Reading and Writing RFID Data with SIMATIC S7-1500 via IO-Link

SIMATIC RF220R Reader, ET 200SP

https://support.industry.siemens.com/cs/ww/en/view/73565887

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1 Task

Introduction

With RFID, complete tracking and documentation of all delivered, stored and shipped goods can be performed for intralogistics or in small assembly lines. For this purpose, a small data medium – referred to as transponder – that stores all essential information is attached to each product or package. A read/write device (reader) is used to read from / write to the transponder.

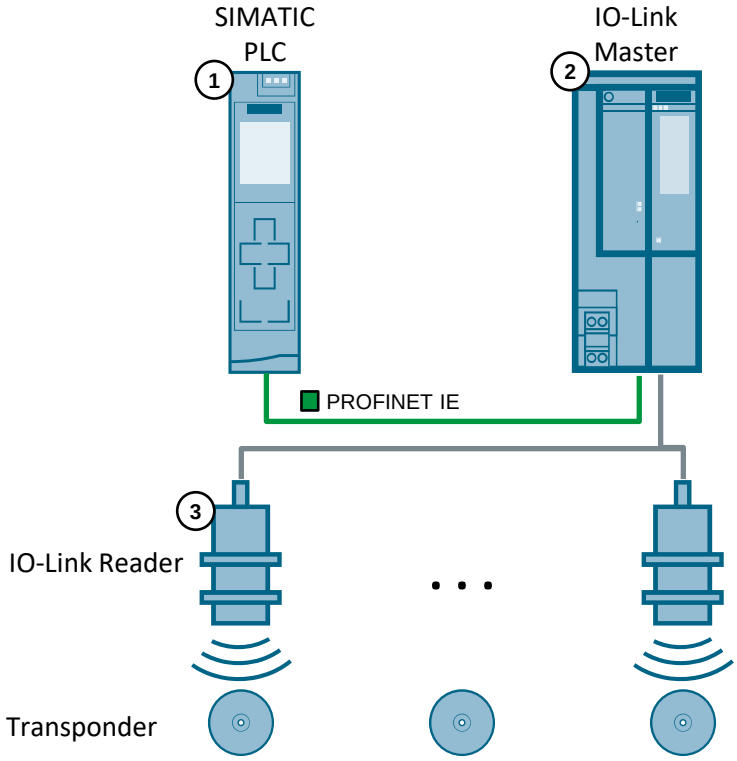
Overview of the automation task

In order to realize simple identification jobs, the RF200 readers are available in an interface variant for IO-Link. Using this standardized interface it becomes particularly easy and economical to automatically integrate the read data from the reader into the automation level.

The communication between a SIMATIC CPU (1) and the RF200 Reader (3) with IO-Link interface is realized via a respective IO-Link master module (2). It reads the data via configured address areas of the RF200 IO-Link reader.

The figure below provides an overview of the automation task.

Figure 1-1



Problem description

This application should meet the following requirements:

- The connection of the data read by the reader into the S7 station is to be performed via the IO-Link interface.
- The intention is to show how easily the function blocks of the Library for IO-Link (LIOLink) can be used for this task.
- The following RFID functions are to be implemented in the user program:
  - Switching on an integrated antenna of the RF220R reader ("LIOLink_RF200_SwitchAntenna")
  - Reading RFID data from transponders ("LIOLink_RF200_ReadTag") and writing RFID data to transponders ("LIOLink_RF200_WriteTag")
  - Switching off integrated antenna after a successful read/write process or after an error in order to prevent possible interferences with other read devices.
- Integration of simple functions to monitor the implemented processes
- Error handling

To realize the application, a SIMATIC RF220R IO-Link reader (version 1.1) with a SIMATIC S7-1513-1 PN CPU should be used.

The read/write process shall be controlled and visualized via a watch table.

Further informations

You can download the Library for IO-Link (LIOLink) separately in the Siemens Industry Online Support:

https://support.industry.siemens.com/cs/ww/en/view/82981502

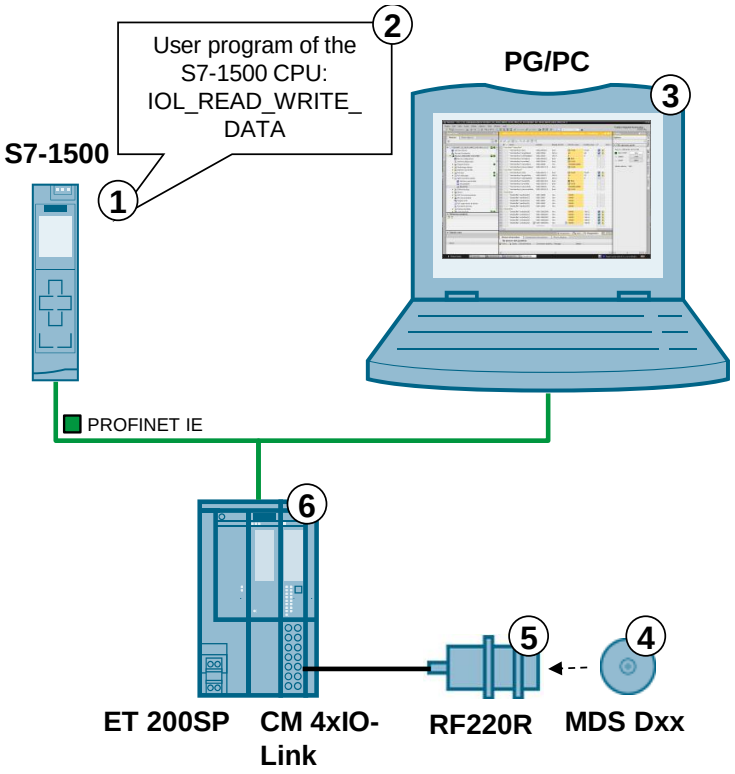
2 Solution

2.1 Overview

Schematic layout

The figure below shows a schematic overview of the most important components of the solution:

Figure 2-1



Components included

Table 2-1

No.	Component	Description
1.	S7-1500 CPU	Any S7-1500 CPU can be used
2.	User program	" IOL_READ_WRITE_DATA" with: • "IolReadAnt" • "IolWriteAnt" • "LIOLink_RF200_ReadTag" • "LIOLink_RF200_WriteTag" • "LIOLink_RF200_SwitchAntenna"
3.	PG/PC	Programming device with TIA Portal
4.	MDS Dxx	Transponder
5.	SIMATIC RF220R with IO-Link interface V1.1	Reader. Any RF200 IO-Link reader V1.1 release can be used

No.	Component	Description
6.	IO-Link master • ET 200SP IM155-6PN HF • ET 200SP, CM 4 X IO-LINK ST	SIMATIC ET 200eco PN, ET 200S or ET 200AL can also be used as IO-Link master.

Structure

The integration of the RF220R via IO-Link to the S7-1500 is performed via the IO-Link Master ET 200SP/ CM 4xIO-Link, to which the RF220R is connected via its IO link interface.

The user blocks FB IolReadAnt and FB IolWriteAnt have been created with the function blocks from the Library for IO-Link (LIOLink). In these blocks the following is realized:

- the interconnection of the RFID functions
- the monitoring functions and
- the error handling.

Advantages

This application example:

- already includes the above-described functions on a fully implemented basis.
- can be easily customized for extensions.
- includes already the configuration of the IO-Link master.
- can be commissioned quickly.

Delimitation

This application does not include a basic description of

- SIMATIC RF200 IO-Link Reader. Please refer to document \6\.
- SIMATIC ET 200SP. Please refer to document \7\.
- the LAD/ FBD/ STL/ SCL programming languages.

Basic knowledge of these topics is assumed.

2.2 Description of the core functionality

Realized functions

The following core functions have been realized in the application example:

- Switching on the integrated antenna of the RF220R reader before starting a read or write job.
- Reading/writing RFID data when a transponder is located in the reader's field.
- Switching off the integrated antenna of the RF220R reader when the read/write job has been completed successfully or with an error.
- Time monitoring of the read/write function.

Note For a more detailed description of these functions, please refer to chapter 3 and the following chapters.

Note Explanations on the difference between job and function:

Read/write job:
Call of " LIOLink_RF200_ReadTag" / " LIOLink_RF200_WriteTag" function block of the Library for IO-Link (LIOLink).

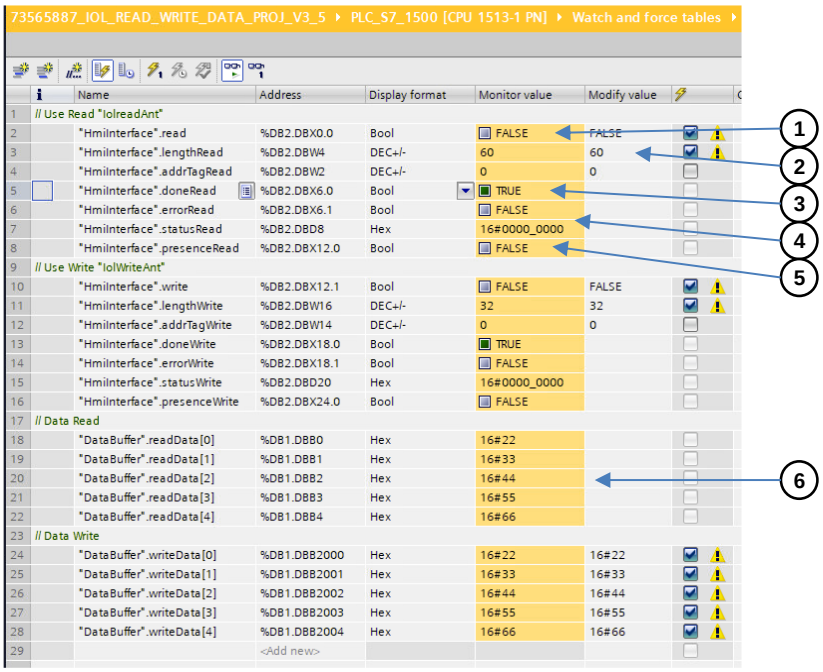
Read/write function:
The entire process for reading/writing the RFID data including switching on and off of the integrated antenna of the reader, read/write job and monitoring function.

2.2.1 Reading / writing of RFID data from / to a transponder

Visualization "READ"

The following figure shows the watch table "ReadWrite" for the "READ" function.

Figure 2



	Name	Address	Display format	Monitor value	Modify value
1	// Use Read "IolreadAnt"				
2	"HmiInterface".read	%DB2.DBX0.0	Bool	FALSE	FALSE
3	"HmiInterface".lengthRead	%DB2.DBW4	DEC+/-	60	60
4	"HmiInterface".addrTagRead	%DB2.DBW2	DEC+/-	0	0
5	"HmiInterface".doneRead	%DB2.DBX6.0	Bool	TRUE	
6	"HmiInterface".errorRead	%DB2.DBX6.1	Bool	FALSE	
7	"HmiInterface".statusRead	%DB2.DBD8	Hex	16#0000_0000	
8	"HmiInterface".presenceRead	%DB2.DBX12.0	Bool	FALSE	
9	// Use Write "IolWriteAnt"				
10	"HmiInterface".write	%DB2.DBX12.1	Bool	FALSE	FALSE
11	"HmiInterface".lengthWrite	%DB2.DBW16	DEC+/-	32	32
12	"HmiInterface".addrTagWrite	%DB2.DBW14	DEC+/-	0	0
13	"HmiInterface".doneWrite	%DB2.DBX18.0	Bool	TRUE	
14	"HmiInterface".errorWrite	%DB2.DBX18.1	Bool	FALSE	
15	"HmiInterface".statusWrite	%DB2.DBD20	Hex	16#0000_0000	
16	"HmiInterface".presenceWrite	%DB2.DBX24.0	Bool	FALSE	
17	// Data Read				
18	"DataBuffer".readData[0]	%DB1.DBB0	Hex	16#22	
19	"DataBuffer".readData[1]	%DB1.DBB1	Hex	16#33	
20	"DataBuffer".readData[2]	%DB1.DBB2	Hex	16#44	
21	"DataBuffer".readData[3]	%DB1.DBB3	Hex	16#55	
22	"DataBuffer".readData[4]	%DB1.DBB4	Hex	16#66	
23	// Data Write				
24	"DataBuffer".writeData[0]	%DB1.DBB2000	Hex	16#22	16#22
25	"DataBuffer".writeData[1]	%DB1.DBB2001	Hex	16#33	16#33
26	"DataBuffer".writeData[2]	%DB1.DBB2002	Hex	16#44	16#44
27	"DataBuffer".writeData[3]	%DB1.DBB2003	Hex	16#55	16#55
28	"DataBuffer".writeData[4]	%DB1.DBB2004	Hex	16#66	16#66
29		<Add new>			

Table 2-2

No.	Description
1.	"READ" starts a read job.
2.	Entry of the length, and the offset with the data to be read.
3.	"DONE" indicates whether the last job has been processed without errors.
4.	"ERROR" indicates whether an error has occurred. "STATUS" gives an indication of which error has happened (see Chapter 3.2.3).
5.	Display whether a transponder is located in the detection area of the reader.
6.	Outputs up to 24 bytes of the read data after a job has been executed without errors.

Visualization "WRITE"

The figure below shows the watch table "ReadWrite" for the "WRITE" function.

Figure 2-2

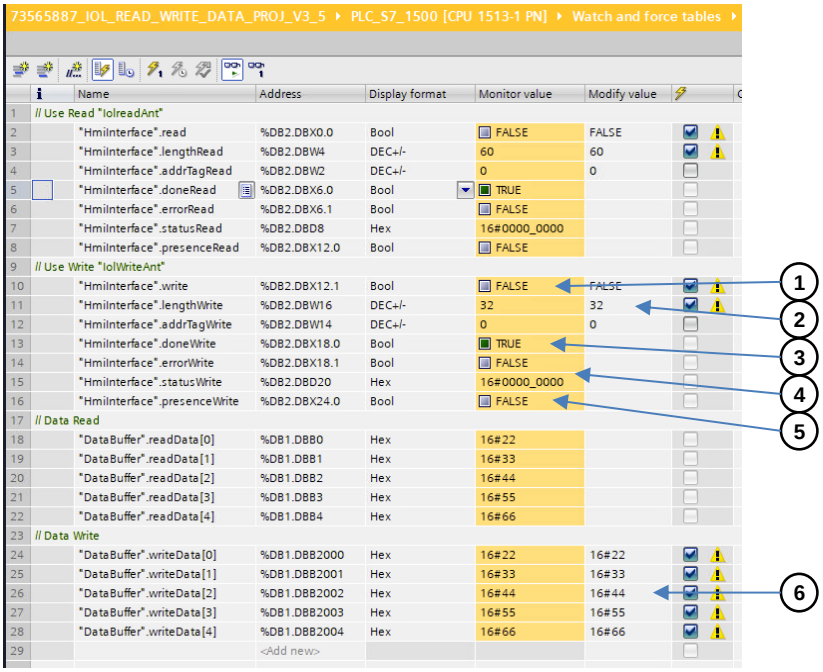


Table 2-3

No.	Description
1.	"WRITE" starts a write job.
2.	Entry of the length, and the offset with the data to be written.
3.	"DONE" indicates whether the last job has been processed without errors.
4.	"ERROR" indicates whether an error has occurred. "STATUS" gives an indication of which error has happened (see Chapter 3.2.3).
5.	Display whether a transponder is located in the write area of the reader.
6.	24 bytes of the data to be written can be entered here. The data entered here is directly written to data block "Data_Buffer" (DB1).

Sequence of the core functionality

Figure 2-3

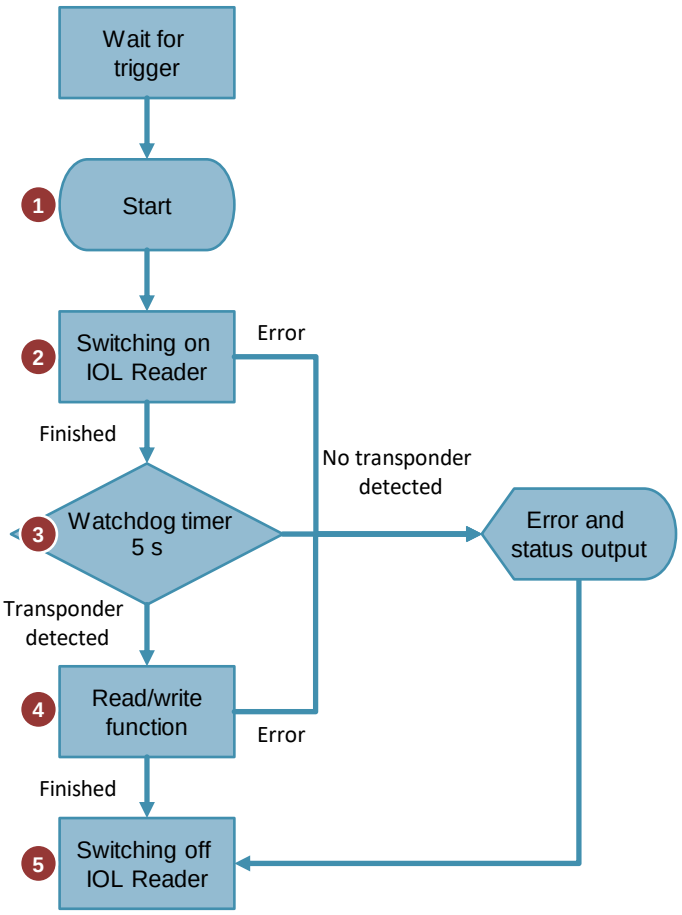


Table 2-4

No.	Action	Note
1.	Job triggered by the user.	With watch table.
2.	Switch on IOL reader by selecting the "LIOLink_RF299_SwitchAntenna" block.	
3.	Start the watchdog timer.	The watchdog timer monitors whether a transponder is located within the detection area within a monitoring time of 5 seconds.
4.	Read the transponder with the "LIOLink_RF200_ReadTag" block.	
5.	Switch off IOL reader by selecting the "LIOLink_RF200_SwitchAntenna" block.	Executed if the read job has been executed successfully or an error has occurred during the read job. Switching off the antenna field terminates the read function.

2.3 Hardware and software components

2.3.1 Validity

- all S7-1500 CPUs from the SIMATIC product range
- STEP 7 V17
- reader of the RF200 (V1.1) family with IO-Link interface

2.3.2 Components used

The application was created with the following components:

Hardware components

Table 2-5

Component	No.	Article number	Note
SIMATIC S7-1500 CPU 1513-1PN	1	6ES7 513-1AL02-0AB0 FW V2.9	Alternatively, any other compatible SIMATIC S7-1500 with PN interface can also be used.
SIMATIC PM 1507 24 V	1	6EP1332-4BA00	Alternatively, any other voltage supply can also be used.
ET 200SP IM 155-6PN HF	1	6ES7155-6AU02-0CN0 FW V4.1	Another IO-Link master can also be used.
CM 4xIO-Link	1	6ES7137-6BD00-0BA0	
SIMATIC RF220R IOL	1	6GT2821-2BC32	Another RF200 IO-Link reader (V1.1) can also be used.
Reader cable	1	6GT2891-0LH50	When using alternative IO-Link master, the respectively suitable cables are documented in \10\.
RF Transponder	n	MDS Dxyz	Alternatively, another transponder type can also be used.

Software components

Table 2-6

Component	No.	Article number	Note
TIA Portal V17	1	6ES7822-1A.06-..	
S7-PCT-Port Configuration Tool (as of V3.4 HF2)	1		Available for download in the Online Support \3\
IODD file RF220R for IO Link V1.1	1		Available for download in the Online Support \4\

Example files and projects

The following list includes all files and projects that are used in this example.

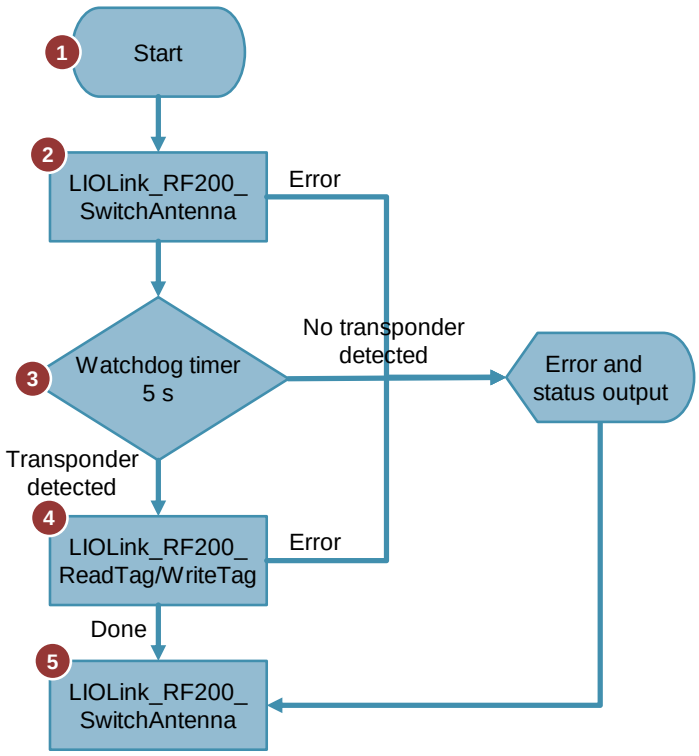
Table 2-7

Component	Note
73565887_IOL_READ_WRITE_DATA_PROJ_V3_5.zip	This zip file contains the STEP 7 project.
73565887_IOL_READ_WRITE_DATA_DOC_V3_5_en.pdf	This document.

3 Mode of Operation

3.1 General overview

Figure 3-1



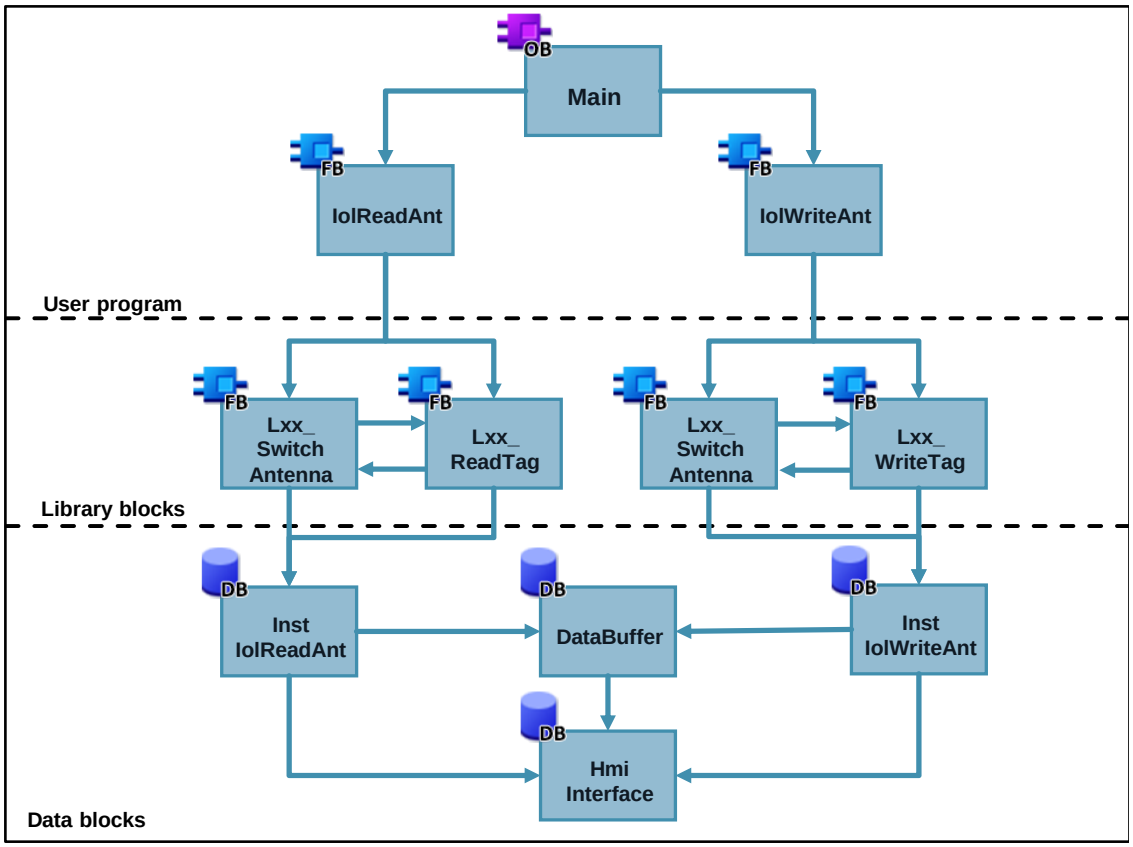
The table below shows the individual steps of the read/write function (reading/writing RFID data from/to the transponder).

Table 3-1

No.	Description
1.	Use the "READ"/"WRITE" button via the watch table "ReadWrite" to start the read/write function.
2.	The " LIOLink_RF200_SwitchAntenna" library block switches on the antenna field at the reader.
3.	The "TONR" watchdog timer monitors whether a transponder is located in the detection/write area within the monitoring time of 5 s.
4.	If a transponder is detected in the reader's field within the 5 seconds, the " LIOLink_RF200_ReadTag" / "LIOLink_RF200_WriteTag" library block will read/write the RFID data from/to the transponder.
5.	The " LIOLink_RF200_SwitchAntenna" library block switches off the antenna field at the reader when: • the read/write job has been successfully completed • an error has occurred while processing the read/write job • no transponder was detected in the reader's field within the specified time. Turning off the antenna field terminates the read/write function.

Program overview

Figure 3-2



Program blocks

Table 3-2

Element	Symbolic name	Description
OB1	Main	Cyclic OB: Calling the blocks for both functions.
FB3	IolReadAnt	FB "IolReadAnt" includes the described functions (Chapter 3.1) on an already fully implemented basis. In this block, the blocks are called from the "LIOLink_RF200_V31" library and the "TONR" monitoring function.
FB5.	IolWriteAnt	FB "IolWriteAnt" includes the described functions (Chapter 3.1) on an already fully implemented basis. In this block, the blocks are called from the "LIOLink_RF200_V31" library and the "TONR" monitoring function.
FB1	LIOLink_RF200_ SwitchAntenna	Function block for switching the antenna of an RF200 IO-Link reader on/off.
FB2	LIOLink_RF200_ReadTag	Function block for reading the transponder.
FB3	LIOLink_RF200_WriteTag	Function block for writing to the transponder.
DB1	DataBuffer	Global data block for saving the RFID data
DB2	HmiInterface	Global data block for the tags to control the functions.

Element	Symbolic name	Description
DB3	InstIolReadAnt	Instance data block of the IolReadAnt block
DB4	InstIolWriteAnt	Instance data block of the IolWriteAnt block

Note

For a more detailed description of the library blocks, refer to the library documentation:

https://support.industry.siemens.com/cs/ww/en/view/82981502

"Main"

OB 1 calls the following blocks:

- FB3: "IolReadAnt" contains the flowchart for a read job from switching the reader on, via the read function, to switching the reader off.
- FB5: "IolWriteAnt" contains the sequence for a write job from switching the reader on, via the read function, to switching the reader off.

"HmiInterface"

The "HmiInterface" data block (DB2) includes the data for the visualization in tags. These tags are integrated into a watch table and form the HMI interface.

Table 3-3

Name	Data type	Description
read	Bool	Read job triggered at positive edge.
addrTagRead	Word	Offset of the data to be read on the transponder
lengthRead	Time	Length of the data read during the read job.
doneRead	Bool	True, if write job completed without error.
errorRead	Bool	True, if read job has failed.
statusRead	Bool	Read job status in Hex code.
presenceRead	Word	Presence of a transponder in the detection area.
write	DWord	Write job triggered at positive edge
addrTagWrite	Bool	Offset where the data is written to the transponder.
lengthWrite	DWord	Length of the data written during the write job.
doneWrite	Bool	True, if write job completed without error.
errorWrite	Bool	True, if read job has failed.
statusWrite	Bool	Write job status in Hex code.
presenceWrite	Word	Presence of a transponder in the write area.

"DataBuffer"

In data block "DataBuffer" (DB1), the RFID data to be read from or written to the transponder is stored.

Table 3-4

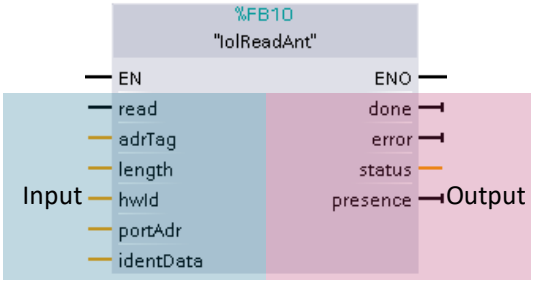
Name	Data type	Description
readData	Array[0..1999] of byte	Data read from the transponder after a read job.
writeData	Array[0..1999] of byte	Data, to be written to a transponder during a write process.

3.2 Functionality

3.2.1 Program details on FB "IolReadAnt" (FB3)

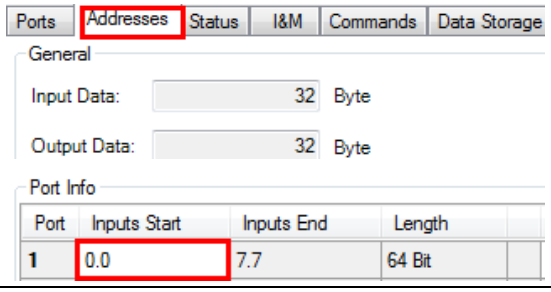
The following figures and tables show the call interface of user block FB "IolReadAnt" (FB3).

Figure 3-3



The block has the following inputs:

Table 3-5

Name	Data type	Description
read	Bool	Enables the read function after a positive edge
addrTag	Word	Start address of the data to be read from the transponder.
length	DWord	Length of the data that is read from the transponder.
hwId	HW_ANY	Hardware identifier of the IO-Link communication module.
portAddr	INT	Start address of the connected reader (PCT Tool). 

The block has the following in-/outputs:

Name	Data type	Description
identData	Variant	Data area where the read data is stored.

The block has the following outputs:

Table 3-6

Name	Data type	Description
done	Bool	TRUE, if processing the routine has been terminated. FALSE, during and before executing a new command. Default value: FALSE
error	Bool	TRUE if an error occurs when processing the routine. FALSE if a new command is started. Default value: FALSE
status	DWord	DW#16#00, if a command was completed without errors. In the case of an error (ERROR=TRUE) Hex value unequal zero (see 3.2.3)
presence	Bool	Presence bit. This bit is only set if a transponder is in the field of the reader.

NOTE

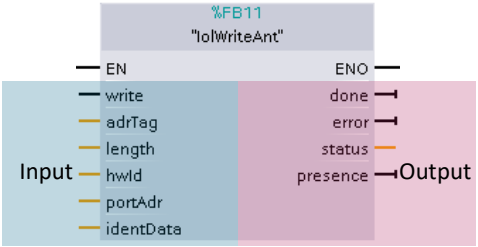
For a S7-300 CPU, the input "hwId" must be set to the IO start address of the IO-Link master.

For a ET 200eco PN Master, the input "portAddr" must be set to "0".

3.2.2 Program details on FB "IolWriteAnt" (FB5)

The following figure and table show the call interface of user block FB "IolWriteAnt" (FB5).

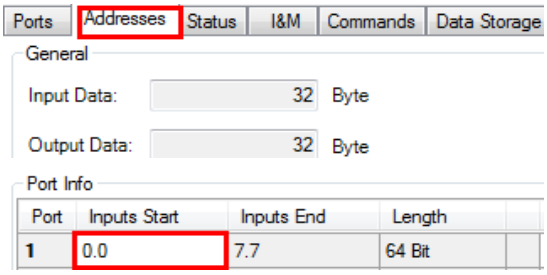
Figure 3-4



The block has the following inputs:

Table 3-7

Name	Data type	Description
read	Bool	Enables the write function after a positive edge

Name	Data type	Description
addrTag	Word	Start address of the data to be written on the transponder.
length	DWord	Length of the data that is written to the transponder.
hwId	HW_ANY	Hardware identifier of the IO-Link communication module.
portAddr	INT	Start address of the connected reader (PCT Tool). 

The block has the following in-/outputs:

Name	Data type	Description
identData	Variant	Data area where the read data is stored.

The block has the following outputs:

Table 3-8

Name	Data type	Description
done	Bool	TRUE, if processing the routine has been terminated. FALSE, during and before executing a new command. Default value: FALSE
error	Bool	TRUE if an error occurs when processing the routine. FALSE if a new command is started. Default value: FALSE
status	DWord	DW#16#00, if a command was completed without errors. In the case of an error (ERROR=TRUE) Hex value unequal zero (see 3.2.3)
presence	Bool	Presence bit. This bit is only set if a transponder is in the field of the reader.

NOTE

For a S7-300 CPU, the input "hwId" must be set to the IO start address of the IO-Link master.

For a ET 200eco PN Master, the input "portAddr" must be set to "0".

3.2.3 Error and status display

For error diagnostics, the function blocks "IolReadAnt" (FB3) and "IolWriteAnt" (FB5) have one STATUS output each. By reading the STATUS output of the function block you receive information on

- Error messages of the IolReadAnt function block (FB3) and the function blocks of the library
- Error messages of the connected RF200 IO-Link reader.

Note If there are error messages, the received data is invalid.

Error messages of the user program

The table below shows error messages of the function blocks "IolReadAnt" (FB3), "IolWriteAnt" (FB5) and the function blocks of library ("LIOL_Antenna", "LIOL_Read", "LIOL_Write").

Table 3-9

STATUS	Description	Remedy
16#00018101	The transponder has left the field during the read process.	Restart process
16#00018102	The previous job has not been completed yet. The job is finished at the next possible time.	Restart process
16#00018103	No transponder was detected in the reader's field within the specified time.	Restart process
16#00018104	The given length is smaller than 28.	Specify a length of a minimum of 28.
16#000180xy 16#000187xy 16#000185xy 16#00018xyy	Error messages of the extended instructions "BLKMOV", "DPRD_DAT" and "DPWR_DAT".	Online help in STEP 7
16#001100xx	Error messages of the connected reader	See below.

Error messages of the RF200 IO-Link reader

The error of the connected reader can be determined as follows:

- directly on the reader by counting the flash pattern of the red error LED
- via the STATUS parameter (16#001100xx)

A detailed overview of these errors is available in the manual "RFID systems SIMATIC RF200 IO-Link" (see \5\, Chapter 7).

4 Installation and Commissioning

4.1 Hardware installation

The required hardware components are listed in 3.2.3 (used hardware and software components).

NOTICE	**Always follow the installation guidelines for all components.**

NOTICE	**Before you switch on the power supply, complete and check the installation!**

The figure below shows the hardware configuration of the application.

Figure 4-1

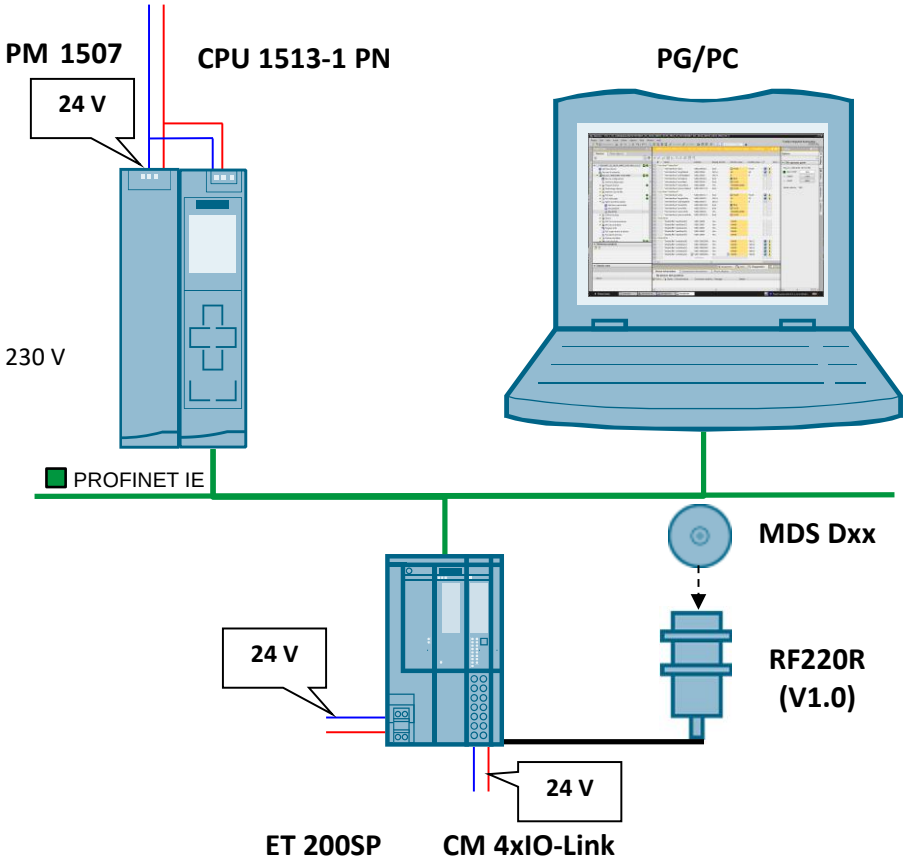


Table 4-1

No.	Action	Remarks
1.	Connect the individual modules to a suitable module rack.	
2.	Connect the PM 1507 with the power supply system (230 V alternating current).	When wiring the 24V, make sure that the polarity is correct.
3.	Interconnect the following devices: • PROFINET interface of the PG/PC to the PROFINET interface of the S7 CPU • PROFINET interface of the S7-CPU with the PROFINET interface of ET 200SP • Reader cable with the CM 4xIO link (see \9\, Chapter 3.1)	

4.2 Installing the software

Note It is recommended to run the latest versions of any installed software.

TIA Portal with Step 7 and WinCC

Table 4-2

No.	Action	Remarks
1.	Install STEP 7 Professional V17	Follow the instructions of the installation program.
2.	Install WinCC Professional V17	
3.	Install the PCT Tool V3.5 SP3 HF2 \3\	
4.	Install the IODD file for RF220R with IO-Link interface \4\	

4.3 Commissioning

4.3.1 Restore S7-1500 CPU factory setting

Before you begin with the commissioning of the application, the S7-1500 CPU must have the factory settings (see \8\, Chapter 13.5).

Under the following circumstances you can reset the S7-1500 to the original factory settings:

- No memory card has been inserted in the CPU.
- The CPU is in STOP mode.

Procedure via the mode switch:

- Put the mode switch to MRES position. Keep the mode switch in this position until the RUN/STOP LED lights up for the second time and remains lit (after three seconds). Then release the switch again.
- Set the mode switch to the MRES position again within the next three seconds and then back to STOP.

Result:

The CPU then performs a "Reset to factory settings" whilst the RUN/STOP LED flashes yellow. If the RUN/STOP LED lights up yellow, the CPU has been reset to factory settings and is in STOP mode. The "Reset to factory settings" event is entered in the diagnostic buffer.

4.3.2 Setting the IP addresses

NOTICE	**When assigning the IP addresses of your devices please ensure that they are all located in the same subnet and each IP is only assigned once across the subnets.**

The following table shows the configured IP addresses:

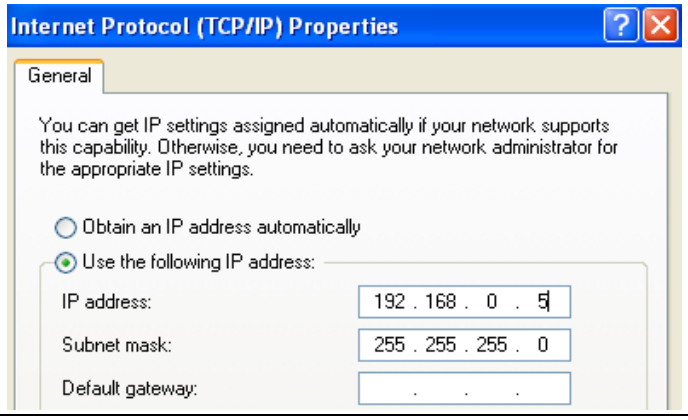
Table 4-3

Module	IP address
CPU 1513-1 PN	192.168.0.1
ET 200SP IM 155-6PN HF	192.168.0.10
PG/PC	192.168.0.5

4.3.3 Changing the IP addresses of the PC/PG

The table below shows the network setting to which you have to change the PC/PG:

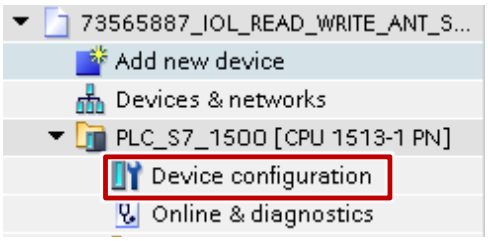
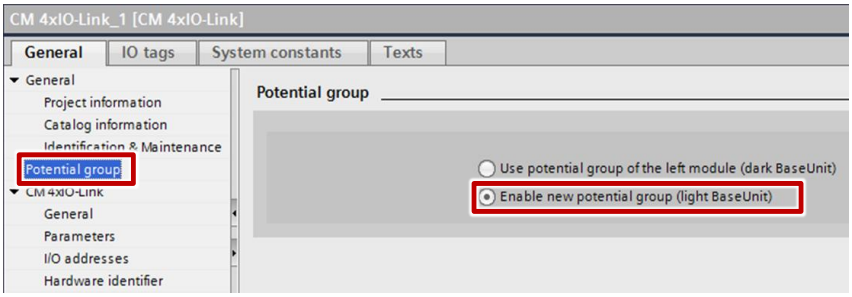
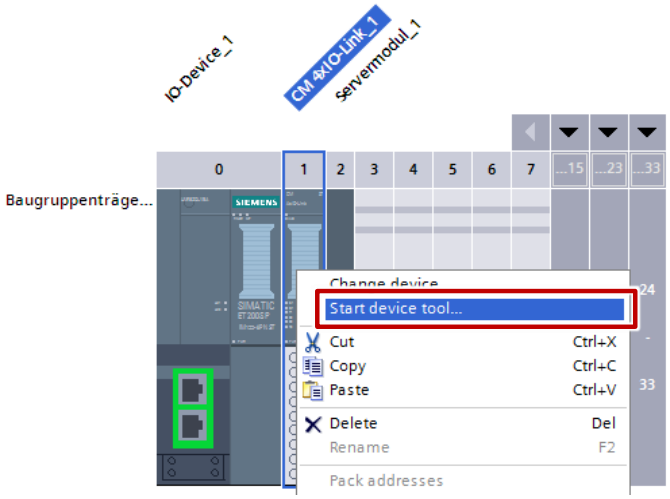
Table 4-4

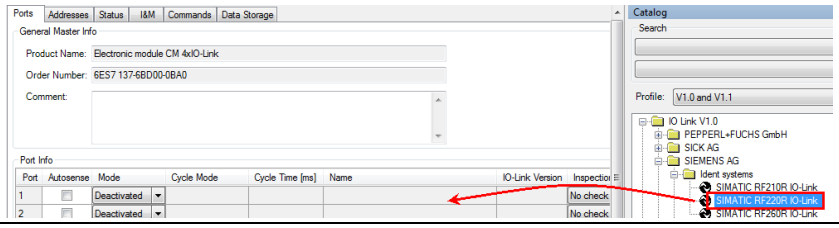
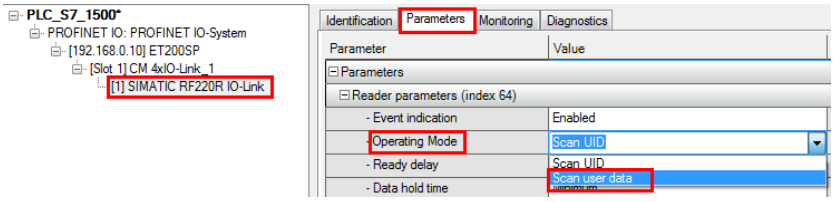
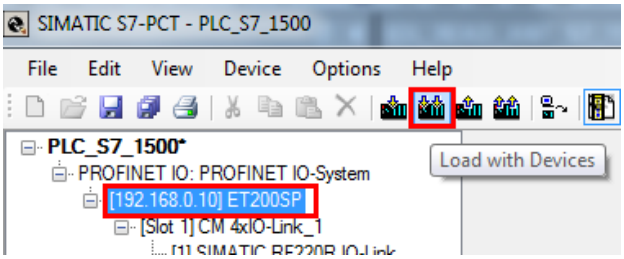
No.	Action
1.	Open the Internet Protocol (TCP/IP) Properties by selecting "Start > Settings > Network Connections > Local Connections".
2.	In the open window, select Internet Protocol (TCP/IP) and open Properties.
3.	Select the option box "Use following IP address" and fill in the box as shown in the picture. Close the dialog boxes with "OK". 
4.	If your PG has an IWLAN interface, switch it off.

4.3.4 Configuration of the IO-Link Master

Before you start operating the application, the following steps are necessary to commission the RF200 IO-Link reader.

Table 4-5

No.	Action
1.	In the TIA Portal, open the Device configuration of the PLC_S7_1500 station. 
2.	Open the properties of the CM 4xIO-Link module and activate a new potential group. "Properties" > "Potential group" 
3.	Move your mouse pointer over the CM 4xIO-Link module. Open the dialog window with the right mouse-button and click on "Start device tool". 

No.	Action
4.	In PCT (S7 Port Configuration Tool) go to the Ports tab, open the product catalog in PCT and select an IO-Link device V1.1. Drag this device to the desired port of the master module. In this example an RF200 IO-Link reader is inserted. 
5.	Go to the Addresses tab to perform a possible change of the device addresses.
6.	Expand the project tree and click the newly added IO-Link device (IO-Link reader). Go to the Parameters tab. Set the operating mode to "Scan user data". 
7.	Load the configuration into the device. 

Note

The start addresses have to be within the I/O addresses of the 4SI IO-Link module.

4.3.5 Change the IP address of the CPU

Before the STEP 7 project can be loaded into the CPU, the IP address of the S7-1500 CPU with which you can load the project into the CPU, must be changed.

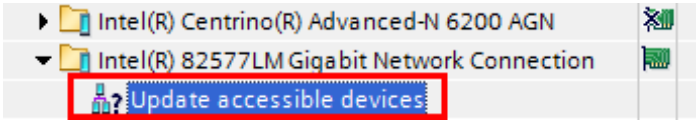
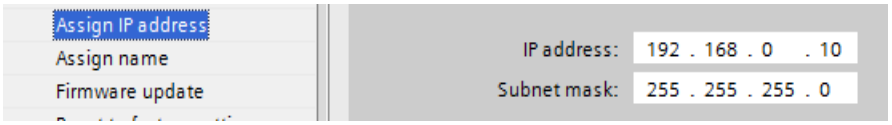
Note The IP address configured in STEP 7 V17 (TIA Portal) for the S7-1500 CPU must be located in the same subnet as the IP address set in Windows.

Table 4-6

No.	Action
1.	Navigate to the "IP address" option via the display of your S7-1500 CPU. Settings > Addresses >X1 (IE/PN) > IP Address
2.	Set the IP address used in the example project of the S7-1500 (192.168.0.1).

4.3.6 Changing IP address of the ET 200SP

Table 4-7

No.	Action	
1.	Start the TIA Portal V17 in the project view. Search for "Nodes accessible online". To this end, navigate to "Project Tree> Online Access> [Your_Ethernet_Adapter]> Update accessible devices". Your stations are now recognized. 	
2.	The procedure is identical for all CPUs: Now you navigate to "[Your_S7CPU]> Online&Diagnostics". In the graphical area of "Online & diagnostics", select "Functions> Assign IP address". 	
3.	Assign the IP address used in the project for the ET 200SP (see inspector window of the device view). Confirm the action with "Assign IP address".	Assign the IP address used in the project for the ET 200SP (see inspector window of the device view). Confirm the action with "Assign IP address".

4.3.7 Loading the STEP 7 project into the S7 CPU

Requirement:

- The STEP 7 V17 project has already been installed and retrieved (see 4.3)
- The IO-Link master has already been configured (see 4.3.4).

Proceed as follows:

- Start the TIA Portal.
- Open the project view.
- Open the "IOL_READ_WRITE_DATA" project.
- In the project navigation:
  - Select "PLC_S7_1500 [CPU 1513-1 PN]"
  - Right-click and select:
    "Download to device > Hardware and software"
- Select the suitable PG/PC interface in the "Extended download to device" dialog window. As soon as loading is possible, the "Download" button will be enabled.
- Click the "Download" button.
- Check the messages in the "Load preview" dialog and if required, enable the actions in the "Action" tab. As soon as loading is possible, the "Download" button will be enabled.
- Click the "Download" button.

  The loading process is executed. Then the "Load events" dialog is opened.

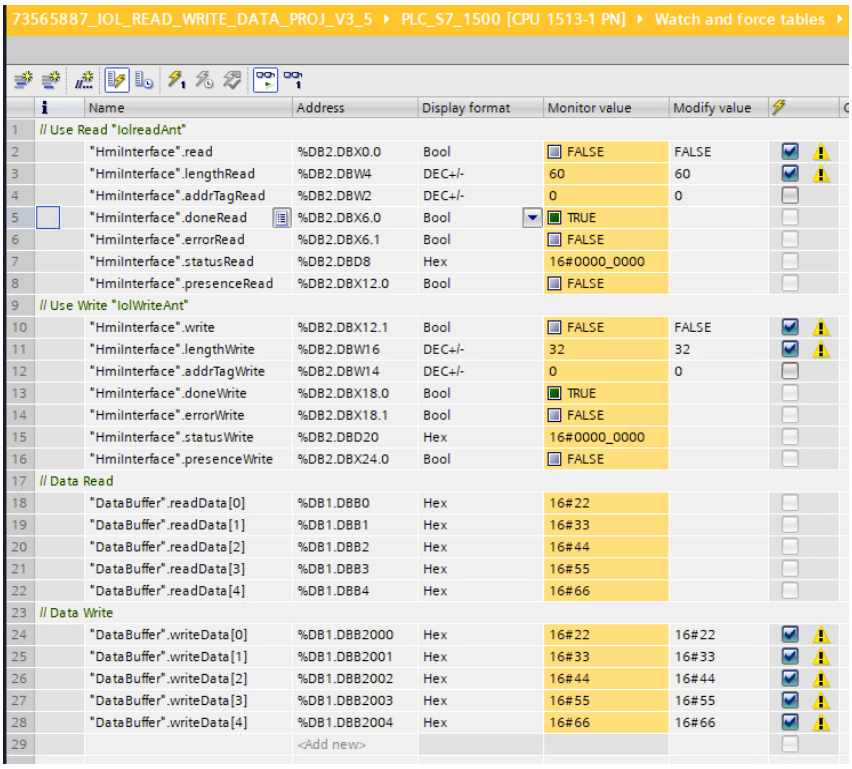
  In this dialog you can check whether the loading process was successful and select possible other actions.

- Click on the "Finish" button.

5 Operating the Application

5.1 Watch table "ReadWrite"

Figure 5-1



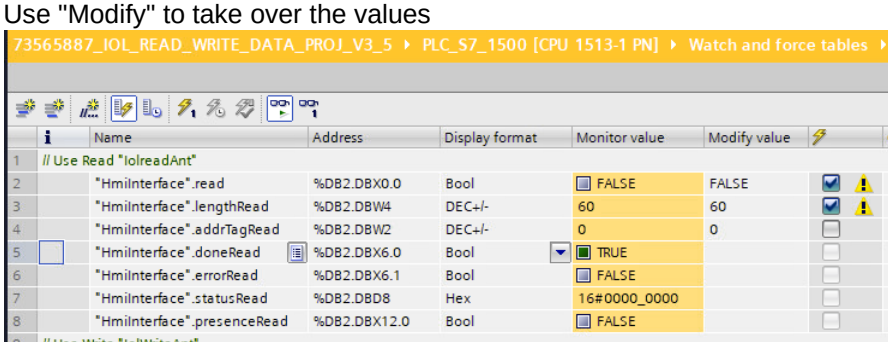
73565887_IOL_READ_WRITE_DATA_PROJ_V3_5 ▸ PLC_S7_1500 [CPU 1513-1 PN] ▸ Watch and force tables ▸

	i	Name	Address	Display format	Monitor value	Modify value	
1		// Use Read "IolreadAnt"					
2		"HmiInterface".read	%DB2.DBX0.0	Bool	FALSE	FALSE	☑ ⚠
3		"HmiInterface".lengthRead	%DB2.DBW4	DEC+/-	60	60	☑ ⚠
4		"HmiInterface".addrTagRead	%DB2.DBW2	DEC+/-	0	0	☐
5		"HmiInterface".doneRead	%DB2.DBX6.0	Bool	TRUE		☐
6		"HmiInterface".errorRead	%DB2.DBX6.1	Bool	FALSE		☐
7		"HmiInterface".statusRead	%DB2.DBD8	Hex	16#0000_0000		☐
8		"HmiInterface".presenceRead	%DB2.DBX12.0	Bool	FALSE		☐
9		// Use Write "IolWriteAnt"					
10		"HmiInterface".write	%DB2.DBX12.1	Bool	FALSE	FALSE	☑ ⚠
11		"HmiInterface".lengthWrite	%DB2.DBW16	DEC+/-	32	32	☑ ⚠
12		"HmiInterface".addrTagWrite	%DB2.DBW14	DEC+/-	0	0	☐
13		"HmiInterface".doneWrite	%DB2.DBX18.0	Bool	TRUE		☐
14		"HmiInterface".errorWrite	%DB2.DBX18.1	Bool	FALSE		☐
15		"HmiInterface".statusWrite	%DB2.DBD20	Hex	16#0000_0000		☐
16		"HmiInterface".presenceWrite	%DB2.DBX24.0	Bool	FALSE		☐
17		// Data Read					
18		"DataBuffer".readData[0]	%DB1.DBB0	Hex	16#22		☐
19		"DataBuffer".readData[1]	%DB1.DBB1	Hex	16#33		☐
20		"DataBuffer".readData[2]	%DB1.DBB2	Hex	16#44		☐
21		"DataBuffer".readData[3]	%DB1.DBB3	Hex	16#55		☐
22		"DataBuffer".readData[4]	%DB1.DBB4	Hex	16#66		☐
23		// Data Write					
24		"DataBuffer".writeData[0]	%DB1.DBB2000	Hex	16#22	16#22	☑ ⚠
25		"DataBuffer".writeData[1]	%DB1.DBB2001	Hex	16#33	16#33	☑ ⚠
26		"DataBuffer".writeData[2]	%DB1.DBB2002	Hex	16#44	16#44	☑ ⚠
27		"DataBuffer".writeData[3]	%DB1.DBB2003	Hex	16#55	16#55	☑ ⚠
28		"DataBuffer".writeData[4]	%DB1.DBB2004	Hex	16#66	16#66	☑ ⚠
29			<Add new>				☐

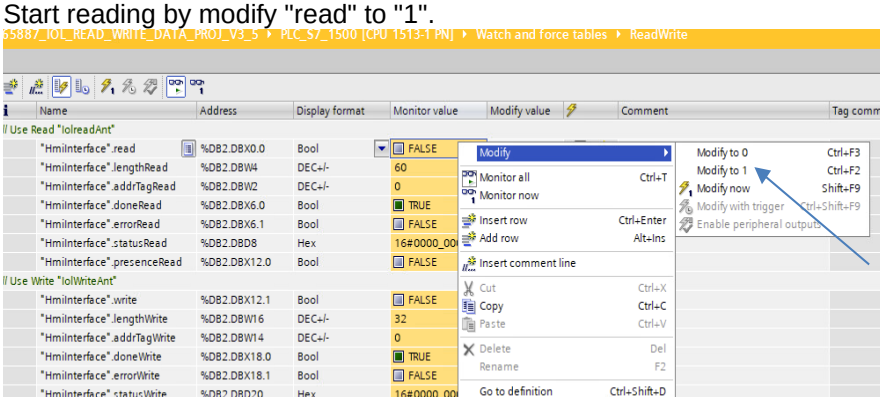
You can operate both use cases "Read" and "Write" with one watch table "ReadWrite".

5.2 Reading RFID data from the transponder

1. In the input fields "lengthRead" and "addrTag" you enter the values relevant for reading the RFID data. (see 2.2.1)
   Use "Modify" to take over the values

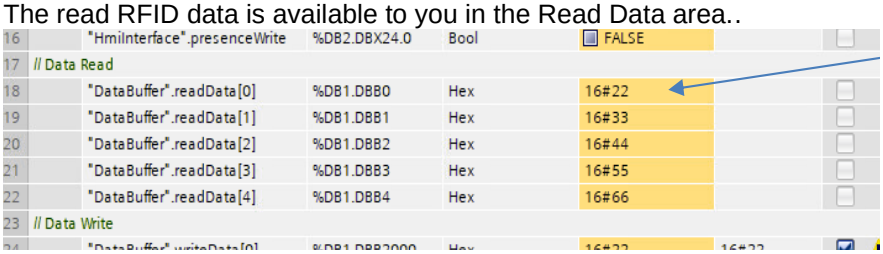


2. Start reading by modify "read" to "1".



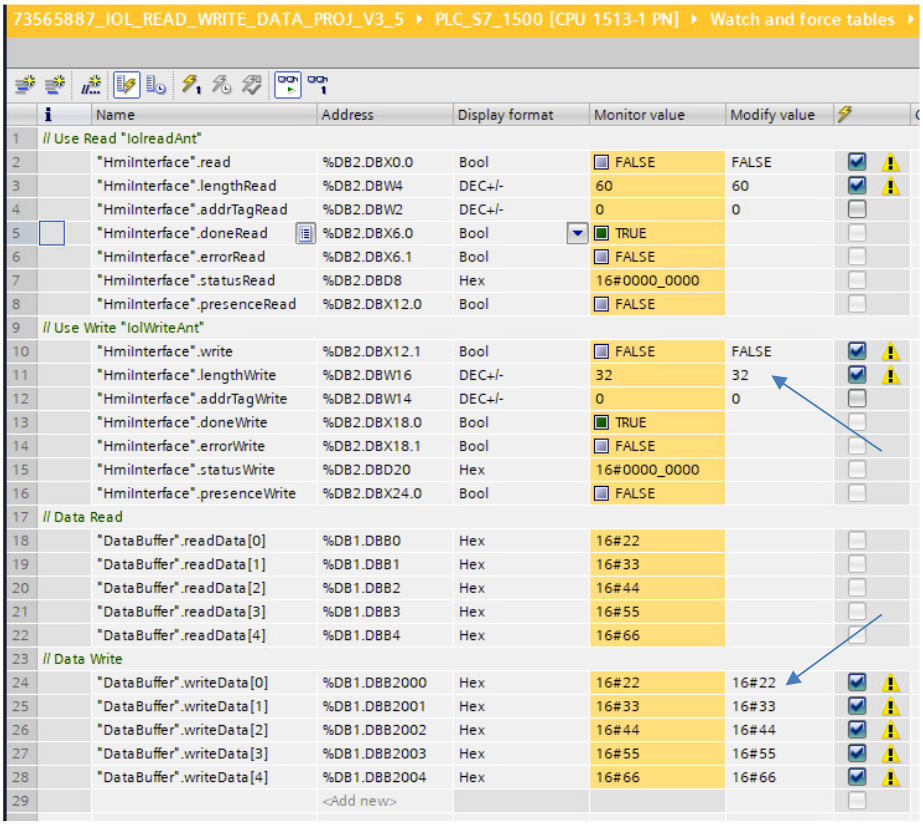
3. If the write job has been completed successfully, this is indicated by the green "doneRead" signal.

4. The read RFID data is available to you in the Read Data area..



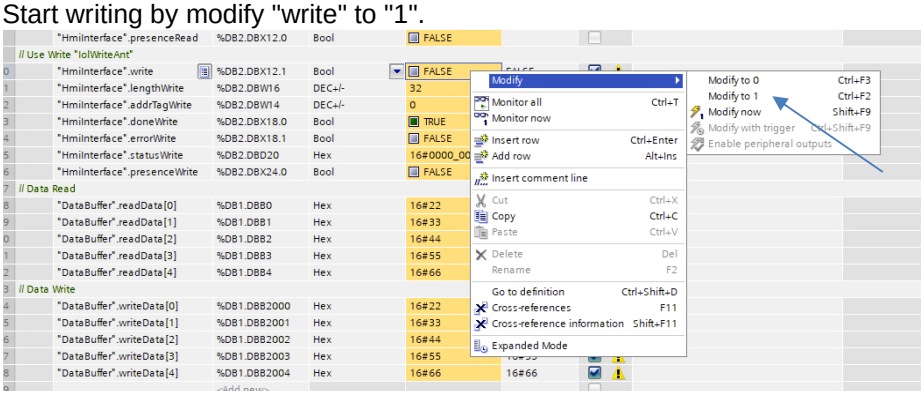
5.3 Writing RFID data to the transponder

1. In the input fields "lengthRead" and "addrTag" you enter the values relevant for writing the RFID data. (see 2.2.1)
   Enter your desired data in the input fields of "Write Data".
   Use "Modify" to take over the values



	Name	Address	Display format	Monitor value	Modify value
1	// Use Read "IolreadAnt"				
2	"HmiInterface".read	%DB2.DBX0.0	Bool	FALSE	FALSE
3	"HmiInterface".lengthRead	%DB2.DBW4	DEC+/-	60	60
4	"HmiInterface".addrTagRead	%DB2.DBW2	DEC+/-	0	0
5	"HmiInterface".doneRead	%DB2.DBX6.0	Bool	TRUE	
6	"HmiInterface".errorRead	%DB2.DBX6.1	Bool	FALSE	
7	"HmiInterface".statusRead	%DB2.DBD8	Hex	16#0000_0000	
8	"HmiInterface".presenceRead	%DB2.DBX12.0	Bool	FALSE	
9	// Use Write "IolWriteAnt"				
10	"HmiInterface".write	%DB2.DBX12.1	Bool	FALSE	FALSE
11	"HmiInterface".lengthWrite	%DB2.DBW16	DEC+/-	32	32
12	"HmiInterface".addrTagWrite	%DB2.DBW14	DEC+/-	0	0
13	"HmiInterface".doneWrite	%DB2.DBX18.0	Bool	TRUE	
14	"HmiInterface".errorWrite	%DB2.DBX18.1	Bool	FALSE	
15	"HmiInterface".statusWrite	%DB2.DBD20	Hex	16#0000_0000	
16	"HmiInterface".presenceWrite	%DB2.DBX24.0	Bool	FALSE	
17	// Data Read				
18	"DataBuffer".readData[0]	%DB1.DBB0	Hex	16#22	
19	"DataBuffer".readData[1]	%DB1.DBB1	Hex	16#33	
20	"DataBuffer".readData[2]	%DB1.DBB2	Hex	16#44	
21	"DataBuffer".readData[3]	%DB1.DBB3	Hex	16#55	
22	"DataBuffer".readData[4]	%DB1.DBB4	Hex	16#66	
23	// Data Write				
24	"DataBuffer".writeData[0]	%DB1.DBB2000	Hex	16#22	16#22
25	"DataBuffer".writeData[1]	%DB1.DBB2001	Hex	16#33	16#33
26	"DataBuffer".writeData[2]	%DB1.DBB2002	Hex	16#44	16#44
27	"DataBuffer".writeData[3]	%DB1.DBB2003	Hex	16#55	16#55
28	"DataBuffer".writeData[4]	%DB1.DBB2004	Hex	16#66	16#66
29		<Add new>			

2. Start writing by modify "write" to "1".



3. If the write job has been completed successfully, this is indicated by the green "doneWrite" signal

5.4 Error states

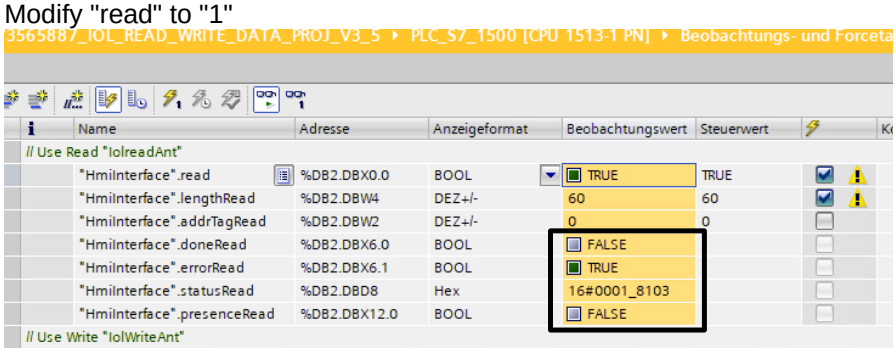
An error while operating the application can have the following causes:

- no transponder in the reader field
- cancellation of the read function

The following table shows an example for such a situation.

Exampl:

1. No transponder in the reader field.
2. Modify "read" to "1"



3. An error has occurred:
   "errorRead"-value: TRUE
   "statusRead": 16#00018103 -> No transponder in the reader field
4. Reset "read" and place a transponder in the reader's field.
   Repeat reading.

5.5 Detailed Information with "LIOLink_RF200"

The library contains a block specially tailored to the RF200 reader, with which system data can be read very easily from the reader. See the IOL library description for more information.

6 Appendix

6.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

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Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

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- Retrofitting and modernization services
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support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

6.2 Industry Mall

The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

6.3 Links and literature

Table 6-1

	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/73565887
\3\	S7-PCT V3.5 SP3 HF2 http://support.automation.siemens.com/WW/view/en/32469496
\4\	IODD file for RF220R with IO-Link interface https://support.industry.siemens.com/cs/ww/en/view/109750193
\5\	RFID Systems SIMATIC RF200 IO-Link https://support.industry.siemens.com/cs/ww/en/view/60641859
\6\	SIMATIC ET 200SP Interface Module IM 155-6 PN ST http://support.automation.siemens.com/WW/view/en/73184046
\7\	SIMATIC HMI control panels Basic Panels http://support.automation.siemens.com/WW/view/en/31032678
\8\	S7-1500 Automation System http://support.automation.siemens.com/WW/view/en/59191792
\9\	ET 200SP IO-Link Master CM 4xIO-Link http://support.automation.siemens.com/WW/view/en/67328527
\10\	SIMATIC Ident Configuration Guide https://support.industry.siemens.com/cs/us/en/view/67384964
\11\	Library for IO-Link (LIOLink) https://support.industry.siemens.com/cs/ww/en/view/82981502

6.4 Change documentation

Table 6-2

Version	Date	Modifications
V1.0	07/2013	First version
V2.0	03/2015	Write function added and update of existing software.
V2.1	12/2016	Update to TIA V14
V3.0	09/2017	Update to TIA V14 SP1 + adaption to the styleguide
V3.1	12/2017	Update for IO-Link V1.1
V3.2	03/2020	Update to TIA V17
V3.3	09/2020	Update of the blocks from the Library for IO-Link (LIOLink)
V3.4	06/2022	Update to TIA V17
V3.5	07/2023	Update of the blocks from the Library for IO-Link (LIOLink) without functional changes. Conversion of operation from a panel to a watch table