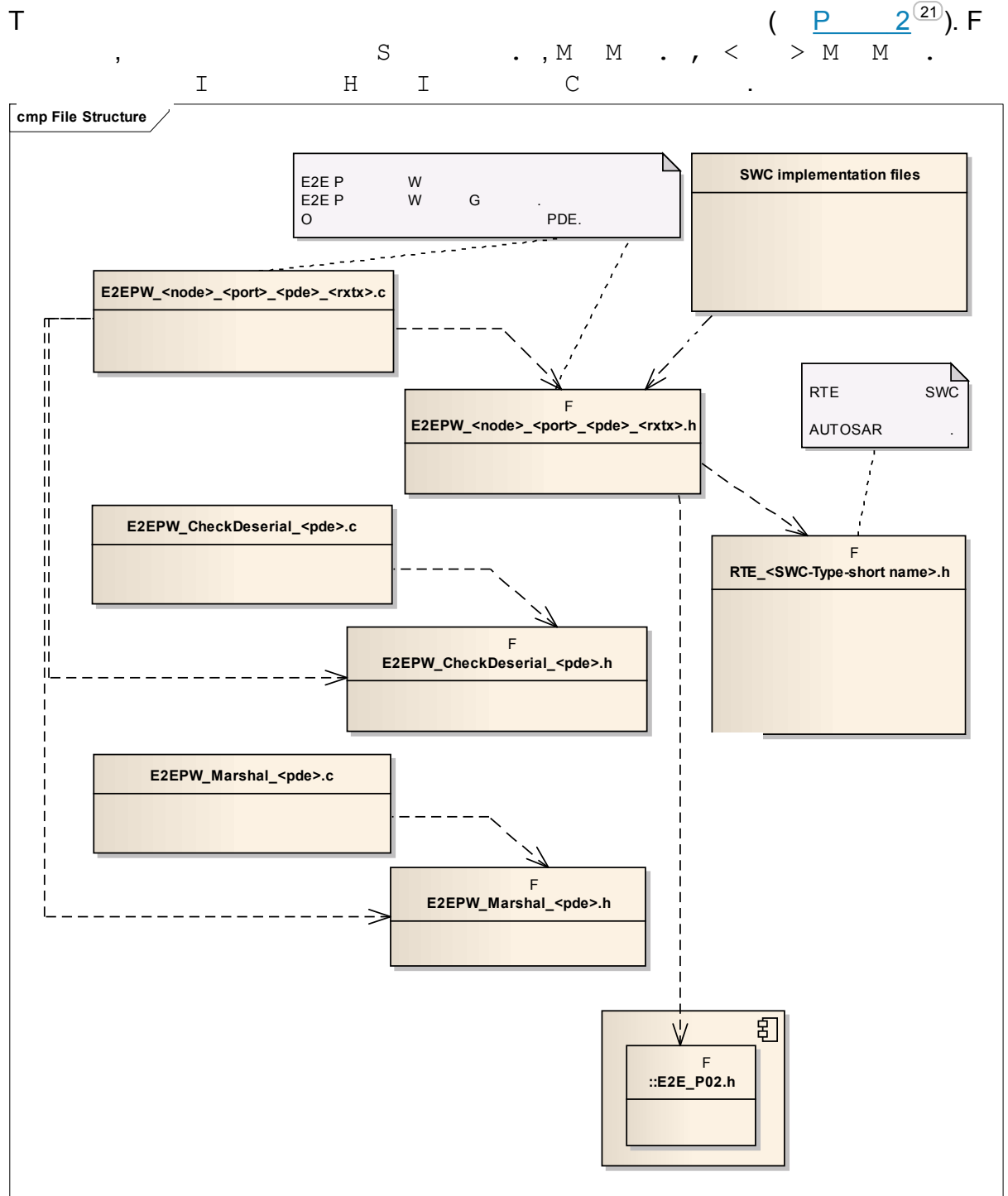
Title	Direct use of opaque parameter in E2EPW_Write_<p>_<o> ()
<b>AUTOSAR 3.2.1/4.0.1</b>	<p>           W A D , E2EP &lt; &gt; &lt; &gt;            () D . T D            CRC D A D            A D R &lt; &gt; &lt; &gt; ().         </p>
<b>TTTech E2EPW 1.3</b>	<p>           W A D , E2EP &lt; &gt; &lt; &gt;            () A D E2E &lt; &gt; P            R &lt; &gt; &lt; &gt; (). N            S - :            ■ A D .            ■ A E2EP &lt; &gt; &lt; &gt; (), CRC            .         </p>
<b>AUTOSAR 4.2.1</b>	N .
<b>TTTech E2EPW 2.0</b>	B - TTT E2EPW 1.3.
Reason	<p>           I ( ),            ( ).         </p>

Title	The array ppa_<port>_<vdp>_au8 [] is module-local.
<b>AUTOSAR 3.2.1/4.0.1</b>	<p>           T PDE            E2EP R &lt; &gt; &lt; &gt; () E2EP &lt; &gt; &lt; &gt; ().         </p>
<b>TTTech E2EPW 1.3</b>	T - .
<b>AUTOSAR 4.2.1</b>	T .
<b>TTTech E2EPW 2.0</b>	N TTT E2EPW 1.3.
Reason	<p>           M M . , . M M            .         </p>

Title	Profile configuration is module-local.
<b>AUTOSAR 3.2.1/4.0.1</b>	T E2E < > C E2EP R < > < > () E2EP < > < > ().
<b>TTTech E2EPW 1.3</b>	T - .
<b>AUTOSAR 4.2.1</b>	T - .
<b>TTTech E2EPW 2.0</b>	N TTT E2EPW 1.3.
<b>Reason</b>	M M . , . M M .

Title	File Structure
<b>AUTOSAR 3.2.1/4.0.1</b>	<p>A (* . * . ) SW-C, SW-C:</p> <ul style="list-style-type: none"> <li>• E2EP &lt; &gt; .</li> <li>• E2EP &lt; &gt; . .</li> </ul>
<b>TTTech E2EPW 1.3</b>	<p>A (* . * . )</p> <p>:</p> <ul style="list-style-type: none"> <li>• E2EP &lt; &gt; &lt; &gt; &lt; &gt; .</li> <li>• E2EP &lt; &gt; &lt; &gt; &lt; &gt; . .</li> </ul> <p>T</p> <p>:</p> <ul style="list-style-type: none"> <li>• E2EP M &lt; &gt; .</li> <li>• E2EP M &lt; &gt; .</li> <li>• E2EP C D &lt; &gt; .</li> <li>• E2EP C D &lt; &gt; .</li> </ul> <p>W</p> <ul style="list-style-type: none"> <li>• &lt; &gt; N N</li> <li>• &lt; &gt; P N</li> <li>• &lt; &gt; DP N</li> <li>• &lt; &gt; PDE N</li> </ul>
<b>AUTOSAR 4.2.1</b>	T AUTOSAR 3.2.1/4.0.1.
<b>TTTech E2EPW 2.0</b>	N TTT E2EPW 1.3.
<b>Reason</b>	S E2EPWG. S PDE. /

## 7 File Structure

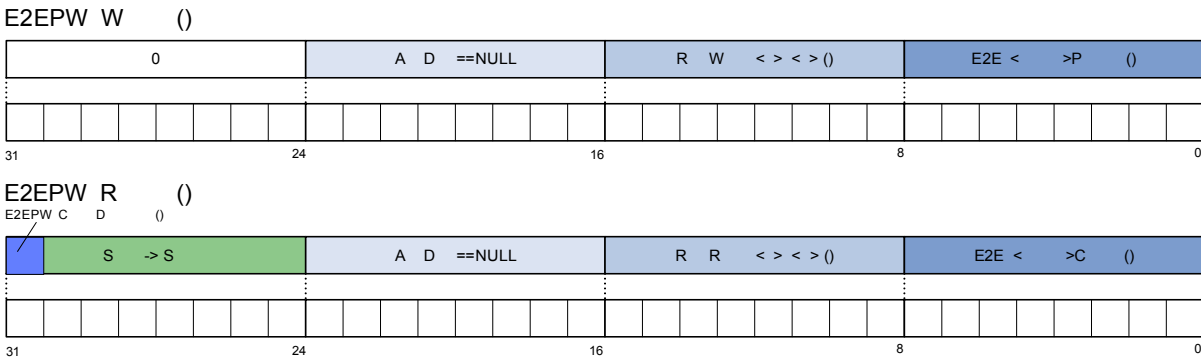


## 8 Functional Specification

TS  
:E2EPW\_Write\_<p>\_<o> () E2EPW\_Read\_<p>\_<o> ()  
.

### 8.1 Return values

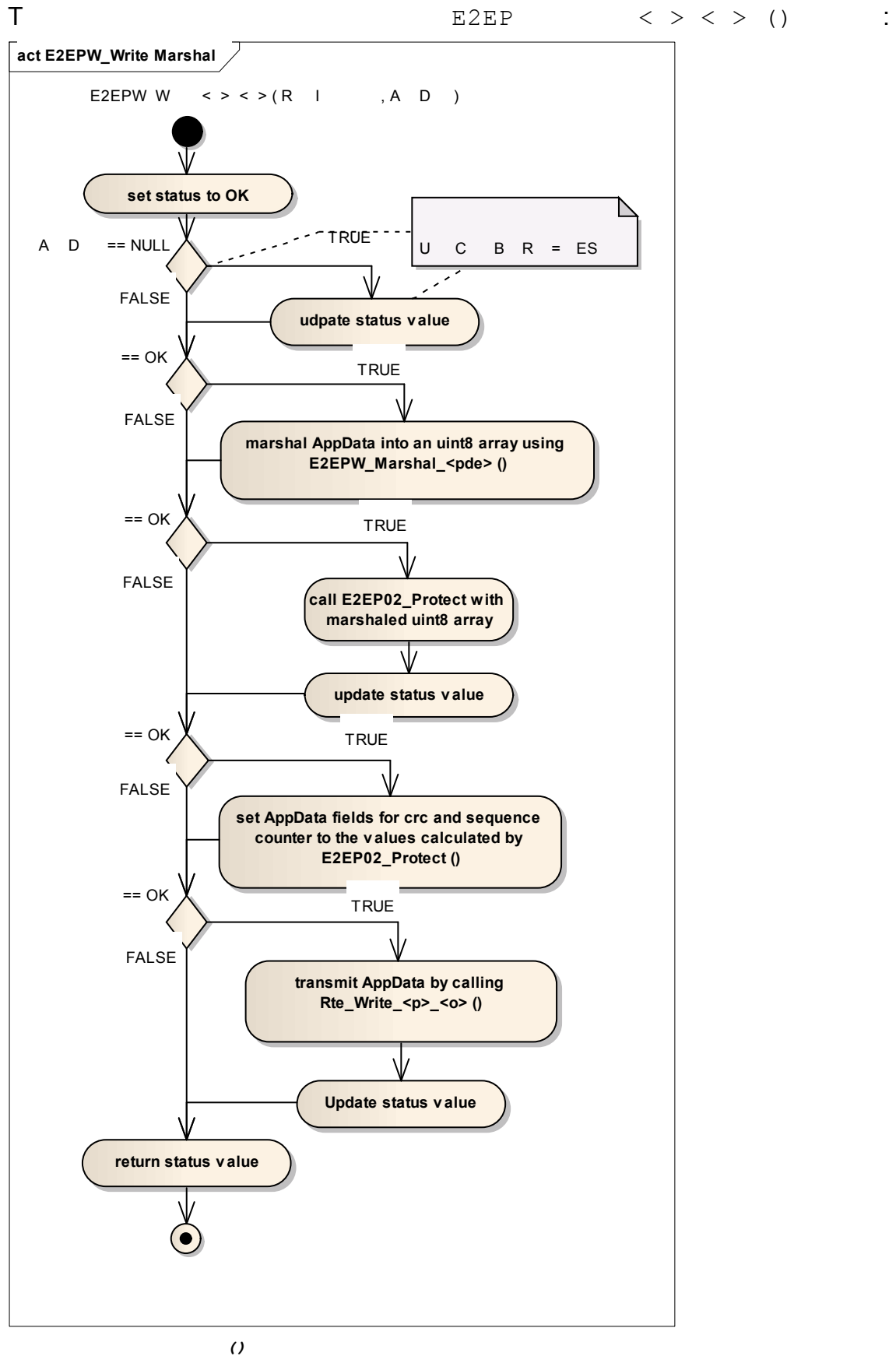
TE  
.  
A  
,  
.  
T32-:

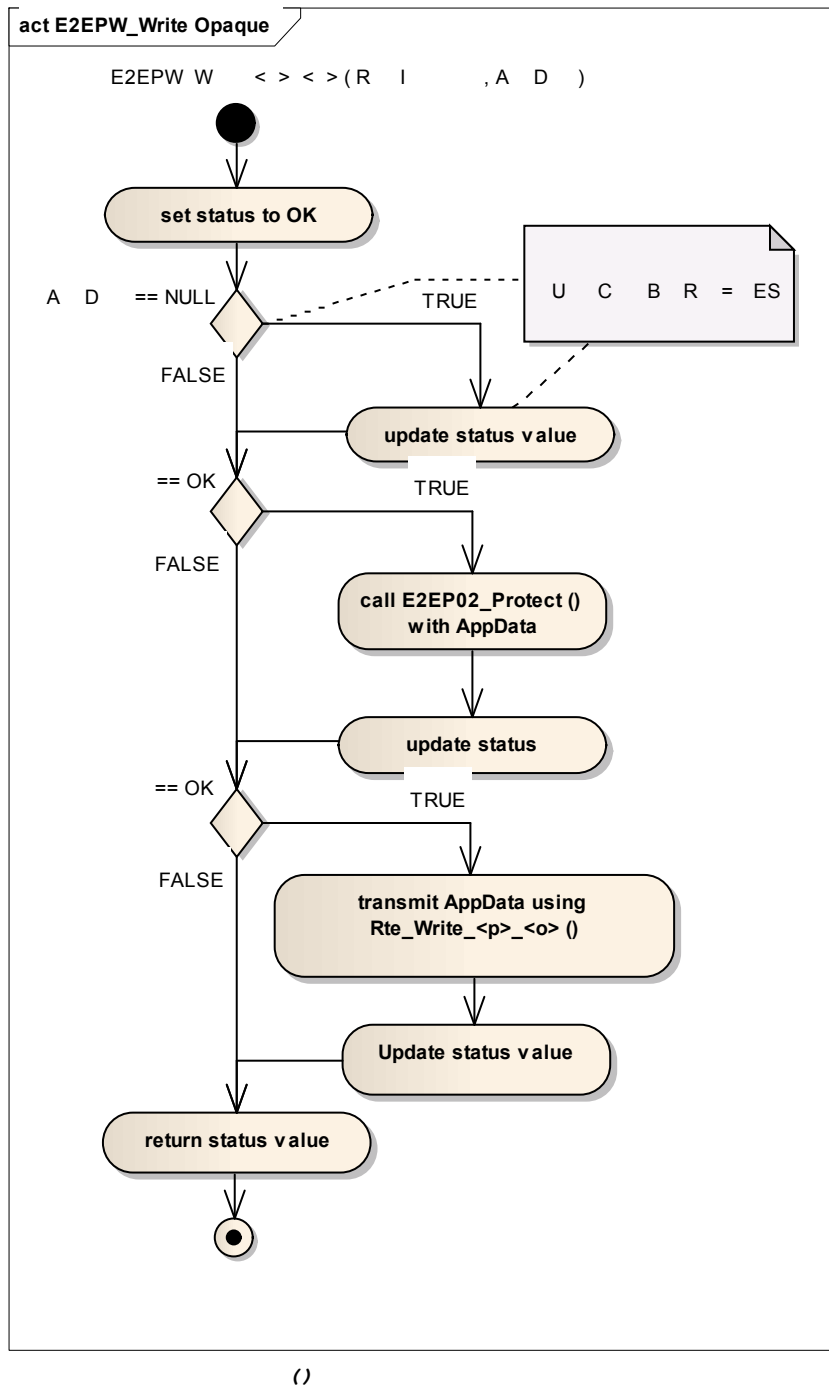


Note: T.T

### 8.2 Function E2EPW\_Write\_<p>\_<o> ()

D, E2EPW\_Write\_<p>\_<o> ()  
:  
• C B R  
• I O





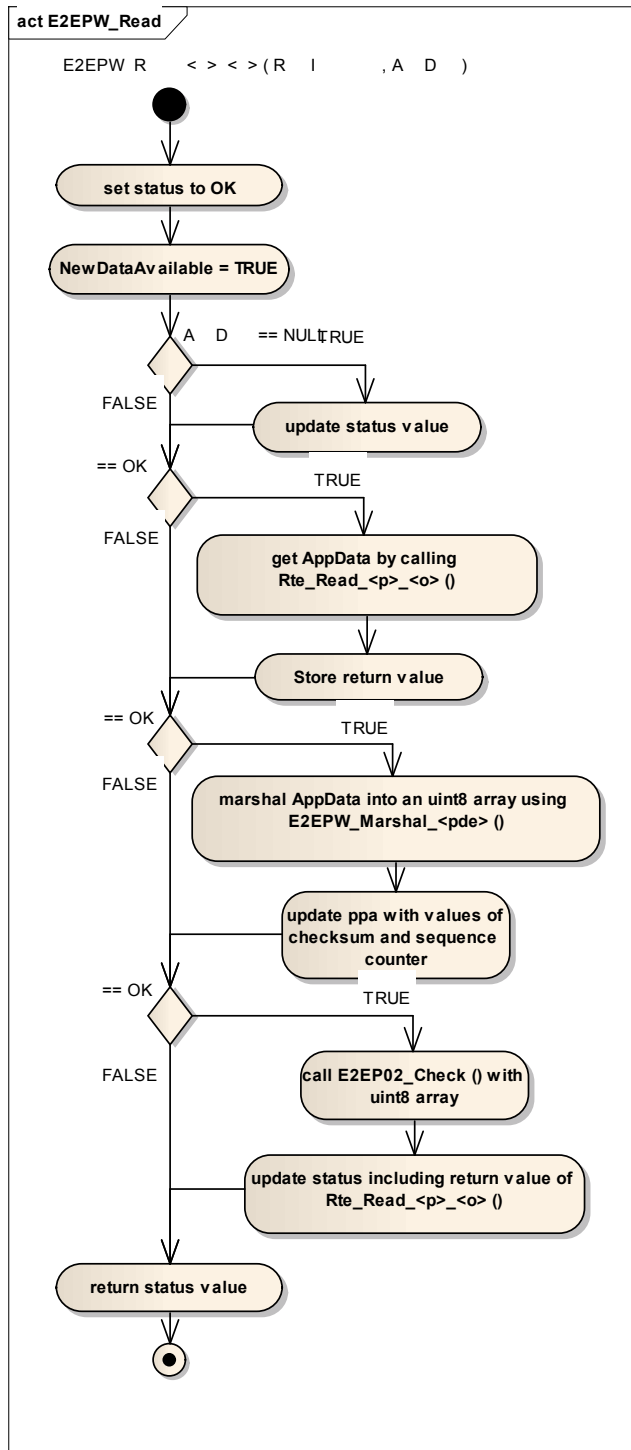
### 8.3 Function E2EPW\_Read\_<p>\_<o> ()

D , E2EPW\_Read\_<p>\_<o> ()

. O :

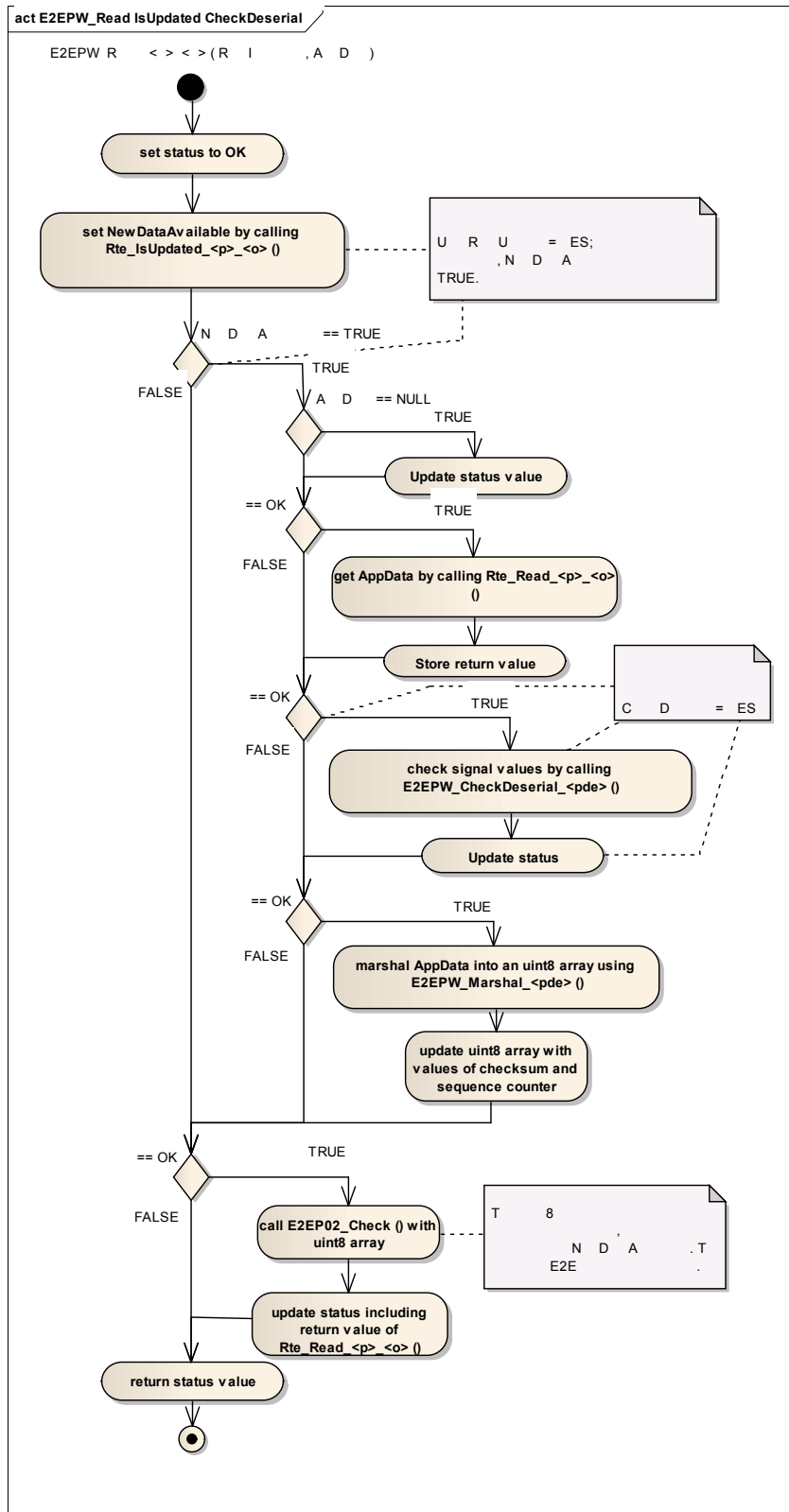
- C D
- I O
- R

T E2EP R < > < > ( ) :

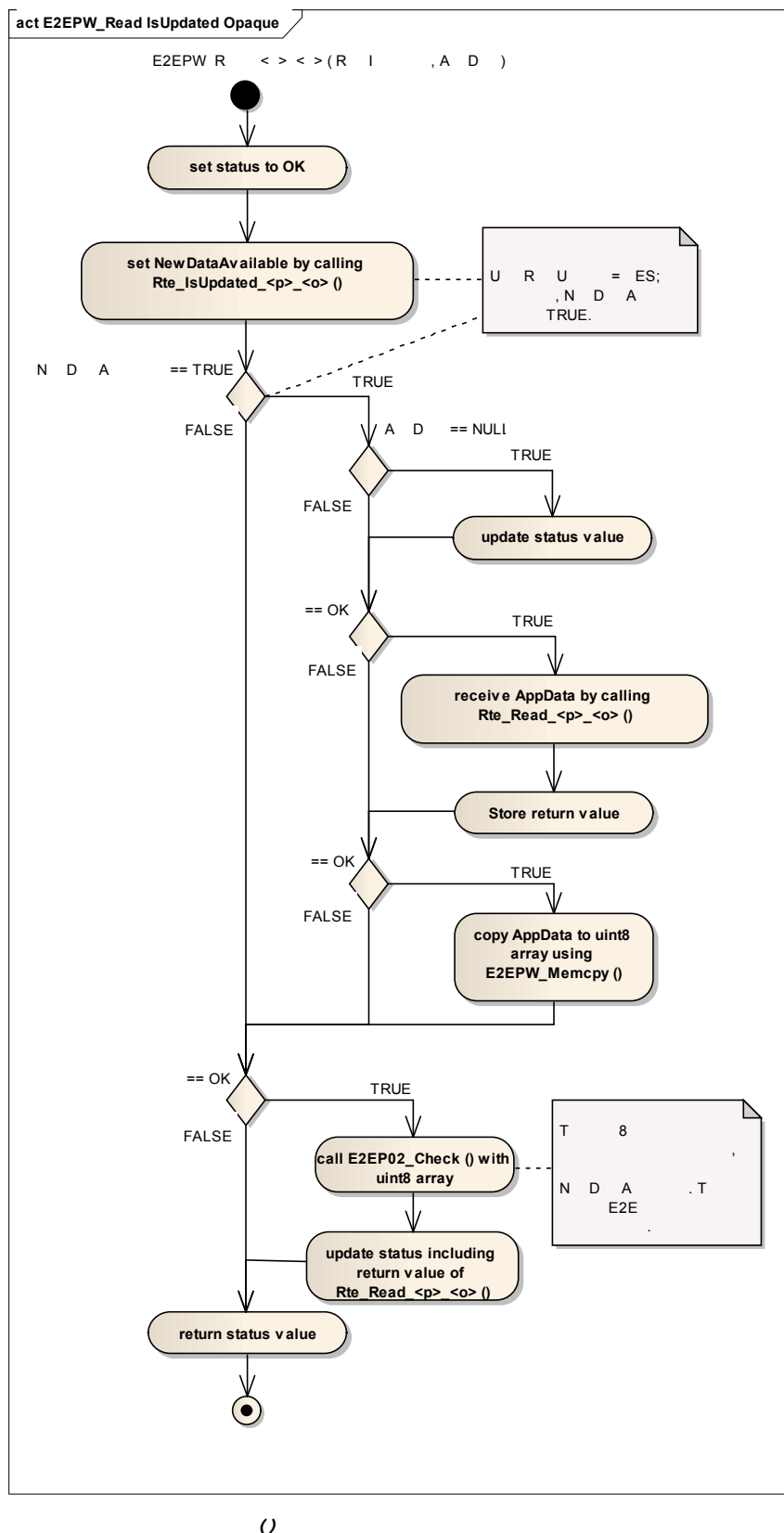


()





()



## 9 Environment Specifics

T S . T P , E2EPWG E2EC ,  
AUTOSAR ,  
 ,  
 .

### 9.1 Vector DaVinci Developer/RTE Configurator for AUTOSAR 3.2

I [AUTOSAR RTE](#)<sup>(23)</sup> T  
P G E2E [P01](#)<sup>(20)</sup>  
[P02](#)<sup>(21)</sup> ,  
T P G . S D V

#### 9.1.1 Configuration Restrictions

T V RTE AUTOSAR  
3.2 AUTOSAR 4.0 :  
• I O NO ( RTE DE )  
• C B R ES ( - DE  
RTE)  
• R R I ES . I RTE  
NO. T R I < > < > ( ) , R  
E2EC  
S . R

#### 9.1.2 Preprocessor Restrictions

• T DP ( DP N ) PDE N  
SW-C N N E2EC .  
T N N DP N  
A PDE N ( ,  
E2EC M C D  
D SW-C- W D V R12, D V  
[\(52\)](#) . N N SW-C  
M M .  
• T B O CP . T  
LI LE ENDIAN. I B O CP ,  
8 .

#### 9.1.3 E2EPW and RTE in a Safety-Related System

I - ISO 26262  
QM , called

calling ( . . ,  
 .). T ,  
**freedom from interference.** T  
 ( . . , , )  
**(decoupling).**  
 I , E2EPW RTE  
 QM ( . . , **DaVinci RTE Configurator**),  
 . A RTE ,  
 ( ) ,  
 COM . T

**Example:**

A - RTE SW-C A E2EPW. A  
**reviewed manually** RTE , RTE SW-C A **must be**  
 R < > < > ( ) ( F <sup>(45)</sup> )  
 COM ISO 26262. T  
 - SW-C A SW-C B. T SW-  
 C B **different context** ( . . , COM) COM  
 . T SW-C B E2EPW SW-C A.  
 T RTE E2EPW

**9.2 Other Issues**

- A 1.3, E2EPWG SW-C . A  
 N N 2.0.1, < > M M .  
 RTE . I
- F . A  
 - E2EC 128 ,  
 .  
 F , **Windows XP** **Windows 7** **maximum total path**  
**length 260** ( ) . I N N ,  
 PDE N DP N ,  
 , PDE N . A  
 E2EC .

## 10 Integration Notes

T S

E2EPW

E2Elib.

I  
Manual ([TT E2EPW SM](#) <sup>68</sup>)

E2E Protection Wrapper Safety

### 10.1 Checking the Tool Input

M

V

T

V

E2EC

.A  
S

[E2EC](#) <sup>15</sup>

E2EC

### 10.2 Checking the Generated Files

M

- E2EC ( ,  
/ ,  
E2EC ).
- E2EPWG ( . ) ( ,  
/ ).
- ( . , ;  
/ ).

### 10.3 Performing an Integration Test

T

E - -E P

.T

. F E - -E P ,  
ECU

( <sup>53</sup>

). H ,

ECU. T

( , , ),  
E - -E P

A

<sup>63</sup>

.A

( -ECU)

-E P

.A

E - -E P

E -

#### 10.3.1 Using Restbus Simulation

A

E - -E

. T

E - -E P

. A

E2EPW

E - -E

,

## E2EPW

T E - -E  
:S  
D ID,  
I E - -E

E2EPW :

E2Elib <profile> status defines	Description
E2E < >S A S INI IAL	I (M )
E2E < >S A S OK	M
E2E < >S A S RONGCRC	W CRC
E2E < >S A S OKSOMELOS	S ,
E2E < >S A S RONGSEQ ENCE	M
E2E < >S A S REPEA ED	M
E2E < >S A S NONE DA A	N

B , E2EPW ,  
. U ,

A E2EPW:

Status	Wrong CRC	Messages lost	Invalid sequence	Message repeated	No new Message

<sup>1</sup> Refers to masquerading / message insertion

T ( ) , . S

:

F ,

:

1. A / ,

NONE DA A.

2. I / , ,

,

M D C I . A ,

16 (15 E2E 1)

. F , E - -

E P

.

### 10.3.1.1 Example Scenarios

T

.

**Example 1:**

A ECU ECU,

:

1. T - - -

.

2. T

.

3. T

.

4. T

E2EPW.

5. A ;

T : 3,

- - -

T : T

( =4) ( =3) =3)

. T ( =3) . I

. T , ( =5)

( =5)

.

S E2EPW :

Call Number	Sequence counter	Status
1	1	E2E < >S A S INI IAL
2	2	E2E < >S A S OK

Call Number	Sequence counter	Status
3	3	E2E < >S A S OK
4	3	E2E < >S A S REPEA ED
5	5	E2E < >S A S OKSOMELOS
6	6	E2E < >S A S OK

**Example 2:**

Example 1

I , :

- T ( 2).
- T ( 3).
- T E2EPW ( RTE

R I < > < > ( ) ; 4).

N :

Call Number	Sequence counter	Status
1	1	E2E < >S A S INI IAL
2	2	E2E < >S A S OK
3	3	E2E < >S A S OK
4	3	E2E < >S A S NONE DA A
5	5	E2E < >S A S OKSOMELOS
6	6	E2E < >S A S OK

H , R , N , .

**Example 3:**

A , :

Call Number	Sequence counter	Status
1	1	E2E < >S A S INI IAL
2	2	E2E < >S A S OK
3	3	E2E < >S A S OK
4	3	E2E < >S A S NONE DA A
5	4	E2E < >S A S OK



Call Number	Sequence counter	Status
6	5	E2E < >S A S OK

H , .T 4, 5,  
.B 4 5,  
, 4 5, 5.

**Example 4:**

U  
A 3,  
T  
4. I 3 , 4. B  
5.

Call Number	Sequence counter	Status
1	1	E2E < >S A S INI IAL
2	2	E2E < >S A S OK
3	3	E2E < >S A S OK
4	3	E2E < >S A S REPEA ED
5	5	E2E < >S A S OKSOMELOS
6	6	E2E < >S A S OK

H , . T  
( E2EPW).

**10.3.1.2 Integration Test Message Sequence**

I S ,  
E2EPW .  
T :  
1. T  
2. T  
E2EPW.  
3. A ;  
4. T RTE R I < > < > ()  
R R < > < >  
( ).  
5. T E2E M D C I = 2, S C I  
= 0.  
E . T . T  
T :

<b>Call</b>	T E2EP R < > < > ( ) .
<b>SC</b>	T E2EPW.
<b>CRC</b>	<ul style="list-style-type: none"> <li>▪ OK CRC .</li> <li>▪ NOK CRC .</li> </ul>
<b>Status</b>	T E2EPW.
<b>Description</b>	A .
<b>*</b>	F E2E <u>1</u> <sup>(20)</sup> , 15. T .

*Sequence of correct messages:*

Call	SC	CRC	Status	Description
1	0	OK	E2E < > S A S I N I I A L	
2	1	OK	E2E < > S A S O K	
3	2	OK	E2E < > S A S O K	
4	3	OK	E2E < > S A S O K	
5	4	OK	E2E < > S A S O K	
6	5	OK	E2E < > S A S O K	
7	6	OK	E2E < > S A S O K	
8	7	OK	E2E < > S A S O K	
9	8	OK	E2E < > S A S O K	
10	9	OK	E2E < > S A S O K	
11	10	OK	E2E < > S A S O K	
12	11	OK	E2E < > S A S O K	
13	12	OK	E2E < > S A S O K	
14	13	OK	E2E < > S A S O K	
15	14	OK	E2E < > S A S O K	
16	15*	OK	E2E < > S A S O K	

*Deleted and repeated messages:*

Call	SC	CRC	Status	Description
1	0	OK	E2E < > S A S I N I I A L	F .

Call	SC	CRC	Status	Description
2	1	OK	E2E < >S A S OK	
3	-	-	E2E < >S A S NONE DA A	N .
4	3	OK	E2E < >S A S OKSOMELOS	O (2).
5	4	OK	E2E < >S A S OK	
6	5	OK	E2E < >S A S OK	
7	5	OK	E2E < >S A S REPEA ED	M 5 .
8	7	OK	E2E < >S A S OKSOMELOS	O (6).
9	8	OK	E2E < >S A S OK	
10	9	OK	E2E < >S A S OK	
11	9	OK	E2E < >S A S REPEA ED	M 9 .
12	10	OK	E2E < >S A S OK	M 10 11.
13	11	OK	E2E < >S A S OK	M 11 12.
14	13	OK	E2E < >S A S OKSOMELOS	O (12).
15	14	OK	E2E < >S A S OK	
16	15*	OK	E2E < >S A S OK	

*Wrong CRC due to different failure modes:*

Cycle	SC	CRC	Status	Description
1	0	OK	E2E < >S A S INI IAL	
2	1	OK	E2E < >S A S OK	
3	2	NOK	E2E < >S A S RONGCRC	B .
4	3	OK	E2E < >S A S OKSOMELOS	O (2).
5	4	OK	E2E < >S A S OK	
6	5	NOK	E2E < >S A S RONGCRC	U D ID.
7	6	OK	E2E < >S A S OKSOMELOS	O (5).
8	7	OK	E2E < >S A S OK	
9	8	OK	E2E < >S A S OK	
10	13	NOK	E2E < >S A S RONGCRC	B .
11	14	NOK	E2E < >S A S RONGCRC	B .
12	11	OK	E2E < >S A S OKSOMELOS	T (9)

Cycle	SC	CRC	Status	Description
				10).
13	12	OK	E2E < >S A S OK	
14	13	OK	E2E < >S A S OK	
15	14	OK	E2E < >S A S OK	
16	15*	OK	E2E < >S A S OK	

*Sequence error because of swap and sender reset:*

Cycle	SC	CRC	Status	Description
1	0	OK	E2E < >S A S INITIAL	
2	1	OK	E2E < >S A S OK	
3	2	OK	E2E < >S A S OK	
4	4	OK	E2E < >S A S OKSOMELOS	O (3).
5	3	OK	E2E < >S A S RONGSEQ ENCE	M 3 4 .
6	5	OK	E2E < >S A S OK	
7	6	OK	E2E < >S A S OK	
8	-	-	E2E < >S A S NONE DA A	N .
9	0	OK	E2E < >S A S RONGSEQ ENCE	S .
10	1	OK	E2E < >S A S RONGSEQ ENCE	
11	2	OK	E2E < >S A S RONGSEQ ENCE	
12	3	OK	E2E < >S A S RONGSEQ ENCE	
13	4	OK	E2E < >S A S RONGSEQ ENCE	
14	5	OK	E2E < >S A S RONGSEQ ENCE	
15	6	OK	E2E < >S A S REPEA ED	
16	7	OK	E2E < >S A S OK	

*Sequence error because of receiver timing violation:*

Call	SC	CRC	Status	Description
1	0	OK	E2E < >S A S INITIAL	
2	1	OK	E2E < >S A S OK	
3	2	OK	E2E < >S A S OK	
4	-	-	E2E < >S A S NONE DA A	N ( ).
5	-	-	E2E < >S A S NONE DA A	N ( ).
6	5	OK	E2E < >S A S OKSOMELO S	T (3, 4).
7	6	OK	E2E < >S A S OK	
8	10	OK	E2E < >S A S RONGSEQ ENCE	T E2EP R < > < > ( ) O M D C I = 2. A E2EPW 7, 8 9,
9	11	OK	E2E < >S A S RONGSEQ ENCE	
10	12	OK	E2E < >S A S RONGSEQ ENCE	
11	13	OK	E2E < >S A S RONGSEQ ENCE	
12	14	OK	E2E < >S A S RONGSEQ ENCE	
13	15*	OK	E2E < >S A S RONGSEQ ENCE	
14	0	OK	E2E < >S A S RONGSEQ ENCE	
15	1	OK	E2E < >S A S RONGSEQ ENCE	
16	2	OK	E2E < >S A S RONGSEQ ENCE	
17	3	OK	E2E < >S A S RONGSEQ ENCE	
18	4	OK	E2E < >S A S RONGSEQ ENCE	
19	5	OK	E2E < >S A S RONGSEQ ENCE	
20	6	OK	E2E < >S A S REPEA ED	G
21	7	OK	E2E < >S A S OK	F

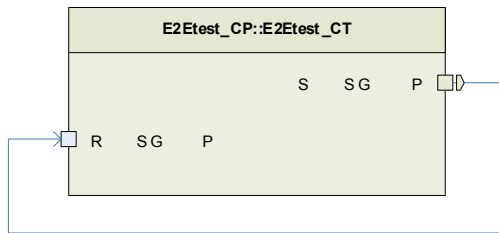
### 10.3.1.3 Hints for Integration Test Setup

1. F E2EPW, E2EPW.
  2. S 16 M T [Sequence of correct messages](#) <sup>(59)</sup> CRC
  3. B
  4. U E2EPW
- Note:** T ( , - , ) F 5 T  
[Wrong CRC due to different failure modes](#) <sup>(60)</sup> , CRC ID T E2EPW ID 5

### 10.3.2 Using Intra-ECU Signaling

- A E2EPW E2E - - - , E2EPW
- T , , E2EPW
- Note1:** T E2E E2EPW / T
- E2EPW ,
- Prerequisites:* A E2EPW B VDP.
- Note 2:** A E - -E P ( IPDU ) T E - -E P A
- Note 3:** T R I < > < > ( )  
 E2EP R < > < > ( ) ,  
 E2EC T RTE , R ES  
 : E

, R I < > < > ( ) R E  
 . T  
 A RTE R < > < > ( ) R R < > < > ( )  
 /  
 , H ,  
 ,  
 .



### 10.3.2.1 Sending Correct Messages

T correct messages ( T [Sequence of correct messages](#) )  
 : T  
 ( ) ,  
 ( ) .  
 E2EP < > < >  
 E2EP R < > < >

### 10.3.2.2 Sending Manipulated Messages

F  
 E2EP < > < > ( ) ,  
 E2EP < > < >



- T :
1. P
  2. C E2EP M < > ()
  3. A C <C > - 1  
16 ( 15 1)
  4. A , ( . . , D ID  
)
  5. C E2E < > P ( ) ,  
I-PDU
  6. E CRC E2E
  7. M , ( )
  8. C R < > < > ( )
  9. M R I < > < > ( )

## 11 Abbreviations

Abbreviation	Description
API	A P I
ASIL	A S I L
COM	C PDU , /
CRC	C R C
DE	D E
E2EConfig file	E2E C F , E2EPWG
E2EPW	E2E P W
E2EPWG	E2E P W G
E2Elib	E - -E C P L
EBNF	E B -N -F ( <u>/E B N F</u> ) <u>:// . . /</u>
ECU	E C U
QM	Q M ( ISO26262 )
PA	P A
PDE	P D E
I-PDU	I L P D U
PGN	P G N
RTE	R -T E
SC	S C
SW-C, SWC	S C
VDP	V D P

## 12 Glossary

Term	Description
<b>Communication stack</b>	T A F CAN ). ( E2EPW:
<b>Data Element (DE)</b>	A C- . A DE / / - I E2E , D E <i>Protected Data Element.</i>
<b>(E2E)Protection Wrapper</b>	A API E2E : ▪ A , API CRC (RTE, COM T ). ▪ A , API CRC
<b>Marshaling</b>	T DE ( C ) I-PDU DE. T CRC I-PDU .
<b>Protected Area</b>	T E2EC P A . E / COM : • E2EPW API ( . . , PDE , , ), • COM API ( . . , ID, ), • ( , ) ).
<b>Protected Data Element</b>	S <i>Data Element.</i>

## 13 References

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