

Lenze

Manual

IEC 61131-3

inside

***Global Drive
PLC Developer Studio***



Global Drive

Function library

LenzePLCToolBox.lib

The function library **LenzePLCToolBox.lib** can be used for the following Lenze PLC devices:

	Type	from hardware version	from software version
9300 Servo PLC	EVS93XX-xI	6A	6.0
9300 Servo PLC	ECS93XX-xT	6A	6.0
Drive PLC	EPL10200	1A	6.0
ECSxA	ECSxAxxx	1C	7.0

Important note:

The software is supplied to the user as described in this document. Any risks resulting from its quality or use remain the responsibility of the user. The user must provide all safety measures protecting against possible maloperation.

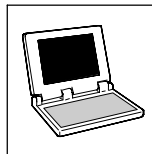
We do not take any liability for direct or indirect damage, e.g. profit loss, order loss or any loss regarding business.

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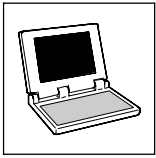
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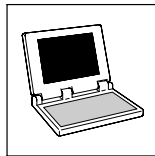


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Function library LenzePLCToolBox.lib

Contents



1 Preface and general information

1.1 About this Manual

This manual contains information about the **LenzePLCToolBox.lib** function library for the **Drive PLC Developer Studio**.

- The **LenzePLCToolBox.lib** function library includes among other things functions and function blocks, which enable "Byte", "Word" and "Double Word" data to be accessed bit by bit.

1.1.1 Conventions used in this Manual

This Manual uses the following conventions to distinguish between different types of information:

Variable identifiers

are written in italics in the explanation:

- "Use *bReset...*"



Tip!

Information about the conventions used for the variables of the Lenze system blocks, function blocks and functions can be found in the appendix of the DDS online documentation "Introduction into IEC61131-3 programming". The conventions ensure universal and uniform labelling and make reading the PLC program easier.

Lenze functions/function blocks

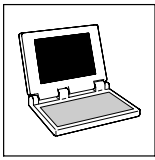
can be recognized by their names. They always begin with an "L_":

- "With the function **L_TBConvBitsToByte...**"

Program listings

are written in "Courier", keywords are printed in bold:

- " **IF** (ReturnValue < 0) **THEN...**"



Function library LenzePLCToolBox.lib

Preface and general information

About this Manual

1.1.2 Layout of the descriptions

All function/function block and system block descriptions contained in this Manual have the same structure:

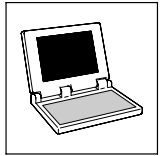
	Function	Function block (FB)/ System block (SB)
①	Headline stating the function and the function identifier	
②	Declaration of the function: - Data type of the return value - Function identifier - List of transfer parameters	-
③	Short description of the most important properties	
④	Function chart including all associated variables - Transfer parameters - Return value	FB/SB chart including all associated variables - Input variables - Output variables
⑤	Table giving information about the transfer parameters: - Identifier - Data type - Possible settings - Info	Table giving information about the input and output variables: - Identifier - Data type - Type of variable - Possible settings - Info
⑥	Table giving information about the return value: - Data type of the return value - Possible return values and their meaning:	-
⑦	Additional information (Notes, tips, application examples, etc.)	

1.1.3 Pictographs used in this Manual

	Use of pictographs	Signal words	
Warning of material damage		Stop!	Warns of potential damage to material . Possible consequences if disregarded: Damage to the controller/drive system or its environment.
Other notes		Tip! Note!	Indicates a tip or note.

1.1.4 Terminology used

Term	In the following text used for
DDS	Drive PLC Developer Studio
FB	Function block
GDC	Global Drive Control (parameterization program from Lenze)
Parameter codes	Codes for setting the functionality of a function block
PLC	9300 Servo PLC - Drive PLC - ECSxA "Application" axis module
SB	System block



1.2 Version identifiers of the function library

The version of the function library can be found under the global constant `C_w[Function library name]Version`.

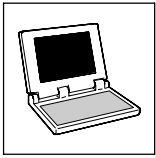
Version identifiers as of PLC software version 7.x:

Constant	Meaning	Example value
<code>C_w[FunctionLibraryName]VersionER</code>	External Release	01
<code>C_w[FunctionLibraryName]VersionEL</code>	External Level	05
<code>C_w[FunctionLibraryName]VersionIR</code>	Internal Release	00
<code>C_w[FunctionLibraryName]VersionBN</code>	Build No.	00

Version: 01 05 00 00

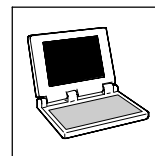
The value of this constant is a hexadecimal code.

- In the example, "01050000" stands for version "1.05".



Function library LenzePLCToolBox.lib

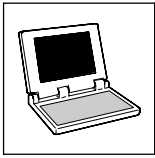
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2 Functions/function blocks

2.1 Overview

Function/function block		Info	
L_TBConvCharToByte	(FUN)	Supplies the ASCII code for a character	2-6
		Converting single bit values into a value of data type:	
L_TBConvBitsToByte	(FUN)	Byte (8 bits)	2-2
L_TBConvBitsToDword	(FUN)	Double word (32 bits)	2-3
L_TBConvBitsToWord	(FUN)	Word (16 bits)	2-4
		Outputting the single bit values for a value of data type:	
L_TBConvByteToBits	(FB)	Byte (8 bits)	2-5
L_TBConvDwordToBits	(FB)	Double word (32 bits)	2-7
L_TBConvWordToBits	(FB)	Word (16 bits)	2-8
		Querying a single bit in a value of data type:	
L_TBGetBitOfByte	(FUN)	Byte (8 bits)	2-9
L_TBGetBitOfDword	(FUN)	Double word (32 bits)	2-10
L_TBGetBitOfWord	(FUN)	Word (16 bits)	2-11
		Resetting a single bit in a value of data type:	
L_TBResetBitOfByte	(FUN)	Byte (8 bits)	2-12
L_TBResetBitOfDword	(FUN)	Double word (32 bits)	2-13
L_TBResetBitOfWord	(FUN)	Word (16 bits)	2-14
		Setting a single bit in a value of data type:	
L_TBSetBitOfByte	(FUN)	Byte (8 bits)	2-15
L_TBSetBitOfDword	(FUN)	Double word (32 bits)	2-16
L_TBSetBitOfWord	(FUN)	Word (16 bits)	2-17
L_TBSquareWave	(FB)	Generates a Boolean square wave signal with a variable high/low time.	2-18



Function library *LenzePLCToolBox.lib*

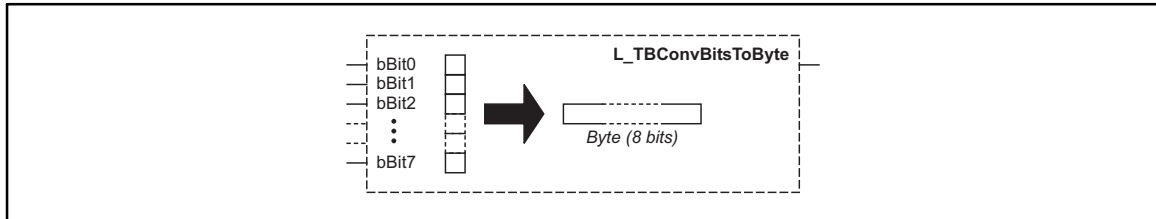
Functions/function blocks

L_TBConvBitsToByte

2.2 L_TBConvBitsToByte

BYTE **L_TBConvBitsToByte** (bBit0, bBit1, bBit2, bBit3, bBit4, bBit5, bBit6, bBit7)

This function converts 8 single bit values into a value of type "byte".



Transfer parameters		
Identifiers	Data type	Info/possible settings
bBit0	Bool	Bit 0 (valency: 2 ⁰)
bBit1	Bool	Bit 1 (valency: 2 ¹)
bBit2	Bool	Bit 2 (valency: 2 ²)
...	...	...
bBit7	Bool	Bit 7 (valency: 2 ⁷)

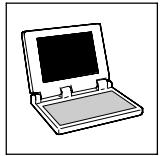
Return value: Byte	
Value	Meaning
0 ... 255	Value of type "byte" corresponding to the transmitted bit values.

Example

Calling the function in ST:

```
byResult := L_TBConvBitsToByte(0, 1, 1, 0, 1, 0, 0, 1);

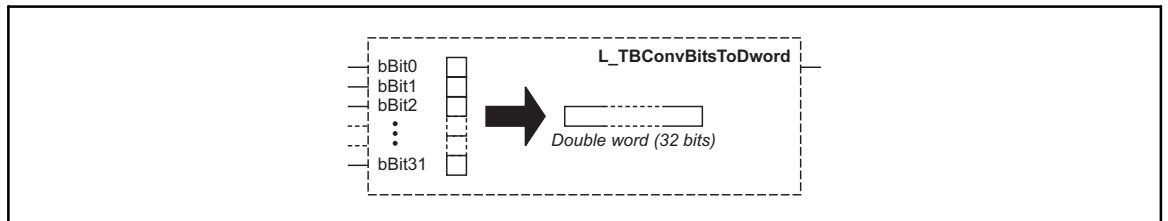
(* byResult = 150 *)
```



2.3 L_TBConvBitsToDword

```
DWORD L_TBConvBitsToDword (bBit0, bBit1, bBit2, bBit3,
    bBit4, bBit5, bBit6, bBit7,
    bBit8, bBit9, bBit10, bBit11,
    bBit12, bBit13, bBit14, bBit15,
    bBit16, bBit17, bBit18, bBit19,
    bBit20, bBit21, bBit22, bBit23,
    bBit24, bBit25, bBit26, bBit27,
    bBit28, bBit29, bBit30, bBit31)
```

This function converts 32 single bit values into a value of type "double word".



Transfer parameters		
Identifiers	Data type	Info/possible settings
bBit0	Bool	Bit 0 (valency: 2 ⁰)
bBit1	Bool	Bit 1 (valency: 2 ¹)
bBit2	Bool	Bit 2 (valency: 2 ²)
...	...	...
bBit31	Bool	Bit 31 (valency: 2 ³¹)

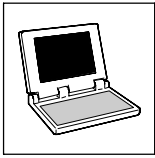
Return value: Double word	
Value	Meaning
0 ... 4294967295	Value of type "double word" corresponding to the transmitted bit values.

Example

Calling the function in ST:

```
dwResult := L_TBConvBitsToDword(0, 1, 1, 0, 1, 0, 0, 1,
    1, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0);

(* dwResult = 406 *)
```



Function library LenzePLCToolBox.lib

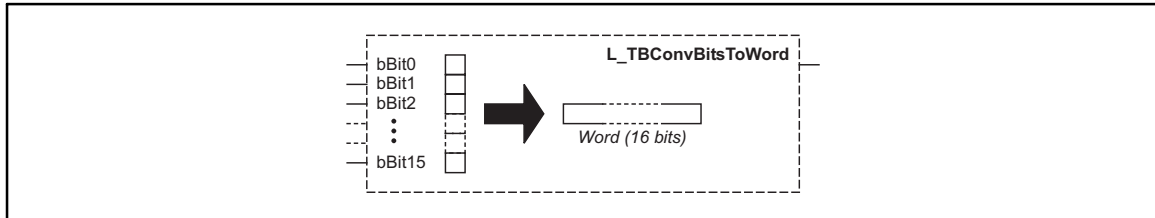
Functions/function blocks

L_TBConvBitsToWorld

2.4 L_TBConvBitsToWorld

WORD **L_TBConvBitsToWorld** (bBit0, bBit1, bBit2, bBit3, bBit4, bBit5, bBit6, bBit7, bBit8, bBit9, bBit10, bBit11, bBit12, bBit13, bBit14, bBit15)

This function converts 16 single bit values into a value of type "word".



Transfer parameters		
Identifiers	Data type	Info/possible settings
bBit0	Bool	Bit 0 (valency: 2 ⁰)
bBit1	Bool	Bit 1 (valency: 2 ¹)
bBit2	Bool	Bit 2 (valency: 2 ²)
...	...	...
bBit15	Bool	Bit 15 (valency: 2 ¹⁵)

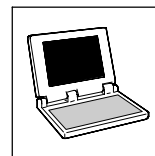
Return value: Word	
Value	Meaning
0 ... 65535	Value of type "word" corresponding to the transmitted bit values.

Example

Calling the function in ST:

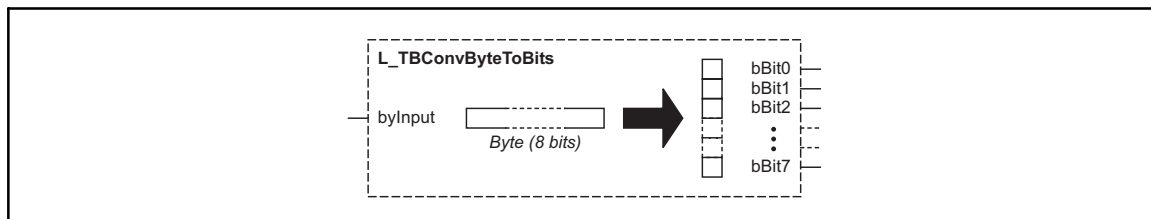
```
wResult := L_TBConvBitsToWorld(0, 1, 1, 0, 1, 0, 0, 1,
1, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0);

(* dwResult = 406 *)
```



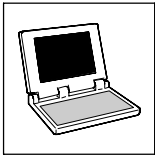
2.5 L_TBConvByteToBits

This FB returns the 8 corresponding bit values for an input value of type "byte".



⇒ Inputs		
Identifiers	Data type	Info/possible settings
byInput	Byte	Value to be converted

Outputs ⇒		
Identifiers	Data type	Value/meaning
bBit0	Bool	Output bit 0 of <i>byInput</i> (valency: 2 ⁰)
bBit1	Bool	Output bit 1 of <i>byInput</i> (valency: 2 ¹)
bBit2	Bool	Output bit 2 of <i>byInput</i> (valency: 2 ²)
...	...	...
bBit7	Bool	Output bit 7 of <i>byInput</i> (valency: 2 ⁷)



Function library *LenzePLCToolBox.lib*

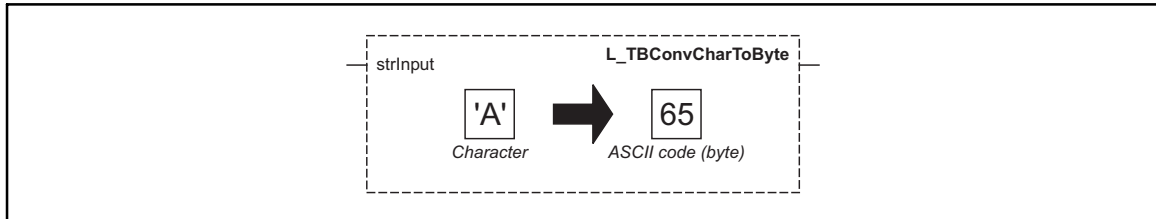
Functions/function blocks

L_TBConvCharToByte

2.6 L_TBConvCharToByte

BYTE **L_TBConvCharToByte** (strInput)

This function returns the appropriate ASCII code for a character (string with character length "1").



Transfer parameters

Identifiers	Data type	Info/possible settings
strInput	String(1)	Character for which the ASCII code is to be returned.

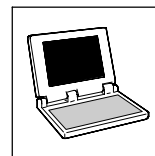
Return value: Byte

Value	Meaning
0 ... 255	ASCII code of <i>strInput</i>

Example

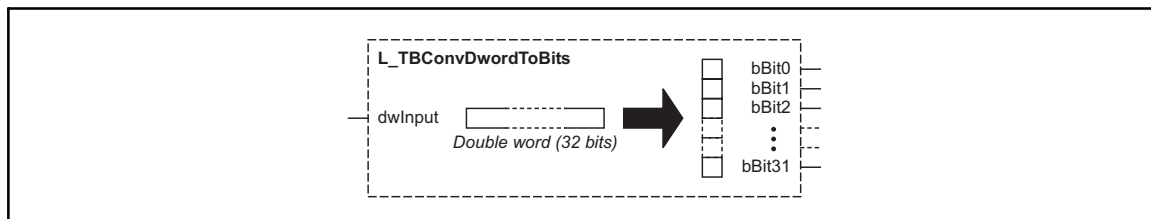
Calling the function in ST:

```
strCharacter := 'A';  
byASCIICode := L_TBConvCharToByte(strCharacter);  
  
(* byASCIICode = 65 *)
```



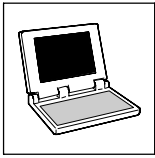
2.7 L_TBConvDwordToBits

This FB returns the 32 corresponding bit values for an input value of type "double word".



⇒ Inputs		
Identifiers	Data type	Info/possible settings
dwInput	Double word	Value to be converted

Outputs ⇒		
Identifiers	Data type	Value/meaning
bBit0	Bool	Output bit 0 of <i>dwInput</i> (valency: 2^0)
bBit1	Bool	Output bit 1 of <i>dwInput</i> (valency: 2^1)
bBit2	Bool	Output bit 2 of <i>dwInput</i> (valency: 2^2)
...	...	...
bBit31	Bool	Output bit 31 of <i>dwInput</i> (valency: 2^{31})

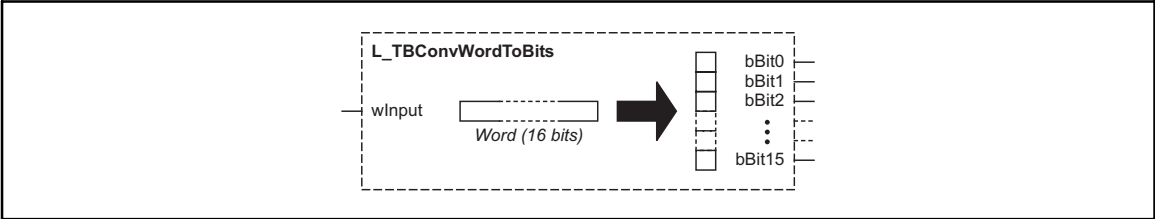


Function library LenzePLCToolBox.lib

Functions/function blocks
L_TBConvWordToBits

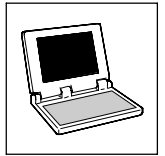
2.8 L_TBConvWordToBits

This FB returns the 16 corresponding bit values for an input value of type "word".



⇒ Inputs		
Identifiers	Data type	Info/possible settings
wInput	Word	Value to be converted

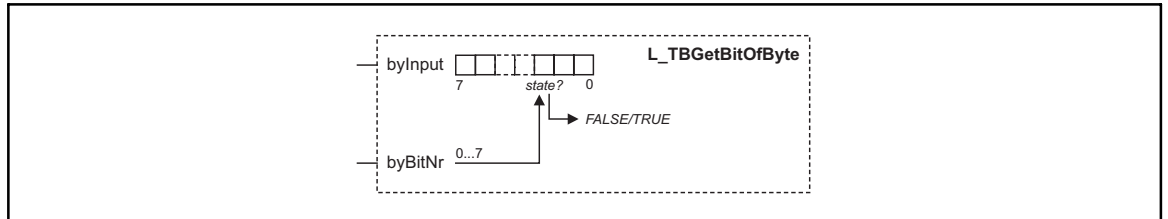
Outputs ⇒		
Identifiers	Data type	Value/meaning
bBit0	Bool	Output bit 0 of <i>wInput</i> (valency: 2 ⁰)
bBit1	Bool	Output bit 1 of <i>wInput</i> (valency: 2 ¹)
bBit2	Bool	Output bit 2 of <i>wInput</i> (valency: 2 ²)
...	...	...
bBit15	Bool	Output bit 15 of <i>wInput</i> (valency: 2 ¹⁵)



2.9 L_TBGetBitOfByte

BOOL **L_TBGetBitOfByte** (byInput, byBitNr)

This function returns the state of a single bit within a "byte" value.



Transfer parameters

Identifiers	Data type	Info/possible settings
byInput	Byte	Value
byBitNr	Byte	No. (0 ... 7) of the bit of <i>byInput</i> whose state is to be determined.

Return value: Bool

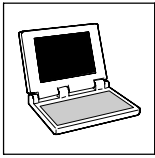
Value	Meaning
FALSE/TRUE	State of bit <i>byBitNr</i> of <i>byInput</i> .

Example

Calling the function in ST:

```
byValue := 105 (* byValue = 105 dec = 01101001 bin *)

bBit0 := L_TBGetBitOfByte(byValue, 0); (* bBit0 = TRUE *)
bBit1 := L_TBGetBitOfByte(byValue, 1); (* bBit1 = FALSE *)
bBit2 := L_TBGetBitOfByte(byValue, 2); (* bBit2 = FALSE *)
```



Function library *LenzePLCToolBox.lib*

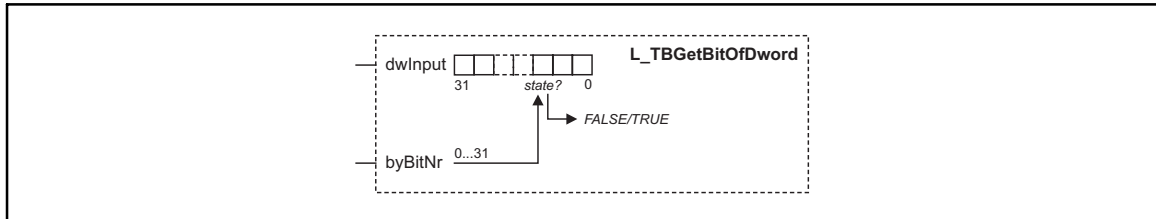
Functions/function blocks

L_TBGetBitOfDword

2.10 L_TBGetBitOfDword

BOOL **L_TBGetBitOfDword** (dwInput, byBitNr)

This function returns the state of a single bit within a "double word" value.



Transfer parameters		
Identifiers	Data type	Info/possible settings
dwInput	Double word	Value
byBitNr	Byte	No. (0 ... 31) of the bit of <i>dwInput</i> whose state is to be determined.

Return value: Bool	
Value	Meaning
FALSE/TRUE	State of bit <i>byBitNr</i> of <i>dwInput</i> .

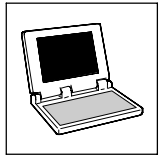
Example

Calling the function in ST:

```
dwValue := 105

(* dwValue = 105 dec = 00000000 00000000 00000000 01101001 bin *)

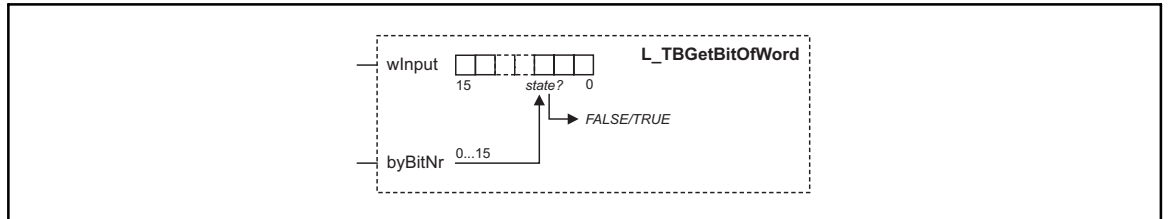
bBit0 := L_TBGetBitOfDword(dwValue, 0); (* bBit0 = TRUE *)
bBit1 := L_TBGetBitOfDword(dwValue, 1); (* bBit1 = FALSE *)
bBit2 := L_TBGetBitOfDword(dwValue, 2); (* bBit2 = FALSE *)
```



2.11 L_TBGetBitOfWord

BOOL **L_TBGetBitOfWord** (wInput, byBitNr)

This function returns the state of a single bit within a "word" value.



Transfer parameters

Identifiers	Data type	Info/possible settings
wInput	Word	Value
byBitNr	Byte	No. (0 ... 15) of the bit of <i>wInput</i> whose state is to be determined.

Return value: Bool

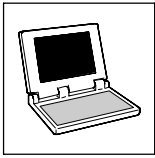
Value	Meaning
FALSE/TRUE	State of bit <i>byBitNr</i> of <i>wInput</i> .

Example

Calling the function in ST:

```
wValue := 105 (* wValue = 105 dec = 00000000 01101001 bin *)

bBit0 := L_TBGetBitOfWord(wValue, 0); (* bBit0 = TRUE *)
bBit1 := L_TBGetBitOfWord(wValue, 1); (* bBit1 = FALSE *)
bBit2 := L_TBGetBitOfWord(wValue, 2); (* bBit2 = FALSE *)
```



Function library *LenzePLCToolBox.lib*

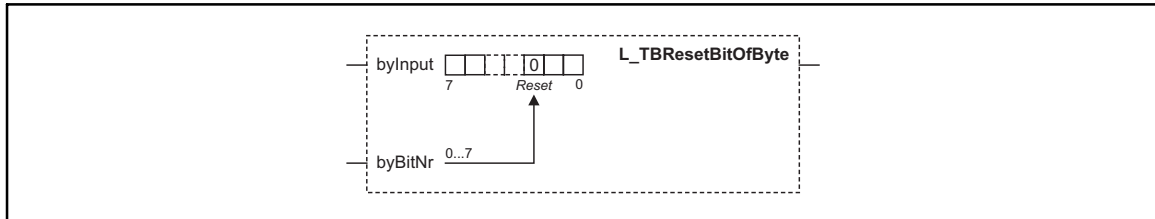
Functions/function blocks

L_TBResetBitOfByte

2.12 L_TBResetBitOfByte

BYTE **L_TBResetBitOfByte** (byInput, byBitNr)

This function resets a single bit in a value of type "byte" to "0".



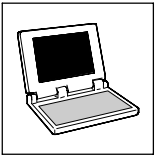
Transfer parameters		
Identifiers	Data type	Info/possible settings
byInput	Byte	Value in which a bit is to be reset to "0".
byBitNr	Byte	No. (0 ... 7) of the bit to be reset.

Return value: Byte	
Value	Meaning
0 ... 255	Value of type "byte" resulting from the reset bit.

Example

Calling the function in ST:

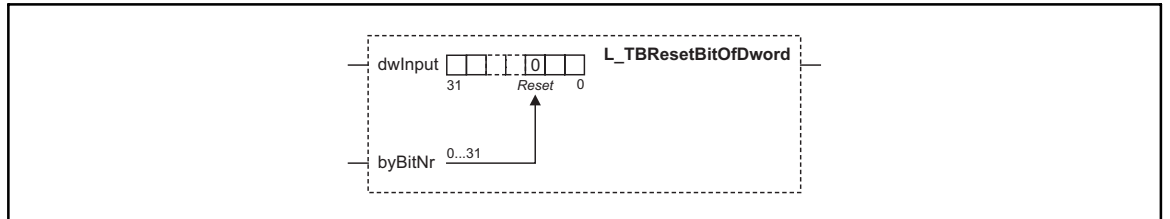
```
byValue := 105 (* byValue = 105 dec = 01101001 bin *)  
  
byValue := L_TBResetBitOfByte(byValue, 3); (* reset bit 3 *)  
  
(* byValue = 97 dec = 01100001 bin *)
```



2.13 L_TBResetBitOfDword

DWORD **L_TBResetBitOfDword** (dwInput, byBitNr)

This function resets a single bit in a value of type "double word" to "0".



Transfer parameters

Identifiers	Data type	Info/possible settings
dwInput	Double word	Value in which a bit is to be reset to "0".
byBitNr	Byte	No. (0 ... 31) of the bit to be reset.

Return value: Double word

Value	Meaning
0 ... 4294967295	Value of type "double word" resulting from the reset bit.

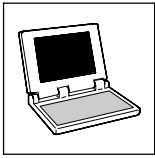
Example

Calling the function in ST:

```
dwValue := 105 (* dwValue = 105 dec = 01101001 bin *)

dwValue := L_TBResetBitOfDword(dwValue, 3); (* reset bit 3 *)

(* dwValue = 97 dec = 01100001 bin *)
```



Function library *LenzePLCToolBox.lib*

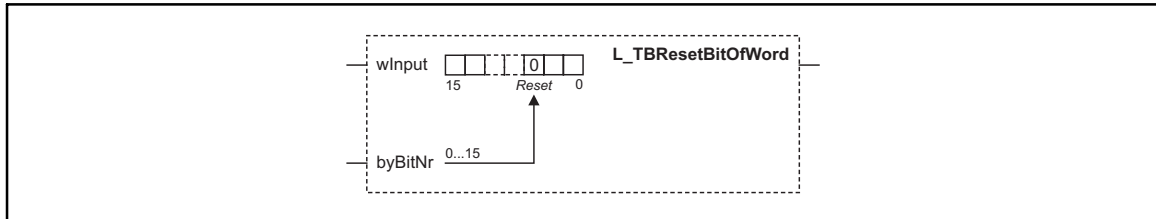
Functions/function blocks

L_TBResetBitOfWord

2.14 L_TBResetBitOfWord

WORD **L_TBResetBitOfWord** (wInput, byBitNr)

This function resets a single bit in a value of type "word" to "0".



Transfer parameters

Identifiers	Data type	Info/possible settings
wInput	Word	Value in which a bit is to be reset to "0".
byBitNr	Byte	No. (0 ... 15) of the bit to be reset.

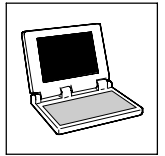
Return value: Word

Value	Meaning
0 ... 65535	Value of type "word" resulting from the reset bit.

Example

Calling the function in ST:

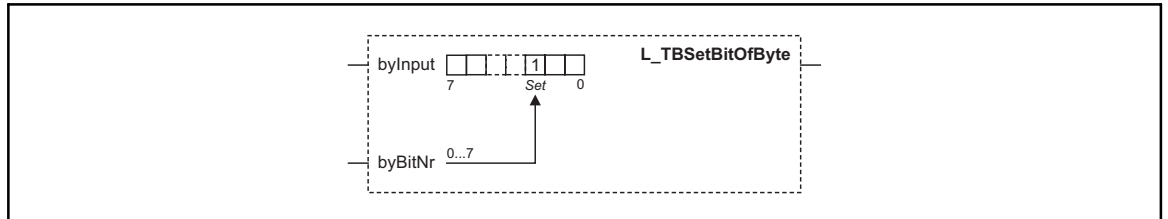
```
wValue := 105 (* wValue = 105 dec = 01101001 bin *)  
  
wValue := L_TBResetBitOfWord(wValue, 3); (* reset bit 3 *)  
  
(* wValue = 97 dec = 01100001 bin *)
```



2.15 L_TBSetBitOfByte

BYTE **L_TBSetBitOfByte** (byInput, byBitNr)

This function sets a single bit in a value of type "byte" to "1".



Transfer parameters

Identifiers	Data type	Info/possible settings
byInput	Byte	Value in which a bit is to be set to "1".
byBitNr	Byte	No. (0 ... 7) of the bit to be set.

Return value: Byte

Value	Meaning
0 ... 255	Value of type "byte" resulting from the set bit.

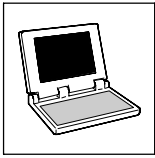
Example

Calling the function in ST:

```
byValue := 97 (* byValue = 97 dec = 01100001 bin *)

byValue := L_TBSetBitOfByte(byValue, 3); (* set bit 3 *)

(* byValue = 105 dec = 01101001 bin *)
```



Function library *LenzePLCToolBox.lib*

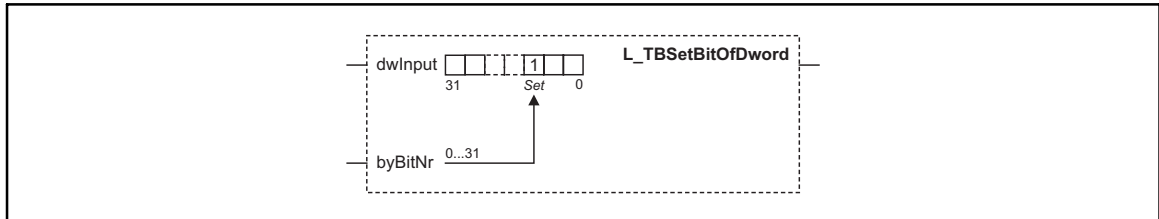
Functions/function blocks

L_TBSetBitOfDword

2.16 L_TBSetBitOfDword

DWORD **L_TBSetBitOfDword** (dwInput, byBitNr)

This function sets a single bit in a value of type "double word" to "1".



Transfer parameters

Identifiers	Data type	Info/possible settings
dwInput	Double word	Value in which a bit is to be set to "1".
byBitNr	Byte	No. (0 ... 31) of the bit to be set.

Return value: Double word

Value	Meaning
0 ... 4294967295	Value of type "double word" resulting from the set bit.

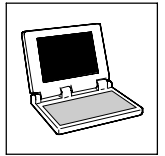
Example

Calling the function in ST:

```
dwValue := 97 (* dwValue = 97 dec = 01100001 bin *)
```

```
dwValue := L_TBSetBitOfDword(dwValue, 3); (* set bit 3 *)
```

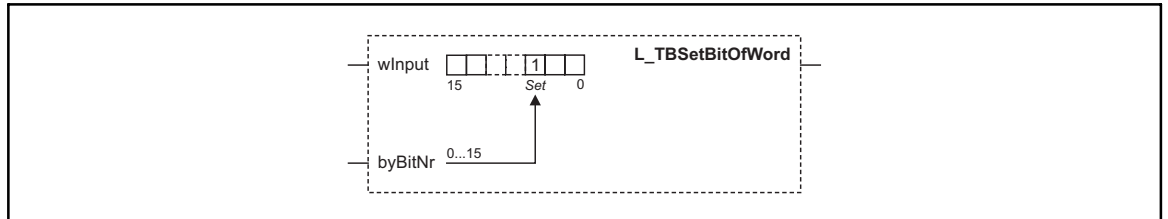
```
(* dwValue = 105 dec = 01101001 bin *)
```



2.17 L_TBSetBitOfWord

WORD **L_TBSetBitOfWord** (wInput, byBitNr)

This function sets a single bit in a value of type "word" to "1".



Transfer parameters

Identifiers	Data type	Info/possible settings
wInput	Word	Value in which a bit is to be set to "1".
byBitNr	Byte	No. (0 ... 15) of the bit to be set.

Return value: Word

Value	Meaning
0 ... 65535	Value of type "word" resulting from the set bit.

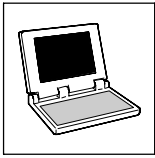
Example

Calling the function in ST:

```
wValue := 97 (* wValue = 97 dec = 01100001 bin *)

wValue := L_TBSetBitOfWord(wValue, 3); (* set bit 3 *)

(* wValue = 105 dec = 01101001 bin *)
```



Function library LenzePLCToolBox.lib

Functions/function blocks

L_TBSquareWave

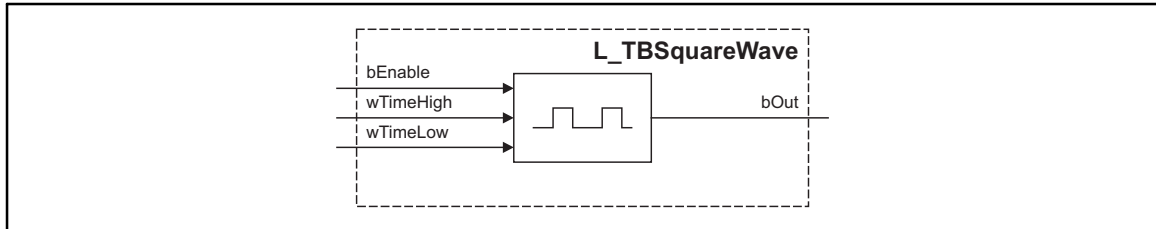
2.18 L_TBSquareWave

This FB can be used to generate a Boolean square wave signal with a variable high/low time.



Note!

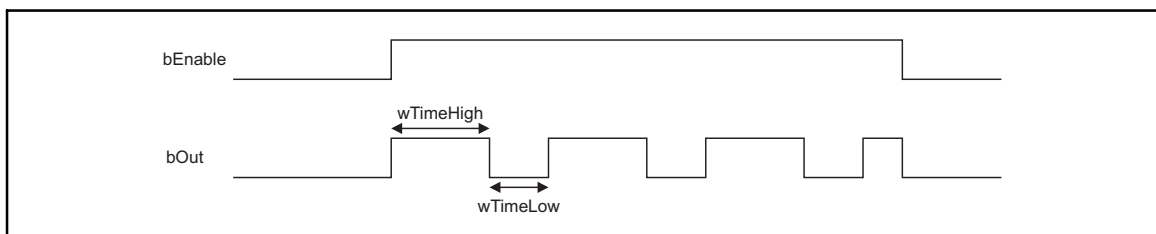
This function block has to be activated in a time-controlled task.



⇒ Inputs (Variable type: VAR_INPUT)			
Identifiers	Data type	Signal type	Info/possible settings
bEnable	Bool	binary	Activating the signal generator
			FALSE Signal generator deactivated, bOut = FALSE
			TRUE Signal generator activated
wTimeHigh	Word	-	High time in [ms]
wTimeLow	Word	-	Low time in [ms]

Outputs ⇒ (Variable type: VAR_OUTPUT)			
Identifiers	Data type	Signal type	Info
bOut	Bool	binary	Boolean square wave signal

If the FB is activated by setting *bEnable* to TRUE, the set square wave signal is output at *bOut* starting with the state HIGH:



- If *bEnable* is reset to FALSE, the *bOut* output is also immediately reset to FALSE.