SIEMENS

SIMATIC Ident

RFID systems
SIMATIC RF200 IO-Link V1.1

Operating Instructions

01/2022
C79000-G8976-C276-08

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Introduction 1

Purpose of this manual

The information provided in this manual enables you to commission IO-Link readers as IO devices.

Basic knowledge required

This manual assumes general knowledge of automation engineering and identification systems.

Validity of the manual

This manual applies to the IO-Link readers of version V1.1 with article numbers 6GT2821-xBC32: These operate according to the IO -Link standard V1.1 and have a process width of 32 bytes. Note that when using the IO-Link readers of version 1.0 with article numbers 6GT2821-xAC32 you should use the documentation with version 02/2017.

Position in the overall information structure

In addition to this manual, you require the operating instructions for the IO-Link master you are using.

Conventions

The following terms/abbreviations are used synonymously in this document:

Reader	Write/read device (SLG)
Transponder, tag	Data carrier, mobile data storage, (MDS)
Communications module (CM)	Interface module (ASM)

The reader names SIMATIC RF200 IO-Link and SIMATIC RF200IOL are used as synonyms.

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IO-Link is a registered trademark of the IO-Link consortium.

Additional documentation

The following documents contain information on the IO-Link masters from Siemens and may contain further information that is relevant for you:

- ET 200AL distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/89254868)
- ET 200pro distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/109738534)
- Distributed I/O device ET 200eco PN (https://support.industry.siemens.com/cs/ww/en/view/29999018)
- Distributed I/O system ET 200S (https://support.industry.siemens.com/cs/ww/en/view/1144348)
- ET 200SP distributed I/O (https://support.industry.siemens.com/cs/ww/en/view/58649293)
- S7-1200 distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/91696622)

Recycling and disposal

The products are low in harmful substances, can be recycled and meet the requirements of the Directive 2012/19/EU for disposal of waste electrical and electronic equipment (WEEE).

Do not dispose of the products at public disposal sites.

For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste or your Siemens representative.

Note the different country-specific regulations.

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Description

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2.1 Area of application of the RF200 IO-Link reader

SIMATIC RF200 IO-Link is an inductive identification system that is compatible with the ISO 15693 standard and was specially designed for use in industrial production for the control and optimization of material flow. With the IO-Link communications interface, readers can be used below the fieldbus level.

SIMATIC RF200 IO-Link is an alternative to SIMATIC RF300 and represents a simple and cost-effective option for RFID applications.

2.2 IO-Link basics

The system components

IO-Link is a specified point-to-point communications interface for sensors/actuators and consists of the following system components:

- IO-Link master,
- IO-Link device (e.g. sensors, actuators, RFID readers),
- Unshielded 3-wire standard cable.

The master / the port operating modes

A master has one or more ports and one device can be connected to each port.

The port can basically be set to two different operating modes:

- SIO mode (Standard Input Output mode)

  In this mode, the device can be used like a digital input module.

- IO-Link mode (SDCI: Single-Drop digital Communication Interface, data communication)

  In this mode, the master communicates with the device and process data and service data can be transferred.

The types of communication

During communication at the IO-Link level, the following types of data are distinguished:

- Cyclic process data (input/output data)

  The data is always transferred with a previously specified length.

- Acyclic service data (parameters, on-request data)

  The data to be written or read is transferred only on request. Since a fixed area is reserved for this in the communication cycle, the acyclic data transfer does not influence the transfer of the cyclic process data.

- Events (errors, warnings, notifications)

  This works in the same way as with acyclic service data, the only difference being that the transfer is triggered by the device due to events.

The data types

While the cyclic process data is exchanged via a defined fixed area, the acyclic service data is selected and addressed using an index or subindex. The indexes available for the RF200 IO-Link reader can be found in the section "Commissioning and parameter assignment (Page 57)".

To allow system integration, each device type has an IODD file available that contains the following information:

- Representation of the communications properties
- Representation of accessible device data
- Identification, process and diagnostics data
- Menu layout
- Textual descriptions in various languages
- Image of the device
- Logo of the manufacturer

2.3 Characteristics of the RF200 IO-Link reader

The IO-Link reader reads out either the UID or user-specific data of a transponder and maps this to cyclically updated process data. User-specific data can also be written.

This data can be read out via the IO-Link master by a PC or a controller.

The IO-Link reader has the following characteristics:

- Point-to-point communication, the address of the IO-Link device does not need to be set
- Supports only IO-Link masters according to specification V1.1
- IO-Link transmission speed 230.4 kBd
- Process data in the process image: 32 bytes of inputs and 32 bytes of outputs
- User data in the process image: 28 bytes of inputs and 28 bytes of outputs
- Transfer of service data parallel to process data
- Parameter up/download functionality for device replacement (parameter server)
- SIO mode (reader indicates the presence of a transponder on the data line (C/Q))
- IODD file for support of parameter assignment, diagnostics and data access.
- System integration (STEP 7 Professional, TIA Portal) using Port Configuration Tool (PCT)
- Degree of protection IP67
- RFID 13.56 MHz complying with ISO 15693

2.4 System integration

The readers are IO-Link device modules intended for operation with an IO-Link master. Depending on the category of the IO-Link master, this can be connected to various controllers (S7-1200 and S7-1500) or fieldbus systems.

The number of devices or readers that can be connected to an IO-Link master differs depending on the master type. Note that each master type has a maximum process data length that the connected IO-Link devices share. Due to this it can happen that some IO-Link masters cannot operate an RFID reader on all IO-Link ports with 32 byte process data length.

Interfacing to the controller

The connection of the IO-Link readers RF2xxR to the controller is via the IO-Link master with IO-Link protocol V1.1. Currently, the following IO-Link masters are available from Siemens:

- ET 200AL with CM 4 x IO-Link
- ET 200eco PN
- ET 200pro with CM 4 x IO-Link HF
- ET 200SP with CM 4 x IO-Link SP
- S7-1200 with SM 1278

or via IO-Link masters of other manufacturers.

The number of IO-Link readers that can be connected depends on the IO-Link master used.

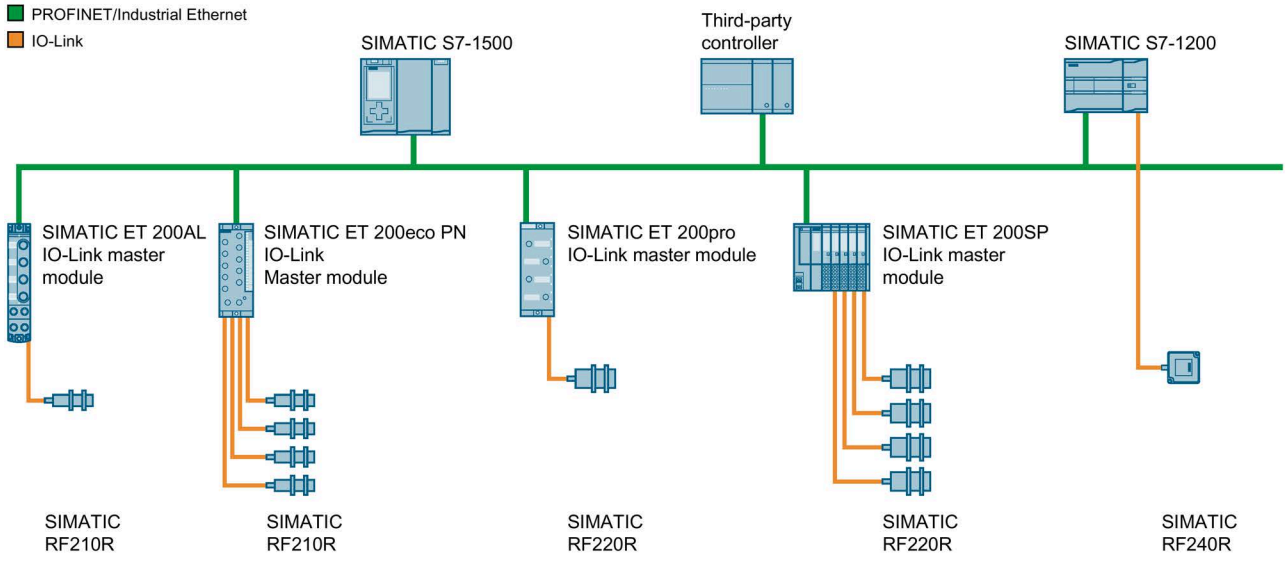

Figure 2-1 Configuration example

System overview

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3.1 RFID components and their function

RF200 IO-Link system components

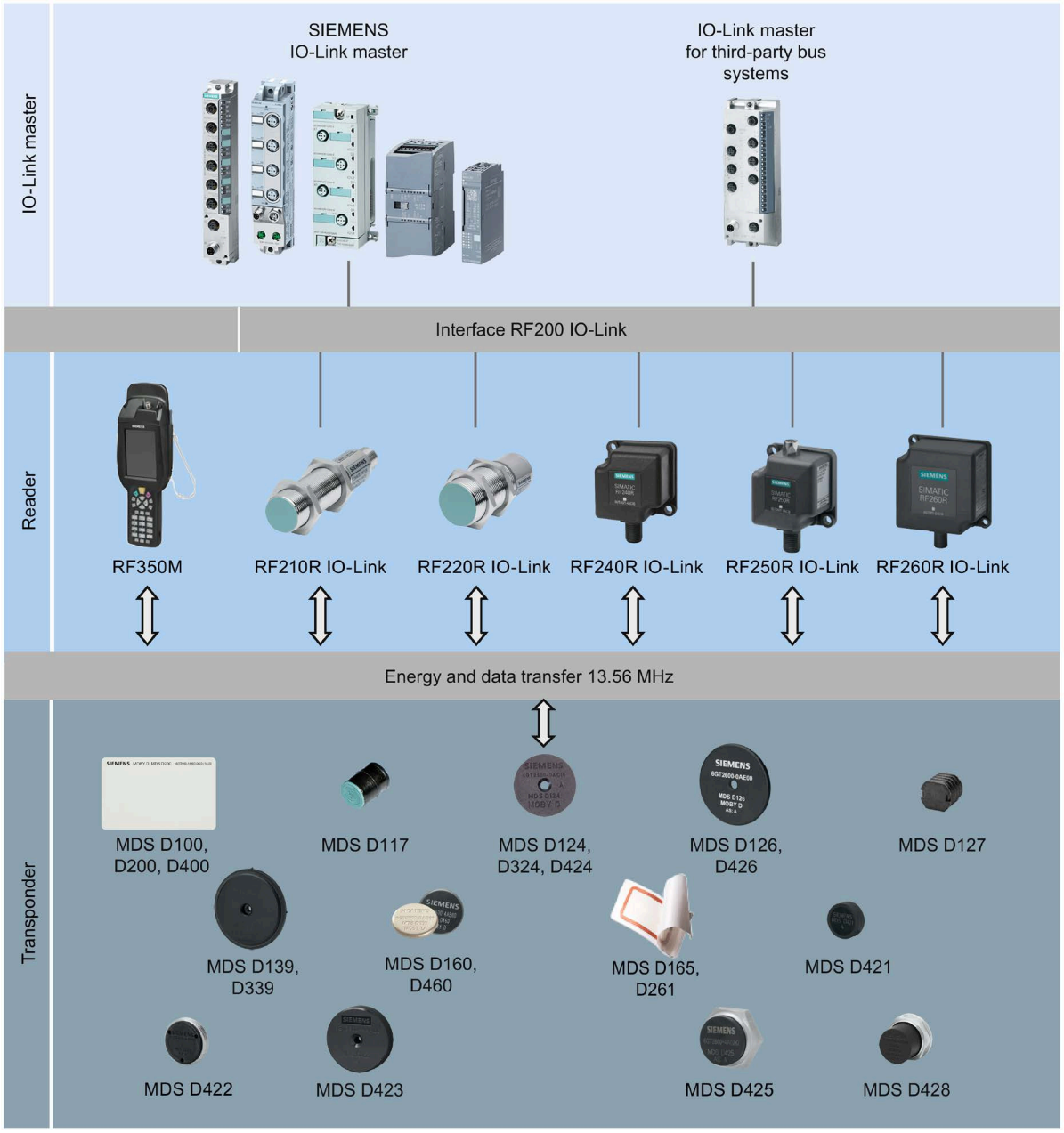

Figure 3-1 System overview RF200 IO-Link

Table 3- 1 Reader-transponder combination options - Part 1

Trans-ponder	RF210R IO-Link	RF220R IO-Link	RF240R IO-Link	RF260R IO-Link
MDS D100	--	◯	✓	✓
MDS D117	◯	--	--	--
MDS D124	✓	✓	✓	✓
MDS D126	--	✓	✓	✓
MDS D127	✓	--	--	--
MDS D139 [1]	--	◯	◯	✓
MDS D160 [2]	✓	✓	✓	✓
MDS D165	--	◯	✓	✓
MDS D200	--	◯	✓	✓
MDS D261	--	◯	✓	✓
MDS D324	✓	✓	✓	✓
MDS D339	--	◯	◯	✓
MDS D400	--	--	✓	✓
MDS D421	✓	◯	--	--
MDS D422	✓	✓	✓	◯
MDS D423	✓	✓	✓	✓
MDS D424	✓	✓	✓	✓
MDS D425	✓	✓	✓	--
MDS D426	--	✓	✓	✓
MDS D428	✓	✓	✓	✓
MDS D460	✓	✓	✓	✓

[1] only with the article number 6GT2600-0AA10

[2] only with the article number 6GT2600-0AB10

Table 3- 2 Reader-transponder combination options - Part 2

Transponder	RF250R with						
	ANT 1	ANT 3	ANT 3S	ANT 8	ANT 12	ANT 18	ANT 30
MDS D100	✓	--	--	--	--	--	◯
MDS D117	--	--	✓	✓	✓	--	--
MDS D124	✓	✓	--	--	--	✓	✓
MDS D126	✓	✓	--	--	--	--	✓
MDS D127	--	--	✓	✓	✓	--	--
MDS D139 [1]	✓	--	--	--	--	--	◯
MDS D160 [2]	✓	✓	--	--	✓	✓	✓
MDS D165	✓	--	--	--	--	--	◯
MDS D200	✓	--	--	--	--	--	◯
MDS D261	✓	--	--	--	--	--	◯
MDS D324	✓	✓	--	--	◯	✓	✓
MDS D339	✓	--	--	--	--	--	◯
MDS D400	✓	--	--	--	--	--	◯
MDS D421	--	--	✓	✓	✓	✓	--
MDS D422	--	✓	--	--	✓	✓	✓
MDS D423	✓	✓	--	--	--	✓	✓
MDS D424	✓	✓	--	--	--	✓	✓
MDS D425	✓	✓	--	--	✓	✓	✓
MDS D426	✓	✓	--	--	✓	✓	✓
MDS D428	✓	✓	--	--	✓	✓	✓
MDS D460	✓	✓	--	--	✓	✓	✓

[1] only with the article number 6GT2600-0AA10

[2] only with the article number 6GT2600-0AB10

- ✓ Combination possible
- -- Combination not possible
- ◯ Combination possible, but not recommended

Note

Information on the SIMATIC RF350R

For further information about the SIMATIC RF350M mobile reader, please refer to the SIMATIC RF350M Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/109481495).

3.2 Overview of transponders

Overview of typical areas of application of ISO transponders for RF200

Transponder	Application
MDS D100	Barcode supplement for storage and distribution logistics
MDS D117	Tool coding
MDS D124	Small paint shops up to 180° C
MDS D126	Identification of transport units
MDS D127	Identification of small metallic workpieces, workpiece holders or containers
MDS D139	Paint spraying lines in the automobile industry
MDS D160	Hired workwear, hospital clothing
MDS D165	Smart labels (self-adhering labels) as substitute for electronic barcode
MDS D200	Warehouse and distribution logistics
MDS D261	Smart labels (self-adhering labels) as substitute for electronic barcode
MDS D324	Assembly and production lines
MDS D339	Paint spraying lines in the automobile industry
MDS D422	Identification of metallic workpiece holders, workpieces or containers
MDS D421	Tool coding according to DIN 69873
MDS D423	Metallic workpiece holders and containers with direct installation of the transponder in metal
MDS D424	Use in assembly and manufacturing lines
MDS D425	For applying to motors, gearboxes and workpiece holders
MDS D426	Identification of transport units
MDS D428	Compact ISO transponder for automatic assembly with screws
MDS D460	Assembly lines with very small workpiece holders

Overview of the memory sizes of the ISO transponders for RF200

Transponder	Memory size
MDS D1xx	112 bytes of EEPROM
MDS D2xx	256 bytes of EEPROM
MDS D3xx	992 bytes of EEPROM
MDS D4xx	2000 bytes of FRAM

Planning an RF200 IO-Link system

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4.1 Fundamentals of application planning

4.1.1 Selection criteria for SIMATIC RF200 components

Assess your application according to the following criteria, in order to choose the right SIMATIC RF200 components:

- Static or dynamic data transfer
- Data volume to be transferred
- Ambient conditions such as relative humidity, temperature, chemical impacts, etc.

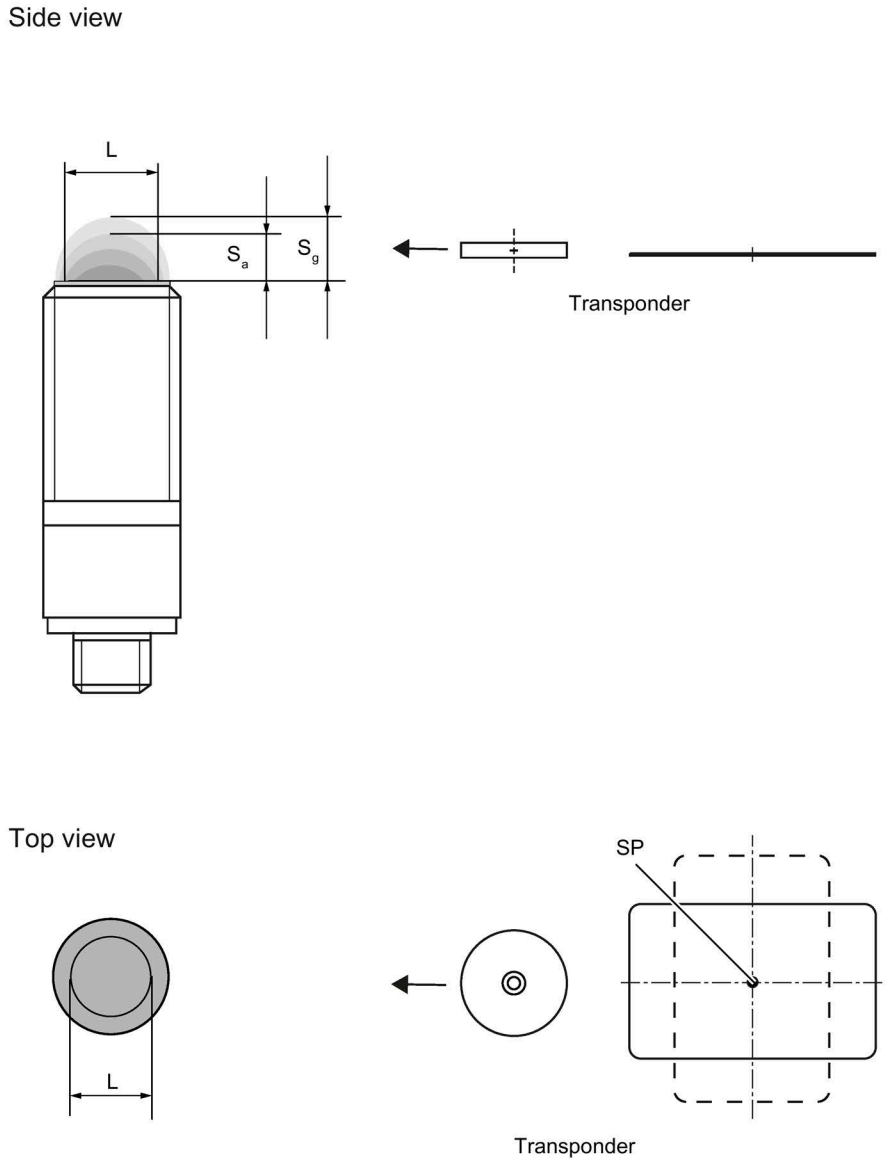
4.1.2 Transmission window and read/write distance

The reader generates an inductive alternating field. The field is strongest close to the reader; however, a read/write distance of "zero" between reader and transponder is not recommended.

The field strength of the alternating field decreases strongly the further away from the reader. The distribution of the field depends on the structure and geometry of the antennas in the reader and transponder

A prerequisite for the function of the transponder is a minimum field strength at the transponder, which is still barely achieved at distance S_g from the reader.

The picture below shows the transmission window of the SIMATIC RF210R and SIMATIC RF220R readers between transponder and reader:



S_a Operating distance between transponder and reader

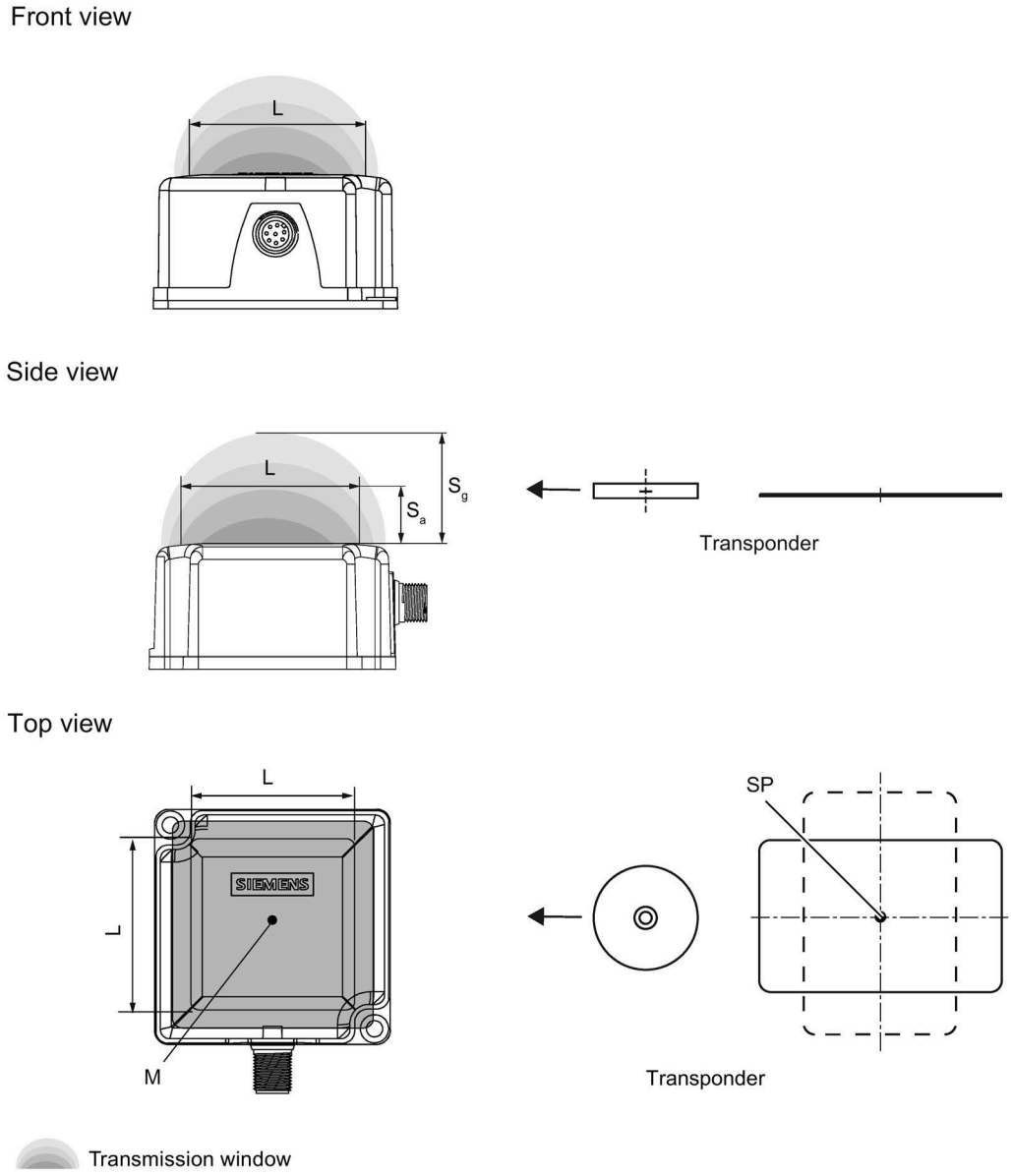
S_g Limit distance (maximum clear distance between upper surface of the reader and the transponder, at which the transmission can still function under normal conditions)

L Diameter of a transmission window.

SP Intersection of the axes of symmetry of the transponder

Figure 4-1 RF210R/RF220R transmission window

The picture below shows the transmission window of the SIMATIC RF260R reader between transponder and reader:



S_a Operating distance between transponder and reader

S_g Limit distance (maximum clear distance between upper surface of the reader and the transponder, at which the transmission can still function under normal conditions)

L Length of a transmission window

M Field centerpoint

Figure 4-2 RF260R transmission window

The transponder can be used as soon as the intersection (SP) of the transponder enters the area of the transmission window.

From the diagrams above, it can also be seen that operation is possible within the area between S_a and S_g. The active operating area reduces as the distance increases and shrinks to a single point at distance S_g. Only static mode should thus be used in the area between S_a and S_g.

4.1.3 Width of the transmission window

Determining the width of the transmission window

The following approximation formula can be used for practical applications:

$$B = 0.4 \cdot L$$

B: Width of the transmission window
L: Length of the transmission window

Tracking tolerances

The width of the transmission window (B) is particularly important for the mechanical tracking tolerance. The formula for the dwell time is valid without restriction when B is observed.

4.1.4 Permissible directions of motion of the transponder

Detection area and direction of motion of the transponder

The transponder and reader have no polarization axis, i.e. the transponder can come in from any direction, assume any position as parallel as possible to the reader, and cross the transmission window. The figure below shows the active area for various directions of transponder motion:

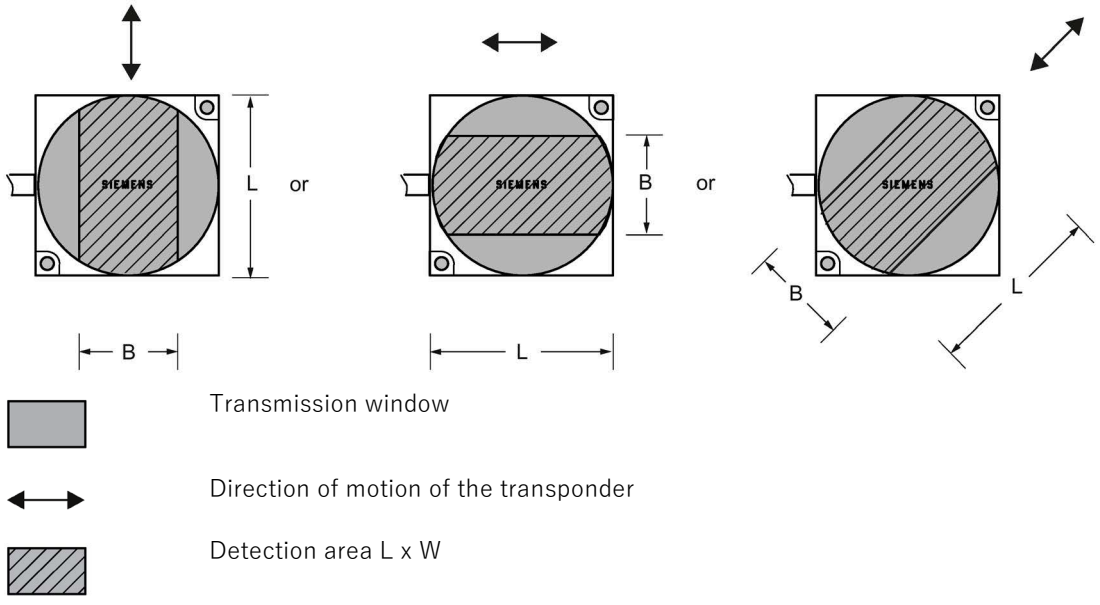


Figure 4-3 Detection areas of the reader for different directions of transponder motion

4.1.5 Operation in static and dynamic mode

Operation in static mode

If working in static mode, the transponder can be operated up to the limit distance (S_g). The transponder must then be positioned exactly over the reader:

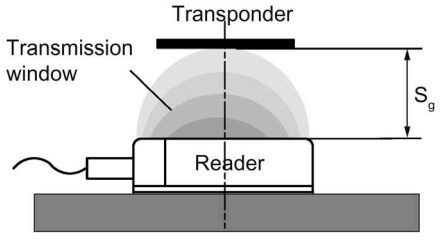


Figure 4-4 Operation in static mode

In static operation, the dwell time tv can be of any length (depending on the application). The dwell time must be sufficiently long to allow communication with the transponder to be completed.

Note

Note that in a metallic environment the values for the limit distance are reduced.

Operation in dynamic mode

Working in dynamic mode is not recommended for the RF200 IO-Link.

See also

Field data of transponders and readers (Page 26)

4.1.6 Communication between the IO-Link master, reader and transponder

The communication time for the user data when the IO-Link master is communicating with the transponder via the interface of the reader is simple to calculate.

Calculation of the communication time for interference-free transfer

The communication time for problem-free transfer is calculated as follows:

$$t_K = K + t_{Byte} \cdot n \qquad (n \geq 1)$$

If the transmission is interrupted briefly due to external interference, the reader automatically continues the command.

Calculation of the maximum amount of user data

The maximum amount of user data is calculated as follows:

$$n_{\max} = \frac{t_V - K}{t_{Byte}}$$

t_k: Communication time between IO-Link master, reader and transponder
t_v: Dwell time
n: Amount of user data in bytes
n_{max}: Max. amount of user data in bytes in dynamic mode
t_{byte}: Transmission time for 1 byte
K: Constant; the constant is an internal system time. This contains the time for power buildup on the transponder and for command transfer

Time constants K and t_{byte}

Table 4- 1 Typical time constants for static operation with an IO-Link cycle of 6 ms (data holding time = minimum / ready delay = deactivated)

	IO-Link in the "UID acquisition" mode		IO-Link in the "user data acquisition" mode	
	K [ms]	**t_{Byte} [ms]**	**K [ms]**	**t_{Byte} [ms]**
Read	45	0	45	2,4
Write	--	--	60	3,3

4.1.7 Impact of secondary fields

Secondary fields in the range from 0 mm to 30 % of the limit distance (S_g) always exist. They should only be used during configuration in exceptional cases, however, since the read/write distances are very limited. Exact details of the secondary field geometry cannot be given, since these values depend heavily on the operating distance and the application. When working, it must be taken into account that at the changeover from the secondary field to the main field, the presence of the transponder can be lost temporarily. It is therefore advisable to select a distance > 30 % of S_g.

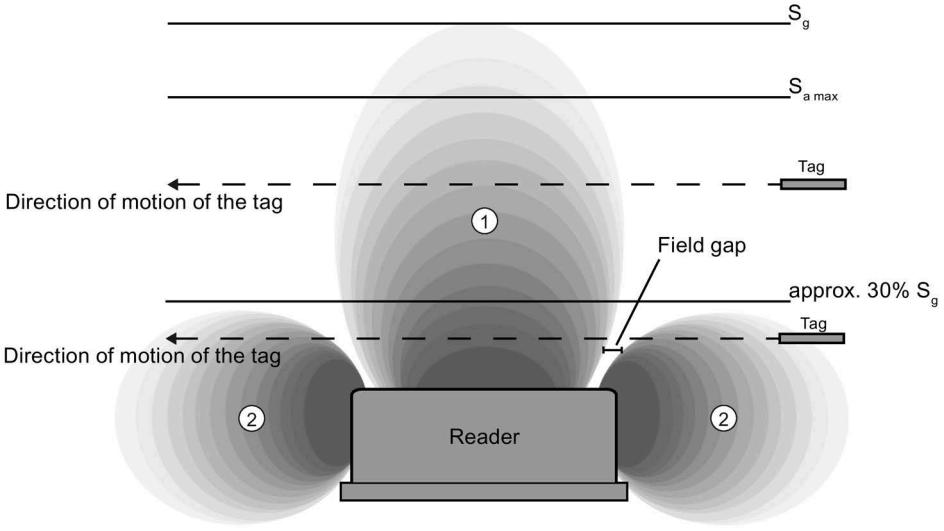


Figure 4-5 Gap in the field resulting from secondary fields

Secondary fields without shielding

The following graphic shows typical primary and secondary fields, if no shielding measures are taken.

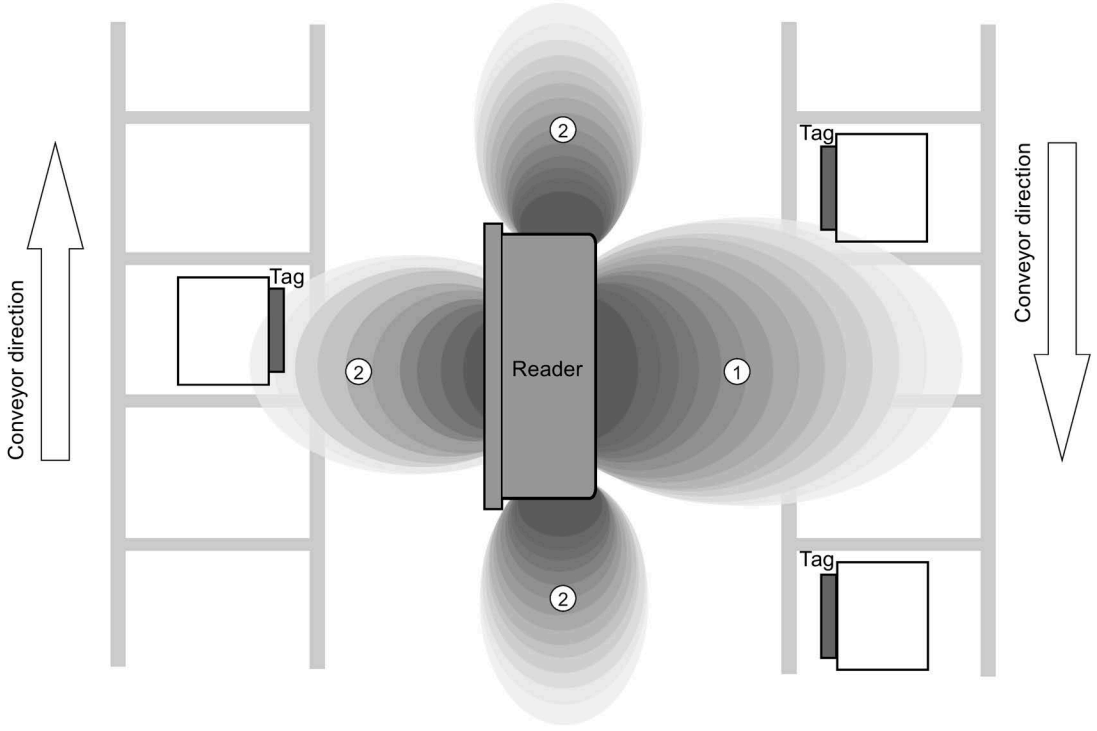


Figure 4-6 Secondary field without shielding

In this arrangement, the reader can also read transponders via the secondary field. Shielding is required in order to prevent unwanted reading via the secondary field, as shown and described in the following.

Secondary fields with shielding

The following graphic shows typical primary and secondary fields, with metal shielding this time.

The metal shielding prevents the reader from detecting transponders via the secondary field.

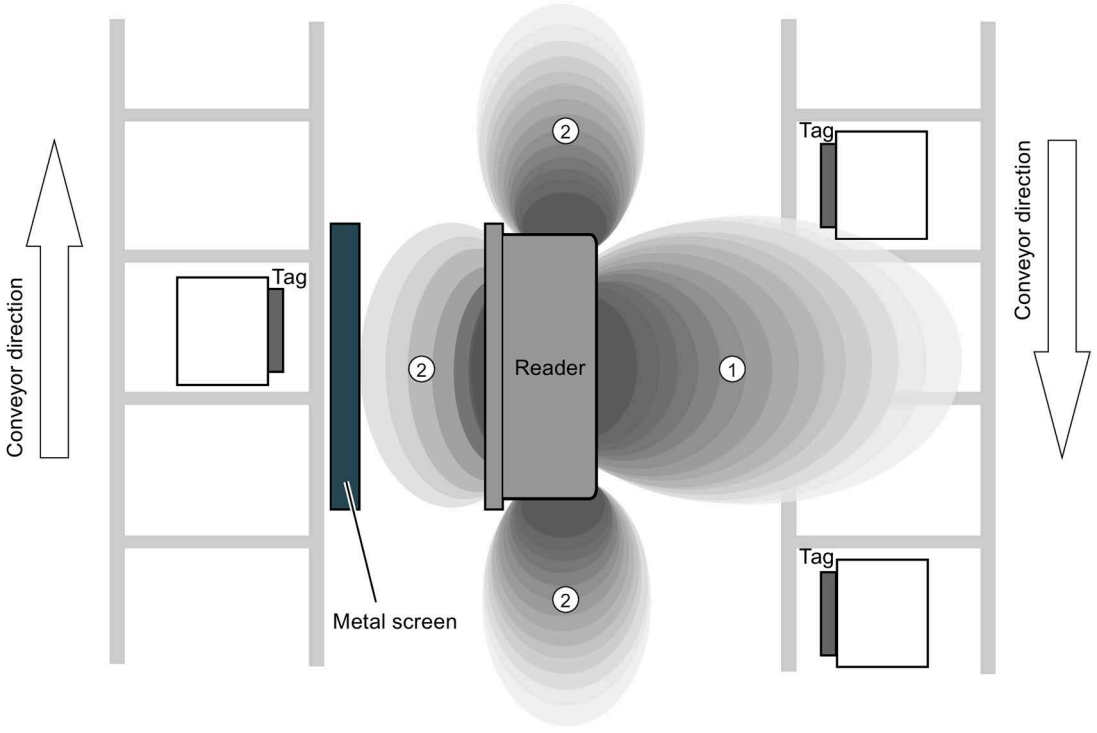


Figure 4-7 Secondary field with shielding

4.2 Field data of transponders and readers

4.2.1 Field data

The limit distances (S_g) and operating distances (S_a) along with the length of the transmission window for each reader-transponder combination are listed in the tables below.

Table 4- 2 SIMATIC RF210R IO-Link field data

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D124	25	1 ... 18	20
MDS D127 [1)]	3	0 ... 2	2
MDS D160	20	1 ... 10	12
MDS D324	20	1 ... 8	9
MDS D421	5	0 ... 3	4
MDS D422	8	1 ... 9	10
MDS D423	20	2 ... 10	12
MDS D424	24	1 ... 16	18
MDS D425	12	1 ... 6	7
MDS D428	20	1 ... 10	11
MDS D460	8	1 ⋯ 8	9

[1)] The transponder is only suitable for static operation.

All dimensions in mm.

Table 4- 3 SIMATIC RF220R IO-Link field data

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D124	35	1 ... 28	31
MDS D126	45	2 ... 30	35
MDS D160	20	1 ... 20	22
MDS D324	30	2 ... 21	25
MDS D422	18	1 ... 12	14
MDS D423	30	2 ...24	28
MDS D424	30	2 ... 25	29
MDS D425	20	1 ... 11	13
MDS D426	40	2 ... 25	30

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D428	25	1 ... 18	21
MDS D460	25	1 ... 18	20

All dimensions in mm.

Table 4- 4 SIMATIC RF240R IO-Link field data

	Length of the transmission window (L)	Operating distance (S_a)	Limit distance (S_g)
MDS D100	100	2 ... 84	95
MDS D124	65	2 ... 53	60
MDS D126	80	2 ... 57	65
MDS D160	50	1 ... 33	37
MDS D165	105	2 ... 80	94
MDS D200	90	2 ... 69	78
MDS D261	70	2 ... 60	70
MDS D324	55	1 ... 36	40
MDS D400	95	2 ... 80	90
MDS D422	25	1 ... 12	15
MDS D423	45	2 ... 35	40
MDS D424	75	1 ... 47	53
MDS D425	30	1 ... 15	17
MDS D426	65	2 ... 45	55
MDS D428	50	1 ... 30	34
MDS D460	50	1 ... 30	34

All dimensions in mm.

Table 4- 5 Field data SIMATIC RF250R, with ANT 1

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D100	80	5 ... 95	115
MDS D124	55	2 ... 60	75
MDS D126	150	2 ... 80	95
MDS D139	75	5 ... 90	105
MDS D160	50	2 ... 35	45
MDS D165	140	5 ... 95	110
MDS D200	130	5 ... 90	100
MDS D261	100	2 ... 90	110

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D324	50	5 ... 60	70
MDS D339	110	2 ... 85	100
MDS D400	140	10 ... 95	110
MDS D423	50	2 ... 35	45
MDS D424	50	2 ... 70	80
MDS D425	40	2 ... 25	30
MDS D426	110	2 ... 80	95
MDS D428	40	2 ... 40	50
MDS D460	50	2 ... 30	40

All dimensions in mm.

Table 4- 6 Field data SIMATIC RF250R IO-Link with ANT 3

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D124	40	1 ... 35	48
MDS D160	24	1 ... 23	30
MDS D324	32	1 ... 22	35
MDS D422	27	0 ... 12	15
MDS D423	30	2 ... 18	26
MDS D424	37	0 ... 34	48
MDS D425	22	1 ... 12	20
MDS D428	30	1 ... 20	32
MDS D460	24	1 ... 21	27

All dimensions in mm.

Table 4- 7 Field data SIMATIC RF250R, with ANT 3S

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D117	2	0 ... 2	3
MDS D127	3	0 ... 2	3
MDS D421	3	0 ... 3	4

All dimensions in mm.

Table 4- 8 Field data SIMATIC RF250R IO-Link with ANT 8

	Length of the transmission window (L)	**Operating distance (S_a)**	**Limit distance (S_g)**
MDS D117	2	0 ... 2	3
MDS D127	3	0 ... 3	4
MDS D421	3	0 ... 3	4

All dimensions in mm.

Table 4- 9 Field data SIMATIC RF250R IO-Link with ANT 12

	Length of the transmission window (L)	**Operating distance (S_a)**	**Limit distance (S_g)**
MDS D117	3	0 ... 3	4
MDS D127	4	0 ... 4	5
MDS D160	18	0 ... 12	17
MDS D421	10	0 ... 3	5
MDS D422	22	0 ... 7	10
MDS D425	12	0 ... 8	10
MDS D428	18	1 ... 10	15
MDS D460	16	1 ... 10	14

All dimensions in mm.

Table 4- 10 Field data SIMATIC RF250R, with ANT 12 (stainless steel variant)

	Length of the transmission window (L_d)	**Operating distance (S_a)**	**Limit distance (S_g)**
MDS D117	3	0 ... 2	3
MDS D127	4	0 ... 3	4
MDS D160	15	0 ... 11	13
MDS D421	9	0 ... 2	3
MDS D422	20	0 ... 5	6
MDS D425	10	1 ... 6	8
MDS D428	16	1 ... 10	12
MDS D460	14	1 ... 8	10

All dimensions in mm.

Table 4- 11 Field data SIMATIC RF250R IO-Link with ANT 18

	Length of the transmission window (L)	**Operating distance (S_a)**	**Limit distance (S_g)**
MDS D124	26	2 ... 24	37
MDS D160	22	1 ... 18	26
MDS D324	30	1 ... 18	27
MDS D421	16	0 ... 3	4
MDS D422	24	1 ... 8	14
MDS D423	21	1 ... 15	18
MDS D424	26	1 ... 27	36
MDS D425	19	1 ... 11	16

	Length of the transmission window (L)	Operating distance (S_a)	Limit distance (S_g)
MDS D428	19	1 ... 8	15
MDS D460	19	1 ... 17	21

All dimensions in mm.

Table 4- 12 Field data SIMATIC RF250R, with ANT 18 (stainless steel variant)

	Length of the transmission window (L_d)	Operating distance (S_a)	Limit distance (S_g)
MDS D124	22	1 ... 28	32
MDS D160	20	1 ... 17	20
MDS D324	28	1 ... 24	27
MDS D421	15	0 ... 3	5
MDS D422	22	0 ... 8	10
MDS D423	21	1 ... 22	25
MDS D424	25	1 ... 30	34
MDS D425	18	1 ... 13	15
MDS D428	18	1 ... 15	18
MDS D460	16	1 ... 15	18

All dimensions in mm.

Table 4- 13 Field data SIMATIC RF250R, with ANT 30

	Length of the transmission window (L)	Operating distance (S_a)	Limit distance (S_g)
MDS D124	40	1 ... 35	48
MDS D126	45	0 ... 47	60
MDS D160	25	1 ... 23	30
MDS D324	35	1 ... 22	30
MDS D422	20	0 ... 12	15
MDS D423	35	0 ... 18	30
MDS D424	35	0 ... 34	48
MDS D425	20	1 ... 12	20
MDS D426	45	0 ... 44	58
MDS D428	20	1 ... 20	32
MDS D460	25	1 ... 21	27

All dimensions in mm.

Table 4- 14 Field data SIMATIC RF250R, with ANT 30 (stainless steel variant)

	Length of the transmission window (L_d)	**Operating distance (S_a)**	**Limit distance (S_g)**
MDS D124	40	1 ... 34	38
MDS D126	45	0 ... 45	50
MDS D160	25	1 ... 22	25
MDS D324	35	1 ... 30	35
MDS D422	20	0 ... 12	15
MDS D423	35	1 ... 28	32
MDS D424	35	1 ... 40	45
MDS D425	20	1 ... 17	20
MDS D426	45	1 ... 40	48
MDS D428	20	1 ... 22	26
MDS D460	25	1 ... 24	27

All dimensions in mm.

Table 4- 15 SIMATIC RF260R IO-Link field data

	Length of the transmission window (L)	**Operating distance (S_a)**	**Limit distance (S_g)**
MDS D100	90	2 ... 110	130
MDS D124	60	2 ... 80	85
MDS D126	80	2 ... 75	100
MDS D139	90	2 ... 80	110
MDS D160	50	2 ... 40	45
MDS D165	120	2 ... 120	135
MDS D200	120	2 ... 100	120
MDS D261	80	2 ... 75	90
MDS D324	50	2 ... 60	70
MDS D339	110	5 ... 65	80
MDS D400	140	2 ... 110	140
MDS D423	50	2 ... 40	45
MDS D424	50	2 ... 60	70
MDS D426	75	2 ... 70	85
MDS D428	45	2 ... 40	45
MDS D460	45	2 ... 40	45

All dimensions in mm.

4.2.2 Minimum clearances

Minimum distance from transponder to transponder

The specified distances refer to a metal-free environment. For a metallic environment, the specified minimum distances must be multiplied by a factor of 1.5. The transponders designed specifically for installation in/on metal are an exception to this.

Table 4- 16 Minimum clearances for transponders - Part 1

	RF210R	RF220R	RF240R	RF260R
MDS D100	--	--	--	≥ 240
MDS D117	≥ 15	--	--	--
MDS D124	≥ 25	≥ 40	≥ 90	≥ 180
MDS D126	--	≥ 50	≥ 100	≥ 180
MDS D127	≥ 15	--	--	--
MDS D139	--	--	--	≥ 200
MDS D160	≥ 20	≥ 25	≥ 70	≥ 150
MDS D165	--	--	--	≥ 240
MDS D200	--	--	--	≥ 240
MDS D261	--	--	--	≥ 200
MDS D324	≥ 25	≥ 40	≥ 90	≥ 180
MDS D339	--	--	--	≥ 200
MDS D400	--	--	--	≥ 240
MDS D421	≥ 10	--	--	--
MDS D422	≥ 15	≥ 20	≥ 50	--
MDS D423	--	--	≥ 80	≥ 160
MDS D424	≥ 25	≥ 40	≥ 90	≥ 180
MDS D425	≥ 20	≥ 25	≥ 75	--
MDS D426	--	≥ 50	≥ 90	≥ 180
MDS D428	≥ 25	≥ 25	≥ 75	≥ 150
MDS D460	≥ 20	≥ 25	≥ 70	≥ 150

All values are in mm, relative to the operating distance (S_a) between reader and transponder, and between transponder edge and transponder edge

Table 4- 17 Minimum clearances for transponders - Part 2

	RF250R [1]				
	ANT 1	**ANT 3 / ANT 30**	**ANT 3S / ANT 18**	**ANT 8**	**ANT 12**
MDS D100	≥ 300	--	--	--	--
MDS D117	--	--	--	≥ 30	≥ 50
MDS D124	≥ 200	≥ 100	≥ 80	--	--
MDS D126	≥ 250	≥ 100	--	--	--
MDS D127	--	--	--	≥ 40	≥ 60
MDS D139	≥ 300	--	--	--	--
MDS D160	≥ 200	≥ 100	≥ 80	--	≥ 60
MDS D165	≥ 300	--	--	--	--
MDS D200	≥ 300	--	--	--	--
MDS D261	≥ 300	--	--	--	--
MDS D324	≥ 200	≥ 100	≥ 80	--	--
MDS D339	≥ 300	--	--	--	--
MDS D400	≥ 300	--	--	--	--
MDS D421	--	--	≥ 50	≥ 30	≥ 40
MDS D422	--	≥ 70	≥ 60	--	≥ 50
MDS D423	≥ 200	≥ 100	≥ 80	--	--
MDS D424	≥ 200	≥ 100	≥ 80	--	--
MDS D425	≥ 150	≥ 80	≥ 60	--	≥ 50
MDS D426	≥ 250	≥ 100	--	--	--
MDS D428	≥ 150	≥ 80	≥ 60	--	≥ 50
MDS D460	≥ 200	≥ 100	≥ 80	--	≥ 60

[1] Depends on the connected antenna.

All values are in mm, relative to the operating distance (S_a) between reader and transponder, and between transponder edge and transponder edge.

Minimum distance from reader to reader

Table 4- 18 Minimum distances to readers or antennas

RF210R IO-Link to RF210R IO-Link	RF220R IO-Link to RF220R IO-Link	RF240R IO-Link to RF240R IO-Link	ANT x to ANT x with RF250R IO-Link	RF260R IO-Link to RF260R IO-Link
≥ 60 mm	≥ 100 mm	with 2 readers: ≥ 120 with multiple readers: ≥ 200	Depending on the transponder used. You can find the values in the "Minimum clearances" sections of the ANT x in the "SIMATIC RF200" System Manual.	with 2 readers: ≥ 150 with multiple readers: ≥ 250

All values are in mm

Note

Effect on inductive fields by not maintaining the minimum distances of the readers

If the values fall below those specified in the "minimum distance from reader to reader", there is a risk of the function being affected by inductive fields. In this case, the data transfer time would increase unpredictably or a command would be aborted with an error.

Adherence to the values specified in the "Minimum distance from reader to reader" table is therefore essential.

If the minimum clearance cannot be maintained due to the construction, the HF field (antenna) of the reader can be turned on or off via the process image (PIQ).

4.3 Installation guidelines

4.3.1 Overview

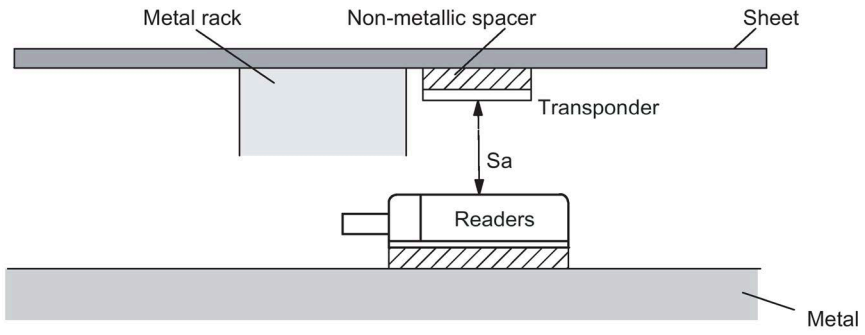
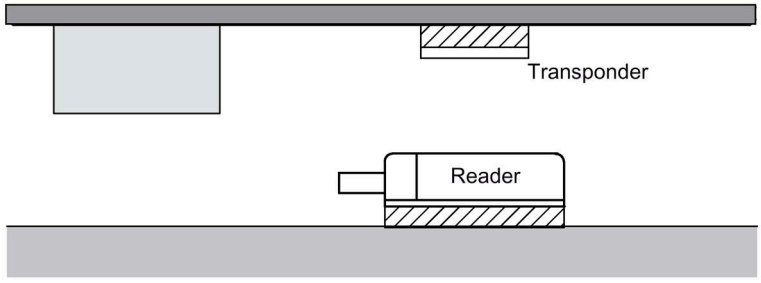
The transponder and reader complete with their antennas are inductive devices. Any type of metal in the vicinity of these devices affects their functionality. Some points need to be considered during configuration and installation if the values described in the section "Field data (Page 26)" are to retain their validity:

- Minimum spacing between two readers or their antennas
- Minimum distance between two adjacent data memories

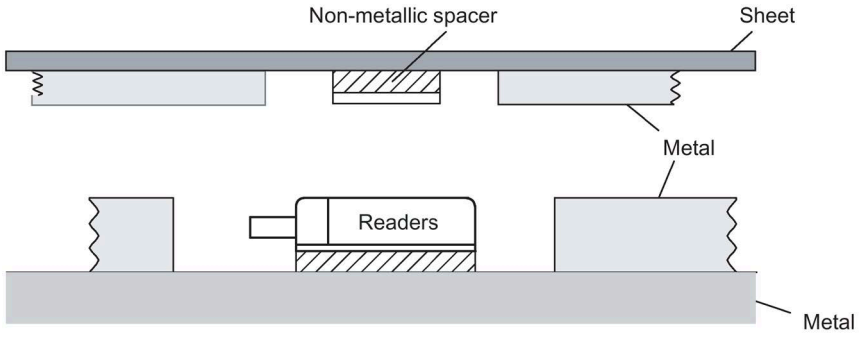
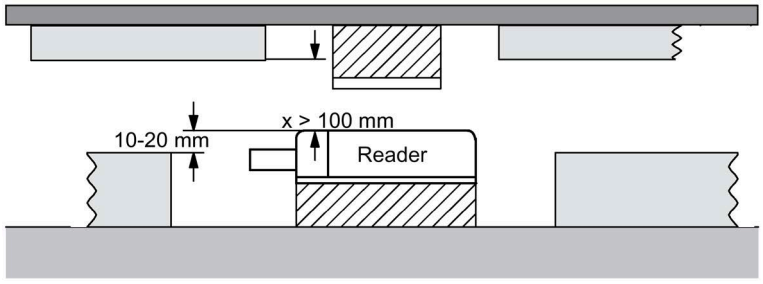
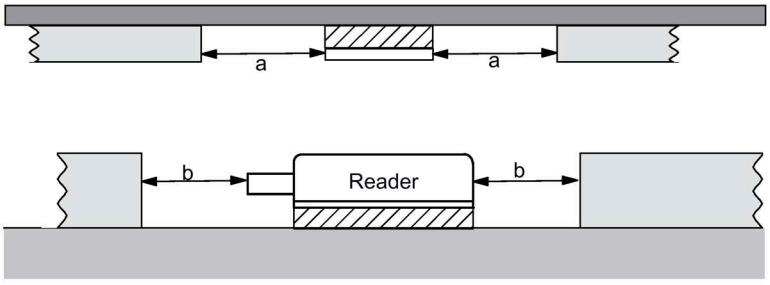
- Metal-free area for flush-mounting of readers or their antennas and transponders in metal
- Mounting of multiple readers or their antennas on metal frames or racks

The following sections describe the impact on the operation of the RFID system when mounted in the vicinity of metal.

4.3.2 Reduction of interference due to metal

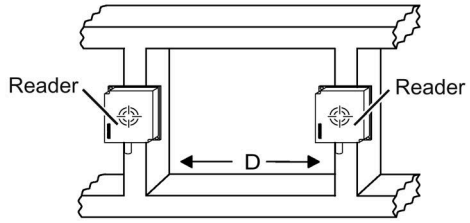
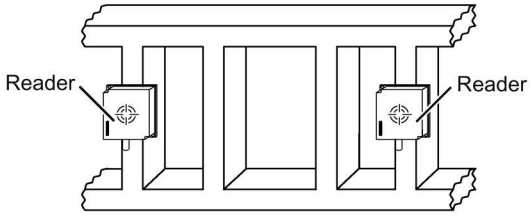
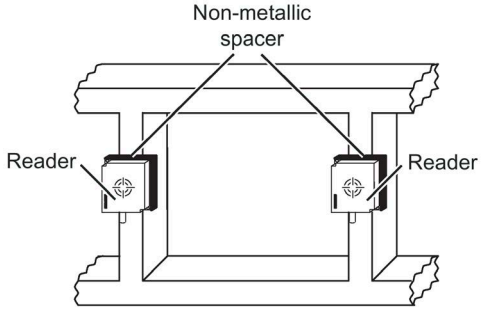
Interference due to metal rack	**Problem**
	A metal rack is located above the transmission window of the reader. This affects the entire field. In particular, the transmission window between reader and transponder is reduced.
	**Remedy:** The transmission window is no longer affected if the transponder is mounted differently.

Flush-mounting

Flush-mounting of transponders and readers	Problem
	Flush-mounting of transponders and readers is possible in principle. However, the size of the transmission window is significantly reduced. The following measures can be used to counteract the reduction of the window:
	**Remedy:** Enlargement of the non-metallic spacer below the transponder and/or reader. The transponder and/or reader are 10 to 20 mm higher than the metal surround. (The value x ≥ 100 mm is valid, e.g. for RF310R. It indicates that, for a distance x ≥ 100 mm, the reader can no longer be significantly affected by metal.)
	**Remedy:** Increase the non-metallic distance a, b. The following rule of thumb can be used: • Increase a, b by a factor of 2 to 3 over the values specified for metal-free areas • Increasing a, b has a greater effect for readers or transponders with a large limit distance than for readers or transponders with a small limit distance.

Mounting of several readers on metal frames or racks

Any reader mounted on metal couples part of the field to the metal frame. There is normally no interaction as long as the minimum distance D and metal-free areas a, b are maintained. However, interaction may take place if an iron frame is positioned unfavorably. Longer data transfer times or sporadic error messages at the communication module are the result.

Mounting of several readers on metal racks	**Problem: Interaction between readers**
	**Remedy** Increase the distance D between the two readers.
	**Remedy** Introduce one or more iron struts in order to short-circuit the stray fields.
	**Remedy** Insert a non-metallic spacer of 20 to 40 millimeter thickness between the reader and the iron frame. This will significantly reduce the induction of stray fields on the rack:

4.3.3 Effects of metal on different transponders and readers

Mounting different transponders and readers on metal or flush-mounting

Certain conditions have to be observed when mounting the transponders and readers on metal or flush-mounting. For more information, please refer to the descriptions of the individual transponders and readers in the relevant section.

4.3.4 Impact of metal on the transmission window

In general, the following points should be considered when mounting RFID components:

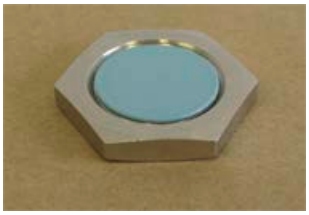
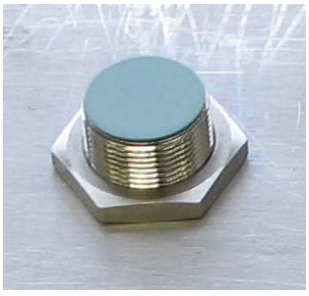
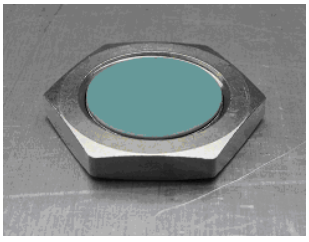
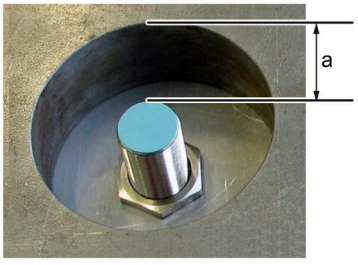
- Direct mounting on metal is allowed only in the case of specially approved transponders.
- Flush-mounting of the components in metal reduces the field data; a test is recommended in critical applications.
- When working inside the transmission window, it should be ensured that no metal rail (or similar part) intersects the transmission field.
  The metal rail would affect the field data.

The impact of metal on the field data (S_g, S_a, L) is shown in a table in this section. The values in the table describe the reduction of the field data in % with reference to non-metal (100% means no impact).

4.3.4.1 RF210R IO-Link

The RF210R IO-Link can be flush-mounted in metal. Please allow for a possible reduction in the field data values.

The following table shows the different arrangements for the reader with and without a metallic environment:

Case	Figure	Description
a)		Reader metal-free
b)		Reader on metal, distance to metal ≥ 12 mm
c)		Reader in metal, flush with M18 nut
d)		Reader in metal, all around

To avoid any influence on the field data, in Case d, the distance a should be ≥ 10 mm.

Table 4- 19 Reduction of field data due to metal, range as %: Transponder and RF210R

Transponder		**Reader without direct metal influence (Case a, b and d)**	**Reader flush-mounted in metal (Case c)**
MDS D124 [1]	metal-free	100	82
	on metal, distance 15 mm	90	90
	flush-mounted in metal; distance all round 15 mm	85	80
MDS D127	flush-mounted in metal; distance all round 0 mm	100	75
MDS D160 [1]	metal-free	100	95
	on metal, distance 10 mm	100	95
MDS D324 [1]	metal-free	100	90
	on metal, distance 15 mm	90	90
	flush-mounted in metal; distance all round 25 mm	80	90
MDS D421	metal-free	100	90
	flush-mounted in metal; distance all round 0 mm	75	50
MDS D422	metal-free	100	80
	flush-mounted in metal; distance all round 0 mm	90	40
MDS D423	metal-free	100	90
	on metal, distance 0 mm	110 [2]	100 [2]
	flush-mounted in metal; distance all round 10 mm	95	85
MDS D424 [1]	metal-free	100	60
	on metal, distance 15 mm	90	80
	flush-mounted in metal; distance all round 25 mm	85	75
MDS D425	metal-free	100	85
	on metal, distance 0 mm	100	85
MDS D428	metal-free	100	90
	on metal, distance 0 mm	100	80
MDS D460 [1]	metal-free	100	90
	on metal, distance 25 mm	100	90

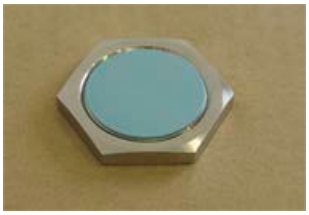
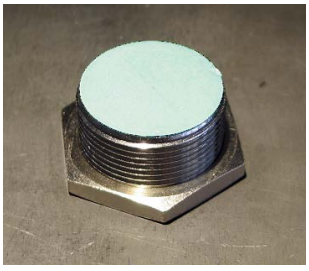
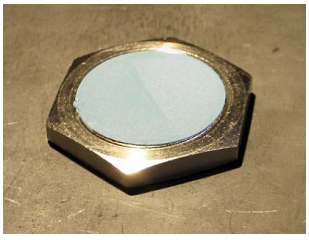
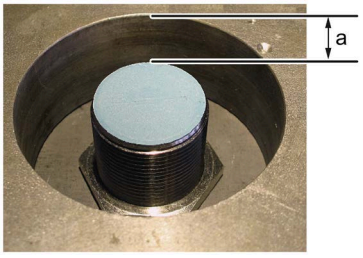
[1] Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

[2] Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

4.3.4.2 RF220R IO-Link

The RF220R IO-Link can be flush-mounted in metal. Please allow for a possible reduction in the field data values.

The following table shows the different arrangements for the reader with and without a metallic environment:

Case	Figure	Description
a)		Reader metal-free
b)		Reader on metal, distance to metal ≥ 12 mm
c)		Reader in metal, flush with M30 nut
d)		Reader in metal, all round

To avoid any impact on the field data, in Case d, the distance a should be ≥ 15 mm.

Table 4- 20 Reduction of field data due to metal, range as %: Transponder and RF220R

Transponder		**Reader without direct metal influence (Case a, b and d)**	**Reader flush-mounted in metal (Case c)**
MDS D124 [1]	metal-free	100	94
	on metal, distance 15 mm	97	89
	Tag flush-mounted in metal; distance all round 15 mm	86	83
MDS D126 [1]	metal-free	100	75
	on metal, distance 25 mm	85	70
	flush-mounted in metal; distance all round 50 mm	80	65
MDS D160 [1]	metal-free	100	89
	on metal, distance 10 mm	100	89
MDS D324 [1]	metal-free	100	90
	on metal, distance 15 mm	97	86
	flush-mounted in metal; distance all round 25 mm	93	86
MDS D422	metal-free	100	90
	flush-mounted in metal; distance all round 0 mm	85	85
MDS D423	metal-free	100	90
	on metal, distance 0 mm	125 [2]	115 [2]
	flush-mounted in metal; distance all round 10 mm	80	75
MDS D424 [1]	metal-free	100	93
	on metal, distance 15 mm	96	89
	flush-mounted in metal; distance all round 25 mm	86	82
MDS D425	metal-free	100	90
	screwed onto metal	100	75
	flush-mounted in metal; distance all round 25 mm	95	75
MDS D426 [1]	metal-free	100	90
	on metal, distance 25 mm	90	75
	flush-mounted in metal; distance all round 50 mm	80	70
MDS D428	metal-free	100	94
	on metal, distance 0 mm	100	94
MDS D460 [1]	metal-free	100	92
	on metal, distance 0 mm	100	92

Transponder	Reader without direct metal influence (Case a, b and d)	Reader flush-mounted in metal (Case c)

1) Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

2) Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

4.3.4.3 RF240R IO-Link

The RF240R IO-Link can be flush-mounted in metal. Please allow for a possible reduction in the field data values.

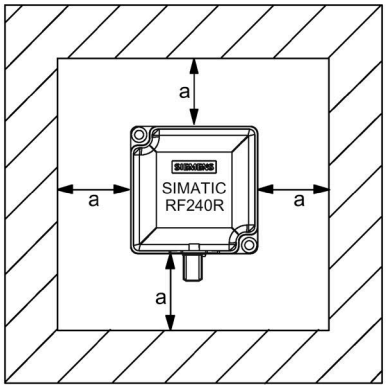


Figure 4-8 Metal-free space RF240R IO-Link

To avoid any impact on the field data, the distance a should be ≥ 20 mm.

Table 4- 21 Reduction of field data due to metal, range as %: Transponder and RF240R

Transponder		Reader without direct metal influence	Reader on metal (metal plate)	Reader flush-mounted in metal (all round 20 mm)
MDS D100 1)	without metal	100	95	80
	on metal, distance 20 mm	95	90	75
	flush-mounted in metal; distance all round 20 mm	90	75	70
MDS D124 1)	without metal	100	85	75
	on metal, distance 15 mm	90	80	75
	flush-mounted in metal; distance all round 25 mm	85	70	65
MDS D126 1)	without metal	100	80	70
	on metal, distance 25 mm	80	75	60

Transponder		Reader without direct metal influence	Reader on metal (metal plate)	Reader flush-mounted in metal (all round 20 mm)
	flush-mounted in metal; distance all round 50 mm	70	55	55
MDS D160 [1]	without metal	100	90	80
	on metal, distance 10 mm	90	85	80
MDS D165	without metal	100	95	75
	on metal, distance 25 mm	75	70	65
MDS D200 [1]	without metal	100	95	85
	on metal, distance 20 mm	95	80	70
	flush-mounted in metal, distance all round 20 mm	70	60	50
MDS D261	without metal	100	90	90
	on metal, distance 25 mm	85	80	70
MDS D324 [1]	without metal	100	90	80
	on metal, distance 15 mm	95	85	80
	flush-mounted in metal; distance all round 25 mm	90	75	70
MDS D400 [1]	without metal	100	90	80
	on metal, distance 20 mm	80	75	55
	flush-mounted in metal, distance all round 20 mm	75	70	50
MDS D422	without metal	100	90	85
	flush-mounted in metal; distance all round 0 mm	90	60	40
MDS D423	without metal	100	95	90
	on metal, distance 0 mm	150 [2]	140 [2]	140 [2]
	flush-mounted in metal; distance all round 10 mm	70	60	60
MDS D424 [1]	without metal	100	85	80
	on metal, distance 15 mm	90	80	75
	flush-mounted in metal; distance all round 25 mm	80	70	65
MDS D425	without metal	100	90	85
	on metal, distance 0 mm	95	85	80
MDS D426 [1]	without metal	100	80	70
	on metal, distance 25 mm	90	80	70
	flush-mounted in metal; Distance all-round 50 mm	85	65	60
MDS D428	without metal	100	90	85
	on metal, distance 0 mm	95	85	83
MDS D460 [1]	without metal	100	90	80
	on metal, distance 0 mm	90	85	80

Transponder	Reader without direct metal influence	Reader on metal (metal plate)	Reader flush-mounted in metal (all round 20 mm)

1) Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

2) Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

4.3.4.4 RF250R IO-Link

The RF250R IO-Link reader is operated with the external antennas ANT 8, 12, 18 and 30. The antennas can be flush-mounted in metal. Please allow for a possible reduction in the field data values.

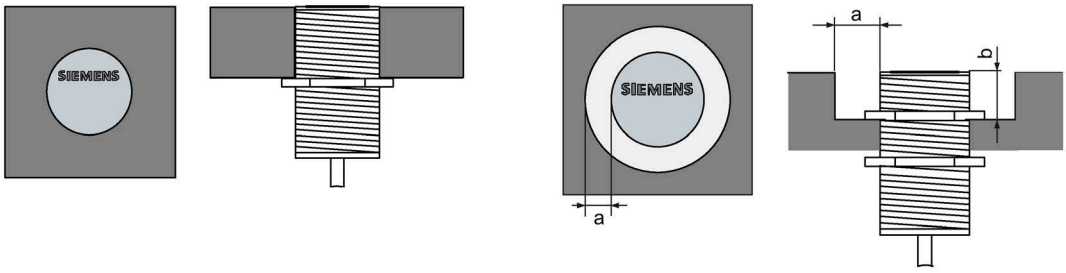


Figure 4-9 Metal-free space for ANT 8 / ANT 12 and ANT 18 / ANT 30

Table 4- 22 Reduction of field data due to metal, range as %: Transponder and RF250R with ANT 3

Transponder		RF250R with ANT 3	
		antenna without metal	antenna flush-mounted in metal (all round 20 mm)
MDS D124 1)	without metal	100	80
	on metal, distance 15 mm	90	75
	flush-mounted in metal; distance all round 25 mm	75	70
MDS D126 1)	without metal	100	80
	on metal, distance 25 mm	85	75
	flush-mounted in metal; distance all round 50 mm	60	50
MDS D160 1)	without metal	100	85
	on metal, distance 10 mm	95	80
MDS D324 1)	without metal	100	80
	on metal, distance 15 mm	95	75
	flush-mounted in metal; distance all round 25 mm	85	70

Transponder		**RF250R with ANT 3**	
MDS D422	without metal	100	95
	flush-mounted in metal; distance all round 0 mm	95	80
MDS D423	without metal	100	90
	on metal, distance 0 mm	130 [2)]	110 [2)]
	flush-mounted in metal; distance all round 10 mm	80	70
MDS D424 [1)]	without metal	100	85
	on metal, distance 15 mm	90	75
	flush-mounted in metal; distance all round 25 mm	75	70
MDS D425	without metal	100	90
	on metal, distance 0 mm	95	75
MDS D426 [1)]	without metal	100	70
	on metal, distance 25 mm	90	65
	flush-mounted in metal; distance all round 25 mm	55	45
MDS D428	without metal	100	90
	on metal, distance 0 mm	100	90
MDS D460 [1)]	without metal	100	85
	on metal, distance 10 mm	90	75

1) Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

2) Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

Table 4- 23 Reduction of field data due to metal, range as %: Transponder and RF250R with ANT 8

Transponder		**RF250R with ANT 8**	
		Antenna without metal	**antenna flush-mounted in metal**
MDS D117	without metal	100	85
	flush-mounted in metal; distance all round 0 mm	65	55
MDS D127	without metal	100	85
	flush-mounted in metal; distance all round 0 mm	70	60
MDS D421	without metal	100	85
	flush-mounted in metal; distance all round 0 mm	75	70

Table 4- 24 Reduction of field data due to metal, range as %: Transponder and RF250R with ANT 12

Transponder		**RF250R with ANT 12**	
		Antenna without metal	**antenna flush-mounted in metal (all round 7 mm)**
MDS D117	without metal	100	85
	flush-mounted in metal; distance all round 0 mm	50	40
MDS D127	without metal	100	85
	flush-mounted in metal; distance all round 0 mm	65	50
MDS D160 [1]	without metal	100	90
	on metal, distance 10 mm	90	85
MDS D421	without metal	100	90
	flush-mounted in metal; distance all round 0 mm	65	45
MDS D422	without metal	100	90
	flush-mounted in metal; distance all round 0 mm	90	75
MDS D425	without metal	100	90
	on metal, distance 0 mm	115 [2]	100
MDS D428	without metal	100	85
	on metal, distance 0 mm	110 [2]	95
MDS D460 [1]	without metal	100	95
	on metal, distance 10 mm	90	80
	flush-mounted in metal; distance all round 0 mm	85	75

[1] Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

[2] Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

Table 4- 25 Reduction of field data due to metal, range as %: Transponder and RF250R with ANT 18

Transponder		**RF250R with ANT 18**	
		Antenna without metal	**antenna flush-mounted in metal (all round 10 mm)**
MDS D124 [1]	without metal	100	80
	on metal, distance 15 mm	100	80
	flush-mounted in metal; distance all round 25 mm	95	70
MDS D160 [1]	without metal	100	90

Transponder		**RF250R with ANT 18**	
	on metal, distance 10 mm	100	90

Transponder		**RF250R with ANT 18**	
MDS D324 [1]	without metal	100	80
	on metal, distance 15 mm	100	80
	flush-mounted in metal; distance all round 25 mm	95	75
MDS D421	without metal	100	85
	flush-mounted in metal; distance all round 0 mm	65	50
MDS D422	without metal	100	100
	flush-mounted in metal; distance all round 0 mm	90	90
MDS D423	without metal	100	85
	on metal, distance 0 mm	120 [2]	110 [2]
	flush-mounted in metal; distance all round 10 mm	90	75
MDS D424 [1]	without metal	100	75
	on metal, distance 15 mm	95	75
	flush-mounted in metal; distance all round 25 mm	95	75
MDS D425	without metal	100	90
	on metal, distance 0 mm	100	90
MDS D428	without metal	100	85
	on metal, distance 0 mm	100	85
MDS D460 [1]	without metal	100	85
	on metal, distance 10 mm	100	85

[1] Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

[2] Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

Table 4- 26 Reduction of field data due to metal, range as %: Transponder and RF250R with ANT 30

Transponder		**RF250R with ANT 30**	
		Antenna without metal	**antenna flush-mounted in metal (all round 20 mm)**
MDS D124 [1]	without metal	100	80
	on metal, distance 15 mm	90	75
	flush-mounted in metal; distance all round 25 mm	75	70
MDS D126 [1]	without metal	100	80
	on metal, distance 25 mm	85	75
	flush-mounted in metal; distance all round 50 mm	60	50

Transponder		**RF250R with ANT 30**	
MDS D160 [1)]	without metal	100	85
	on metal, distance 10 mm	95	80

Transponder		RF250R with ANT 30	
MDS D324 [1]	without metal	100	80
	on metal, distance 15 mm	95	75
	flush-mounted in metal; distance all round 25 mm	85	70
MDS D422	without metal	100	95
	flush-mounted in metal; distance all round 0 mm	95	80
MDS D423	without metal	100	90
	on metal, distance 0 mm	130 [2]	110 [2]
	flush-mounted in metal; distance all round 10 mm	80	70
MDS D424 [1]	without metal	100	85
	on metal, distance 15 mm	90	75
	flush-mounted in metal; distance all round 25 mm	75	70
MDS D425	without metal	100	90
	on metal, distance 0 mm	95	75
MDS D426 [1]	without metal	100	70
	on metal, distance 25 mm	90	65
	flush-mounted in metal; distance all round 25 mm	55	45
MDS D428	without metal	100	90
	on metal, distance 0 mm	100	90
MDS D460 [1]	without metal	100	85
	on metal, distance 10 mm	90	75

[1] Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

[2] Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

4.3.4.5 RF260R IO-Link

The RF260R IO-Link can be flush-mounted in metal. Please allow for a possible reduction in the field data values.

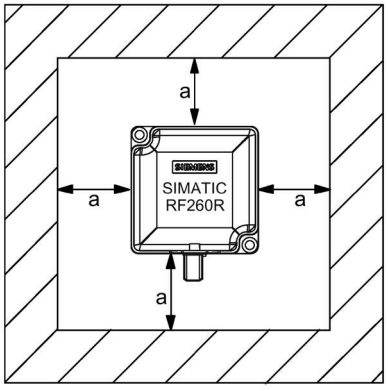


Figure 4-10 Metal-free space RF260R IO-Link

To avoid any impact on the field data, the distance a should be ≥ 20 mm.

Table 4- 27 Reduction of field data due to metal, range as %: Transponder and RF260R

Transponder		**Reader without direct metal influence**	**Reader on metal (metal plate)**	**Reader flush-mounted in metal (all round 20 mm)**
MDS D100 [1]	without metal	100	85	65
	on metal, distance 20 mm	70	65	50
	flush-mounted in metal; distance all round 20 mm	65	50	40
MDS D124 [1]	without metal	100	93	75
	on metal, distance 15 mm	95	85	70
	flush-mounted in metal; distance all round 25 mm	78	75	65
MDS D126 [1]	without metal	100	85	73
	on metal, distance 25 mm	75	68	60
	flush-mounted in metal; distance all round 50 mm	55	53	40
MDS D139 [1]	without metal	100	90	75
	on metal, distance 30 mm	95	90	75
MDS D160 [1]	without metal	100	90	75
	on metal, distance 10 mm	90	80	80
MDS D165	without metal	100	85	65
	on metal, distance 25 mm	65	60	45
MDS D200 [1]	without metal	100	85	70
	on metal, distance 20 mm	70	65	50
	flush-mounted in metal, distance all round 20 mm	55	50	45

Transponder		Reader without direct metal influence	Reader on metal (metal plate)	Reader flush-mounted in metal (all round 20 mm)
MDS D261	without metal	100	85	70
	on metal, distance 25 mm	80	70	60
MDS D324 [1]	without metal	100	90	75
	on metal, distance 15 mm	90	80	70
	flush-mounted in metal; distance all round 25 mm	70	65	55
MDS D339 [1]	without metal	100	90	75
	on metal, distance 30 mm	95	90	75
MDS D400 [1]	without metal	100	85	70
	on metal, distance 20 mm	70	65	50
	flush-mounted in metal; distance all round 20 mm	55	50	45
MDS D423	without metal	100	95	85
	on metal, distance 0 mm	120 [2]	115 [2]	110 [2]
	flush-mounted in metal; distance all round 10 mm	75	65	60
MDS D424 [1]	without metal	100	90	80
	on metal, distance 15 mm	90	80	70
	flush-mounted in metal; distance all round 25 mm	60	60	50
MDS D426 [1]	without metal	100	100	73
	on metal, distance 25 mm	88	85	68
	flush-mounted in metal; distance all round 50 mm	65	55	55
MDS D428	without metal	100	90	90
	on metal, distance 0 mm	90	90	85
MDS D460 [1]	without metal	100	95	90
	on metal, distance 10 mm	90	85	80

[1] Mounting the transponder on or in metal is only possible with the appropriate spacer or if there is adequate clearance to the metal.

[2] Values of > 100 % related to non metal surroundings can occur if transponders were developed specifically for mounting in/on metallic surroundings.

4.4 Further information

For more detailed information on "fundamentals of application planning" and "EMC", refer to chapter 4 of the "SIMATIC RF300 System Manual (https://support.industry.siemens.com/cs/ww/en/view/21738946)".

Commissioning and parameter assignment 5

After the system has been installed and wired up, the following steps are necessary to commission an RF200 IO-Link reader.

5.1 Configuring

Depending on the operating modes SIO mode or IO-Link mode, the IO-Link master needs to be assigned suitable parameters.

- SIO mode:

  To operate the readers in SIO mode, you need to connect the reader to a master port configured in SIO mode or a 24 V standard I/O module.

  You configure the master port using the S7 PCT.

- IO-Link mode:

  To operate the readers in IO-Link mode, you need to connect the reader to a master port configured in IO-Link mode.

  You configure the master port using the S7 PCT. Using STEP 7 you can also specify the size and location of the process image.

  Using an engineering tool (for example STEP 7 Professional / TIA Portal), a new project must be created or an existing project opened in which the IO-Link master will be linked.

Configuring the IO-Link master in the TIA Portal

Note

Configuration software

The configuration described below was created with STEP 7 Professional (TIA Portal). As an alternative you can also create the configuration with STEP 7 Classic (HW Config).

Using the TIA Portal you can drag the IO-Link master from the hardware catalog to the network view and assign the addresses. The size of the I/O area depends on the number of ports you are using and the process data size per port. You may need to adapt the size of the I/O area.

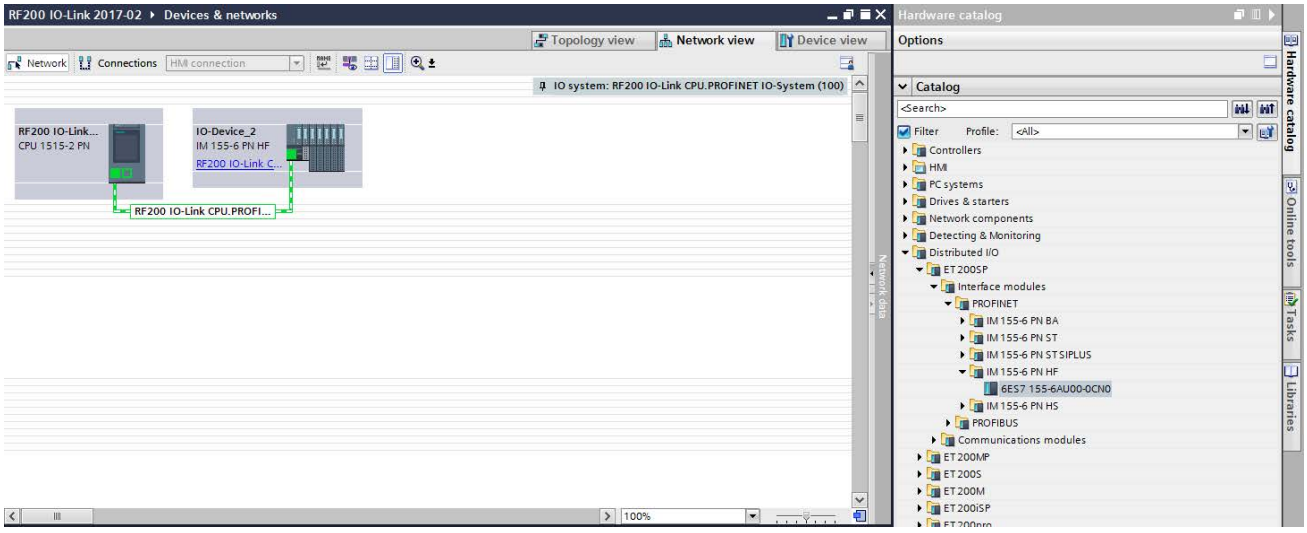


Figure 5-1 Configuration example of an IO-Link master in the TIA Portal

Consistency:

For data consistency, the entire communication path must be taken into account. The amount of data that can be transferred consistently depends on the controller you are using and the bus system being used and details can be found in the relevant manuals. For the data transfer between the IO-Link master and IO-Link device, the master guarantees consistency for 32 bytes.

With the "Ready delay" setting of the S7-PCT, you can also increase the consistent transfer. This delays the transfer of the "RDY" or "Done" bit by one IO-Link cycle so that the system has time to transfer the data.

The S7 controllers also have the system functions "SFC14/15" available that make it possible to guarantee a consistent data transfer.

5.2 Parameter assignment of the IO-Link system

You can start the Port Configuration Tool (PCT) directly from the TIA Portal. To do this, right-click on the IO-Link device in the device view and select the menu command "Start Device Tool" in the shortcut menu.

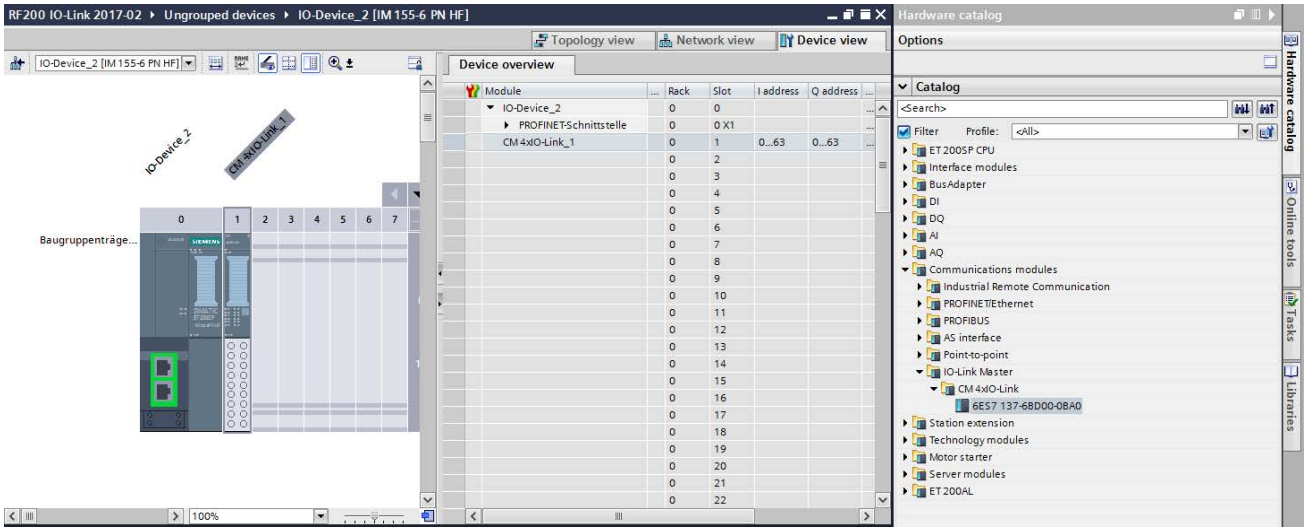


Figure 5-2 Configuration example of an IO-Link device in the device view in the TIA Portal

5.2.1 The Port Configuration Tool (S7-PCT)

When using SIEMENS masters, the "Port Configuration Tool" is available for configuring the IO-Link master and to set parameters for the devices.

When using third-party masters, you will first need to install the tool provided by the manufacturer or use the parameter assignment options of the configuration system.

With the PCT, STEP 7 engineering has a powerful software for assigning parameters for Siemens IO-Link master modules and IO-Link devices. S7 PCT is integrated in STEP 7 Classic as of V5.4 SP5 and is called via the hardware configuration of the IO-Link master. Apart from this program form integrated in STEP 7 engineering, a standalone version of S7 PCT is also available and can be installed separately.

The S7 PCT standalone variant allows simple use of the IO-Link with the distributed SIMATIC I/O system ET 200 in control systems of third-party providers (without STEP 7).

With the Port Configuration Tool, parameter data of the IO-Link devices can be set, changed, copied and saved in the STEP 7 project. In this way, all configuration data and parameters right down to the IO-Link device level are stored consistently.

Properties of the Port Configuration Tool (S7 PCT)

- Available free of charge as a download at Internet (https://support.industry.siemens.com/cs/ww/en/view/32469496)
- Configuration screens (tabs) in S7 PCT with plain language and product image directly from the IODD of the certified device
- Central data storage of all project data in the STEP 7 project with the integrated PCT call
- Wide-ranging test and diagnostics functions
- Reading out identification data from the devices
- Reading back of device information including the parameter assignment supported fully

The PCT integrates IO-Link devices below the fieldbus level completely in all areas of production automation in STEP 7 Professional (TIA Portal).

5.2.2 Parameter assignment with the PCT

With the S7 PCT, you can configure IO-Link master ports, change and read out parameters and much more.

Make sure that the current IODD files (IO-Link V1.1) are contained in the catalog. If they do not, import them using the "Options" > "Import IODD" menu. Then drag the IO-Link devices from the catalog to the main window of the PCT.

You can find the current IODD files on the pages of the Siemens Industry Online Support (https://support.industry.siemens.com/cs/de/en/ps/14972/dl).

Note

Assigning rights

In the "Options" menu, it is possible to assign rights for the particular view with "User Role". All the parameters are enabled with the "Commissioning" role.

The following screenshots show some of the important parameter assignment options at the IO-Link master and IO-Link device level:

IO-Link master level

1. In the "Ports" tab, drag the IO-Link masters from the catalog to the "Port Information" area. You can then configure the ports of the IO-Link masters.

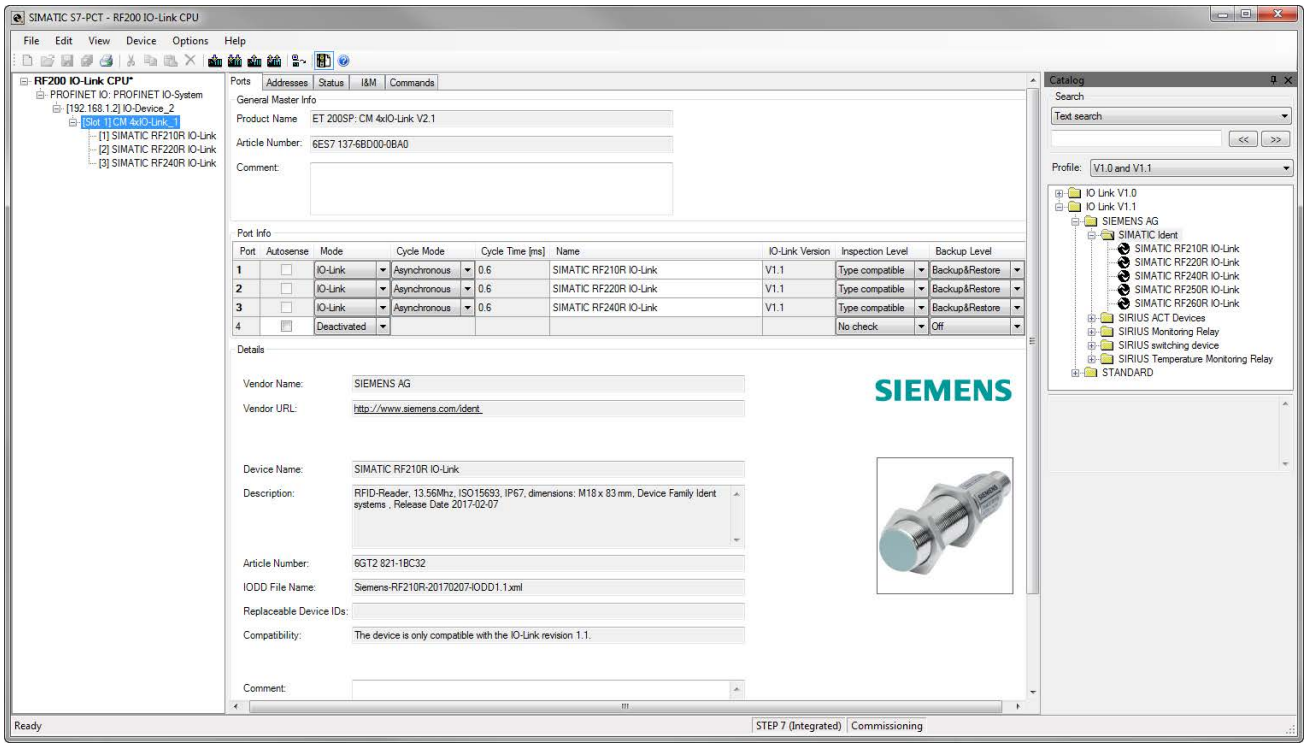


Figure 5-3 Creating IO-Link master ports

2. In the "Inspection Level" drop-down list, select the value "No check" if you want to disable checking of the device type.

3. Change to the "Addresses" tab to check the addresses that have been set.

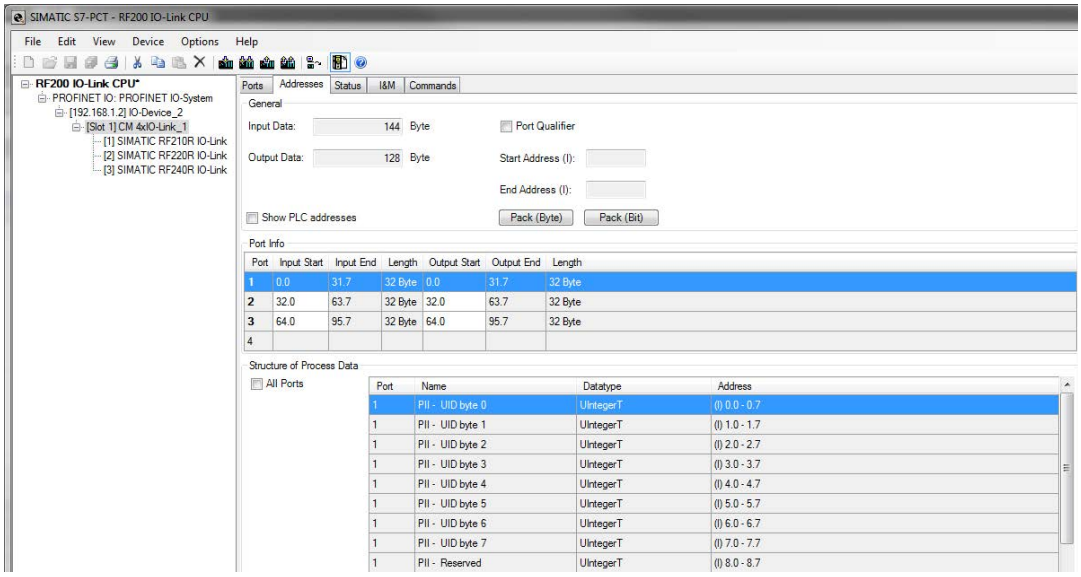


Figure 5-4 Set addresses of the IO-Link master ports

4. Change to the "Status" tab and click the "Refresh" button to update the device status.
   In the "Status" tab, the "Event Buffer" area displays status errors that have occurred.
5. Change to the "I&M" tab and on the left-hand side, select an IO-Link master.
   The I&M data of the selected device is displayed.

IO-Link device level

Note

Changing tabs in offline mode

Change to offline mode before you change between the "Identification", "Parameters", "Monitoring", "Diagnostics" or "Connection" tabs.

1. Click on the "Load to PG" symbol  to display the identification parameters.
2. Change to the "Parameters" tab so that the parameters of the IO-Link device are displayed.

In the "Parameters" tab, you can configure the various Reader parameters. In the "Values" column, click the parameter which you want to change.

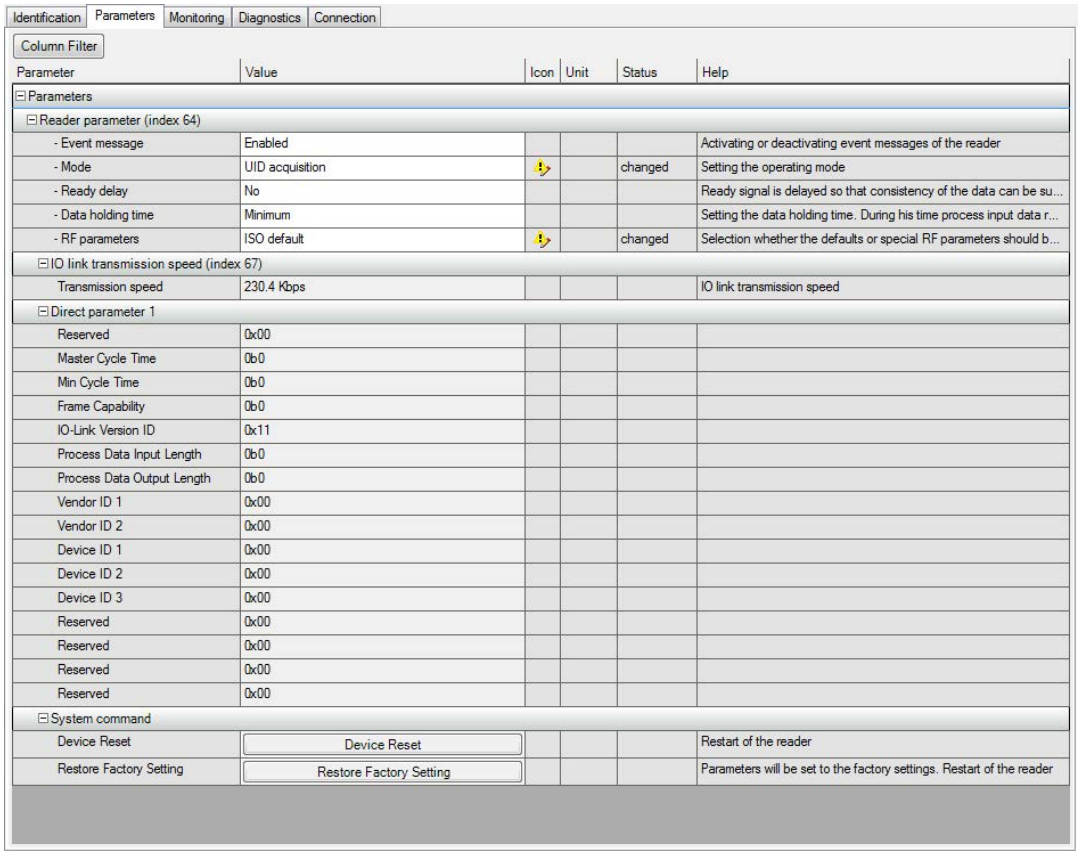


Figure 5-5 "Parameters" tab

Note

Expert parameters "RF parameters" or "Air interface"

The manual adaptation of the "RF parameters" or "Air interface" parameters is intended only for experts. To do this select the value "User defined" in the drop-down list for the "RF parameters" parameter and configure your values for "Parameters air interface".

You will find more information on the "Event message" parameter in the section "Event error codes (Page 102)".

You will find more information on the "Ready delay" parameter in the section "Configuring (Page 57)".

You will find more information on the "Data holding time" parameter in the section "IO-Link mode: Scan UID (Page 70)".

Note

RF250R IO-Link: Disabling event messages

If the value "Enable without antenna control" is selected in the "Event message" parameter. error messages caused by a missing antenna are suppressed with the RF250R IO-Link. In this case, the reader behaves as if there was no transponder in the antenna field.

In the "System command" area, you reset the device or restore the factory settings.

– Click the "Reset device" button to reset the values currently displayed in the "Diagnostics" tab. Note that this only resets the values of the online mode. If the device is in offline mode, the values are not reset.

  Note

  Resetting event messages

  Event messages can only be reset using S7 PCT or the "IO_LINK_DEVICE" function (system commands).

– Click the "Restore Factory Setting" button if you want to reset all the parameters to the factory settings.

3. Click on the "Load"  symbol to transfer the modified data to the device.

Note

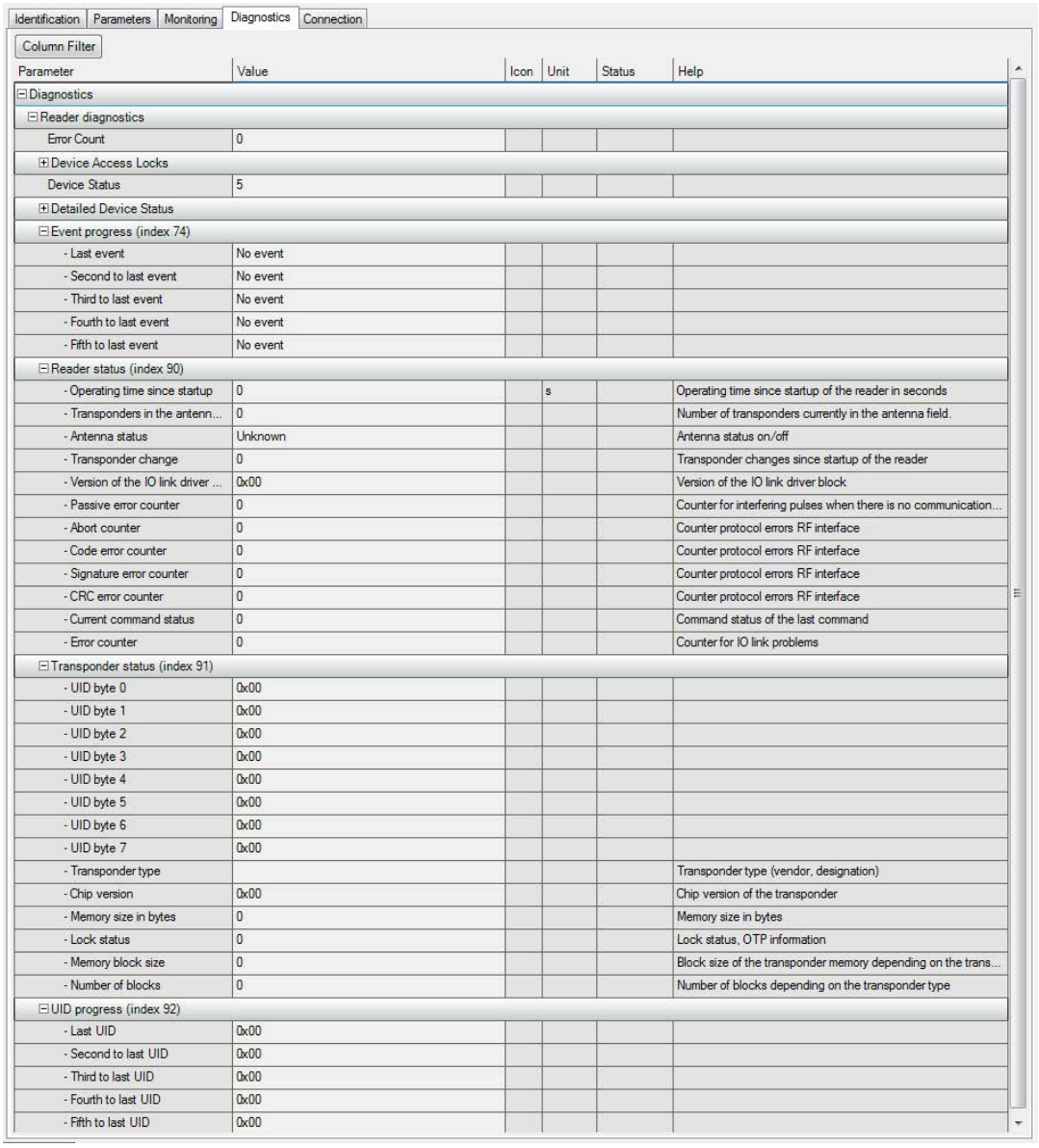
Downloading the parameters

When downloading the data, make sure that you have selected the required reader.

The successful download is displayed in the "Communication Results" area.

In seldom cases, when downloading the parameters, writing to the flash can cause a brief interruption in communication (a few milliseconds). These interruptions have no effect on the transfer of the parameters.

4. Change to the "Diagnostics" tab so that the diagnostics values are displayed.



Parameter	Value	Icon	Unit	Status	Help
⊟ Diagnostics					
⊟ Reader diagnostics					
Error Count	0				
⊞ Device Access Locks					
Device Status	5				
⊞ Detailed Device Status					
⊟ Event progress (index 74)					
- Last event	No event				
- Second to last event	No event				
- Third to last event	No event				
- Fourth to last event	No event				
- Fifth to last event	No event				
⊟ Reader status (index 90)					
- Operating time since startup	0		s		Operating time since startup of the reader in seconds
- Transponders in the antenn...	0				Number of transponders currently in the antenna field.
- Antenna status	Unknown				Antenna status on/off
- Transponder change	0				Transponder changes since startup of the reader
- Version of the IO link driver ...	0x00				Version of the IO link driver block
- Passive error counter	0				Counter for interfering pulses when there is no communication...
- Abort counter	0				Counter protocol errors RF interface
- Code error counter	0				Counter protocol errors RF interface
- Signature error counter	0				Counter protocol errors RF interface
- CRC error counter	0				Counter protocol errors RF interface
- Current command status	0				Command status of the last command
- Error counter	0				Counter for IO link problems
⊟ Transponder status (index 91)					
- UID byte 0	0x00				
- UID byte 1	0x00				
- UID byte 2	0x00				
- UID byte 3	0x00				
- UID byte 4	0x00				
- UID byte 5	0x00				
- UID byte 6	0x00				
- UID byte 7	0x00				
- Transponder type					Transponder type (vendor, designation)
- Chip version	0x00				Chip version of the transponder
- Memory size in bytes	0				Memory size in bytes
- Lock status	0				Lock status, OTP information
- Memory block size	0				Block size of the transponder memory depending on the trans...
- Number of blocks	0				Number of blocks depending on the transponder type
⊟ UID progress (index 92)					
- Last UID	0x00				
- Second to last UID	0x00				
- Third to last UID	0x00				
- Fourth to last UID	0x00				
- Fifth to last UID	0x00				

Index	Description
74	Event progress Offline mode In offline mode, the values that were read from the device with the last "Load to PG" are always shown in this area. The values are not reset by the system command "Device Reset". Online mode: In online mode, the current values are displayed in this area. These values are reset by the system command "Device Reset".
90	Reader status
91	Transponder status In this area among other things the UID of the transponder currently located in the antenna field of the reader is displayed.

92 UID progress

This area displays the UIDs of the transponders that were last located in the antenna field of the reader.

Figure 5-6 "Diagnostics" tab

In the "Event progress" section (index 74) of the "Diagnostics" tab, errors and warnings are displayed that were transferred to the IO-Link master. The IO-Link master only signals errors of the category "incoming/outgoing" to the controller. This is indicated by the LEDs of the IO-Link master or of the controller (SF). With the help of the diagnostics function "OB82 + SFB/SFC(SFC13, 51/SFB54)" of the relevant controller, you can perform other diagnostics functions or display them.

Designation parameter group/parameter	**Example of a value**	**Description**
Reader diagnostics		
Error counter	3	Number of errors which occurred (without warnings)
Device Access Locks		
Parameter (write) access	Unlocked	Parameter access unlocked/locked
Data Storage	Unlocked	Data storage unlocked/locked
Device Status	Device is OK	Device status of the reader
Detailed Device Status		
Detailed Device Status - 1	0xF4, 0x18, 0x34	Currently pending event
Event progress (index 74)		
Last event	Warning exiting state: Over temperature	Display of the error or warning that has occurred
Second to last event	Error entering state: Invalid PIQ	Display of the error or warning that has occurred
Third to last event	Overload	Display of the error or warning that has occurred
Fourth to last event	Warning entering state: Over temperature	Display of the error or warning that has occurred
Fifth to last event	No event	Display of the error or warning that has occurred
Reader status (index 90)		
Operating time since startup	2641	Operating time since startup of the reader in seconds
Transponders in the antenna field	1	Number of transponders currently located in the antenna field
Antenna status	On	Antenna status on/off
Transponder change	11	Transponder changes since startup of the reader
Version of the IO link driver block	0x1a	Version of the IO link driver block
Passive error counter	0	Air interface: Counter interfering pulses

Designation parameter group/parameter		**Example of a value**	**Description**
	Abort counter	0	Air interface: Counter for aborted communication
	Code error counter	135	Air interface: Counter for communication disruptions
	Signature error counter	0	Reserved
	CRC error counter	255	Air interface: Counter for communication disruptions
	Current command status	0	Command status of the last command
	Error counter	3	HOST interface: Counter for IO-Link problems
Transponder status (index 91)			
	UID byte 0	0xe0	Byte 0 of the unique identifier of the transponder
	UID byte ...	0x04	Byte x of the unique identifier of the transponder
	UID byte 7	0x1c	Byte 7 of the unique identifier of the transponder
	Transponder type	ISO 15693 (NXP, MDS D1xx)	Transponder type (vendor, designation)
	Chip version	0x01	Chip version of the transponder
	Memory size in bytes	112	Memory size of the chip in bytes
	Lock status	0	Disabled blocks on the chip
	Memory block size	4	Size of the memory blocks of the chip
	Number of blocks	28	Number of memory blocks of the chip (up to 255)
UID progress (index 92)			
	Last UID	0xe0040100019ce91c	Transponder history Unique identifier of the transponder that was last located in the antenna field.
	Second to last UID	0x00	Transponder history Unique identifier of the transponder that was located second to last in the antenna field.
	Third to last UID	0x00	Transponder history Unique identifier of the transponder that was located third to last in the antenna field.
	Fourth to last UID	0x00	Transponder history Unique identifier of the transponder that was located fourth to last in the antenna field.

Designation parameter group/parameter	Example of a value	Description
Fifth to last UID	0x00	Transponder history Unique identifier of the transponder that was located fifth to last in the antenna field.

5. If necessary change to the "Monitoring" tab so that you can monitor the read results.

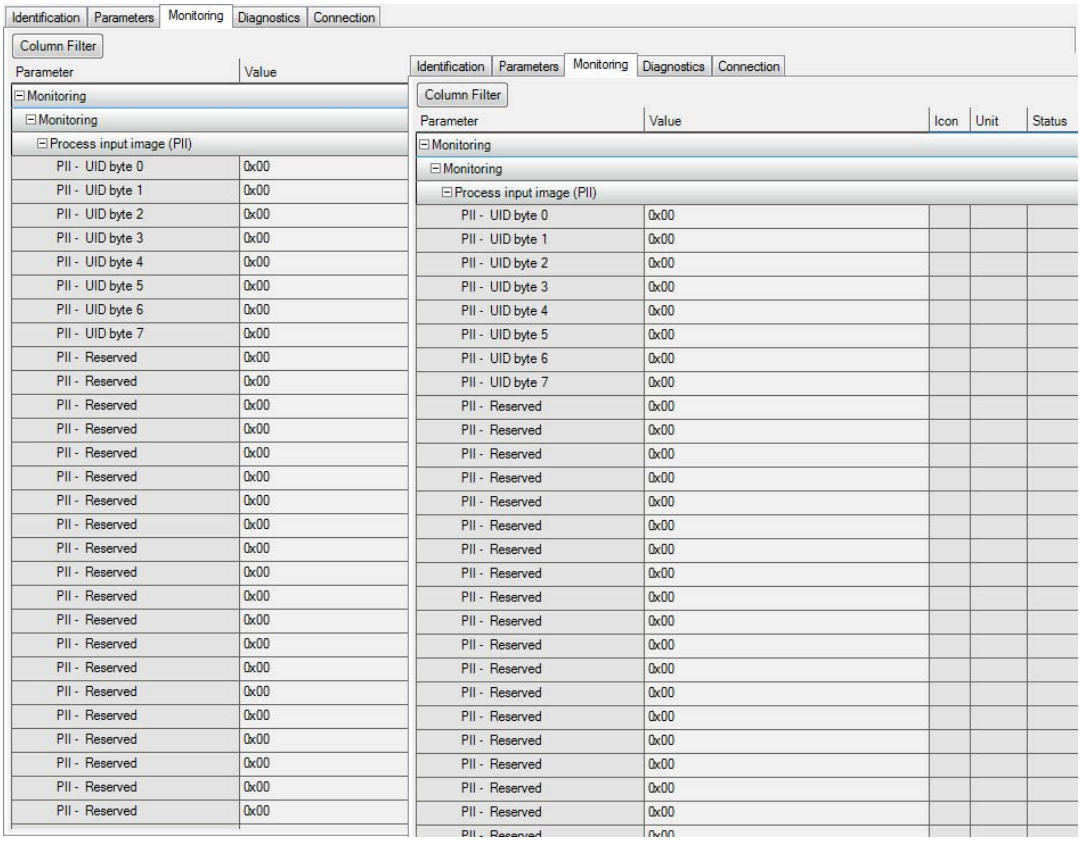


Figure 5-7 "Monitoring" tab in the "UID acquisition" or "Acquisition user data" mode.

5.3 The modes of the RF200 IO-Link reader

5.3.1 SIO mode

To activate the SIO mode you need to configure the relevant ports of the IO-Link master as digital inputs. If the reader is connected to a 24 V standard IO module, the SIO mode is used automatically. In this mode, there is no communication between the reader and IO-Link master.

The signal state of the reader is as follows:

Voltage	Signal	Cause
24 V	On	Transponder in the antenna field of the reader
0 V	Off	No transponder in the antenna field of the reader

5.3.2 IO-Link mode: Scan UID

You change to the "UID acquisition" mode by setting the value "UID acquisition" for the "Mode" reader parameter. The value "UID acquisition" is set as the default in the IODD file.

With IO-Link communication, 32 bytes of the process image of the inputs (PII) and 32 bytes of the process image of the outputs (PIQ) are transferred with the following structure:

Table 5- 1 Process image in the "UID acquisition" mode

Address		Values								Description
PIQ	0...7	0	0	0	0	0	0	0	0	Normal operation
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	
PII	0...7	0	0	0	0	0	0	0	0	No transponder present
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	
PII	0...7 [1)]	UID0	UID1	UID2	UID3	UID4	UID5	UID6	UID7	ISO transponder present
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	

1) UID0 = 0xE0; UID1 = IC vendor code; UID2 ... UID7 = serial number of the IC vendor

The 8-byte long UID of the transponder currently in the antenna field is displayed in the PII. If the transponder leaves the antenna field, 0 is displayed in the PII.

With the reader parameter "Data holding time", a minimum display time can be set in which the data of the reader remain displayed. The display time continues when the transponder has left the antenna field. A new transponder will only be displayed after the "data holding time" has elapsed.

To be certain that all transponders are displayed, there must be an adequate distance between the individual transponders. If the distance between the individual transponders is not great enough, individual transponders will not be displayed due to the data hold time.

The most significant bit of the address 0 with offset 7 (PII 0.7) is "1" when there is a transponder in the antenna field. By setting bit 4 in byte 0 (PIQ 0.4) you can turn off the antenna of the reader and therefore also the RF field.

In the PII, the turned off antenna is confirmed by 0xFF.

Table 5- 2 Process image in the "UID acquisition" mode with antenna turned off

Address		Values								Description
PIQ	0...7	0x10	0	0	0	0	0	0	0	Antenna off
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	
PII	0...7	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	Antenna off
	8...15	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	
	16...23	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	
	24...31	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	

5.3.3 IO-Link mode: Scan user data

You can change to the "Acquisition user data" mode by setting the value "Acquisition user data" for the "Mode" parameter of the reader.

With IO-Link communication, 32 bytes of the process image of the inputs (PII) and 32 bytes of the process image of the outputs (PIQ) are transferred. You can decide which data is read/written (28 bytes of user data) via the process image of the output with a command and by entering an address.

Table 5- 3 Process image in the "User data acquisition" mode

Address		Values								Description
PIQ	0...7	0x02	0	Adr-H	Adr-L	0	0	0	0	Read
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	
PIQ	0...7	0x01	0	Adr-H	Adr-L	Data (1)	Data (2)	Data (3)	Data (4)	Write
	8...15	Data (5)	Data (6)	Data (7)	Data (8)	Data (9)	Data (10)	Data (11)	Data (12)	
	16...23	Data (13)	Data (14)	Data (15)	Data (16)	Data (17)	Data (18)	Data (19)	Data (20)	
	24...31	Data (21)	Data (22)	Data (23)	Data (24)	Data (25)	Data (26)	Data (27)	Data (28)	
PII	0...7	0	0	0	0	0	0	0	0	No transponder present
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	

Address		Values								Description
PII	0...7	Status	error_ RFID	Adr-H	Adr-L	Data (1)	Data (2)	Data (3)	Data (4)	Transponder present (read/write - job complete)
	8...15	Data (5)	Data (6)	Data (7)	Data (8)	Data (9)	Data (10)	Data (11)	Data (12)	
	16...23	Data (13)	Data (14)	Data (15)	Data (16)	Data (17)	Data (18)	Data (19)	Data (20)	
	24...31	Data (21)	Data (22)	Data (23)	Data (24)	Data (25)	Data (26)	Data (27)	Data (28)	
PII	0...7	Status	error_ RFID	Adr-H	Adr-L	0	0	0	0	Transponder present (read/write - job not complete)
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	
PII	0...7	0x10	0	0	0	0	0	0	0	Antenna off
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	
PII	0...7	Status	error_R FID	0	0	0	0	0	0	Error message of the RFID reader
	8...15	0	0	0	0	0	0	0	0	
	16...23	0	0	0	0	0	0	0	0	
	24...31	0	0	0	0	0	0	0	0	

CMD	Command byte
Adr-H	More significant address byte of the data to be processed on the transponder.
Adr-L	Less significant address byte of the data to be processed on the transponder.
error_RFID	Error message of the RFID reader: Errors are acknowledged (= RESET) by the command "antenna off" or by the transponder leaving the field. You will find more detailed information on the error messages in the section "Error messages of the RF200 IO-Link reader (Page 87)".
Status	Status byte

Command execution

Starting a command:

A valid command in the PIQ (read or write) is started on the reader as soon as a transponder enters the antenna field. Other commands (e.g. for reading longer data sequences) are started on the reader as soon as a new address (Adr-L, Adr-H) is transferred to the reader. Here, it is not necessary to set CMD =0 in the meantime.

Finished message without error:

A command was executed correctly when RDY = 1 is set. The requirement for this is that the address in the PII has the same value as in the PIQ and the command code matches.

Finished message with error:

An error is indicated if RDY = 0 and Error = 1. The error is reset when the transponder has left the antenna field or when the command "Antenna off" is sent.

Note

Error message of the RFID reader

Errors are acknowledged (= RESET) by the command "antenna off" or by the transponder leaving the antenna field.

If there is reading beyond the transponder size e.g. reading starting at address 85 with a transponder of the size 112 bytes, the error message "0x0D" is output in "error_RFID"

PIQ (command byte)

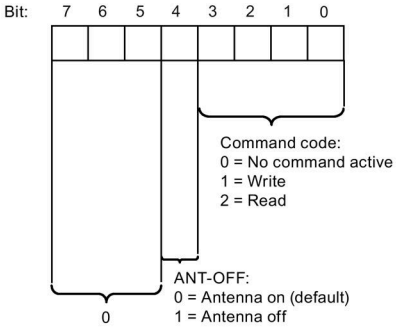


Figure 5-8 Structure of the command byte "PIQ"

PIQ (status byte)

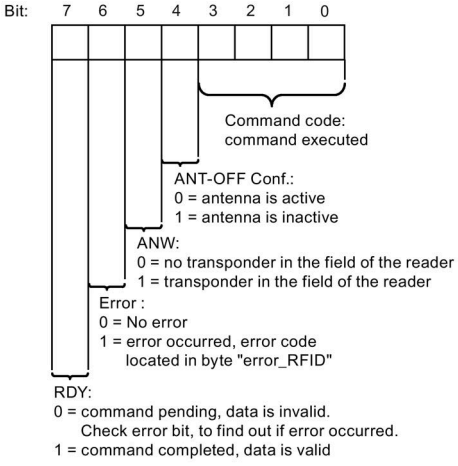


Figure 5-9 Structure of the status byte in the "PII"

5.4 ISDU data traffic

Apart from the process data, various data objects (Indexed Service Data Unit) can be addressed acyclically as necessary for diagnostics and maintenance purposes (you will find further information in the section "Overview of the service data (Page 104)"). For Siemens controllers the functions block "IO_LINK_DEVICE" is available for this.

The block and detailed information on the block can be found with the following link: "Acyclic reading and writing with the IO-Link library (https://support.industry.siemens.com/cs/ww/en/view/82981502)"

Function block "IO_LINK_DEVICE"

Using the "IO_LINK_DEVICE" function block, you can read any data objects of IO-Link devices, save them in non-volatile memory and after replacing an IO-Link device or master write the objects back to the IO-Link device again using the block.

You can control the "IO_LINK_DEVICE" function block call and the retentive saving of the objects from the user program.

Readers

6

6.1 Features

Table 6- 1 SIMATIC RF210R IO-Link

	Characteristics	
	Area of application	Identification tasks on assembly lines in harsh industrial environments
	Structure	① RF200 IO-Link interface ② LED operating display

Table 6- 2 SIMATIC RF220R IO-Link

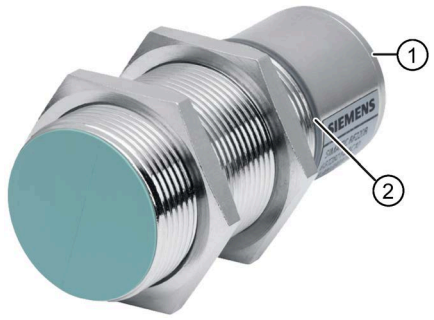
	Characteristics	
	Area of application	Identification tasks on assembly lines in harsh industrial environments
	Structure	① RF200 IO-Link interface ② LED operating display

Table 6- 3 SIMATIC RF240R IO-Link

	Characteristics	
	Area of application	Identification tasks on assembly lines in harsh industrial environments
	Structure	① RF200 IO-Link interface ② LED operating display

Table 6- 4 SIMATIC RF250R IO-Link

	Characteristics	
	Area of application	Identification tasks on assembly lines in harsh industrial environments
	Structure	① RF200 IO-Link interface ② LED operating display ③ Antenna connector, M8

Note

Reader requires external antennas

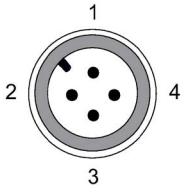
Note that the RF250R reader is designed only for operation with external antennas and can only be operated in conjunction with the antennas ANT 3, ANT 8, ANT 12, ANT 18 or ANT 30.

Table 6- 5 SIMATIC RF260R IO-Link

	Characteristics	
	Area of application	Identification tasks on assembly lines in harsh industrial environments
	Structure	① RF200 IO-Link interface ② LED operating display

6.2 Pin assignment of the RF200 reader with IO-Link interface

Table 6- 6 Pin assignment

Pin	Pin Device end 4-pin M12	Assignment
	1	24 VDC
	2	reserved [1]
	3	GND
	4	IO-Link data signal or switching output port in SIO mode

[1] The pin must not be used.

6.3 LED operating display of the RF200 IO-Link reader

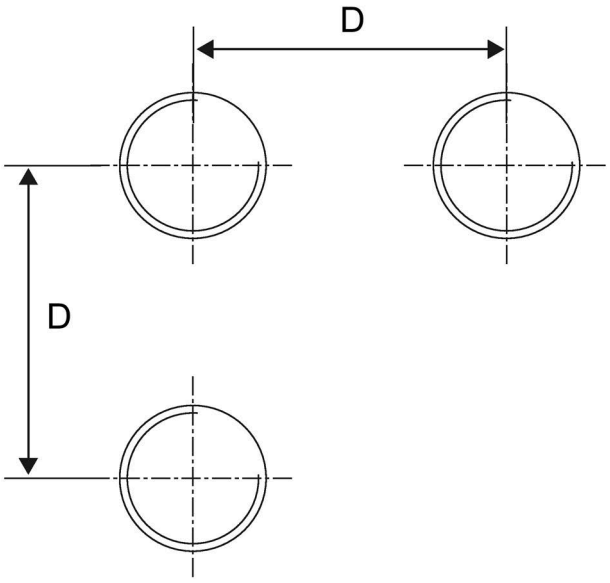
The LEDs indicate the reader's operating states. The LED can appear green, red, or yellow and have the statuses off, on, and flashing.

Table 6- 7 LED operating display on the reader

LED	Meaning
	The reader is turned off.
	Operating voltage present, reader not initialized or antenna turned off On-off ratio 1:1, 1 Hz
	Operating voltage present, reader initialized and antenna turned on SIO mode, no transponder in the antenna field
	Operating voltage present, reader initialized and antenna turned on IO-Link mode, no transponder in the antenna field On-off ratio 10:1
	SIO mode, transponder in the antenna field
	IO-Link mode, transponder in the antenna field On-off ratio 10:1
	There is an error. The number of flashes provides information about the current error. You will find more information on error messages in the section "Error messages of the RF200 IO-Link reader (Page 87)". On-off ratio 1:1, 1 Hz
	Startup On-off ratio 10:1
	Firmware update Pulse duration 500 ms

6.4 Minimum distance between several readers

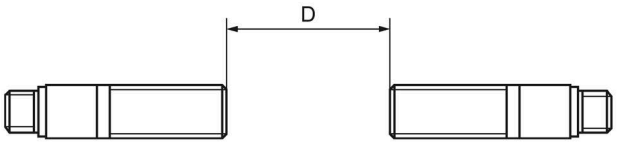
RF210R, RF220R or antennas beside each other



RF210R	≥ 60 mm
RF220R	≥ 100 mm
RF250R with ANT 3	≥ 60 mm (with 2 antennas) ≥ 80 mm (with more than 2 antennas)
RF250R with ANT 8	≥ 30 mm
RF250R with ANT 12	≥ 30 mm (with 2 antennas) ≥ 40 mm (with more than 2 antennas)
RF250R with ANT 18	≥ 30 mm (with 2 antennas) ≥ 40 mm (with more than 2 antennas)
RF250R with ANT 30	≥ 40 mm (with 2 antennas) ≥ 50 mm (with more than 2 antennas)

Figure 6-1 Minimum distance between several RF210R, RF220R or antennas

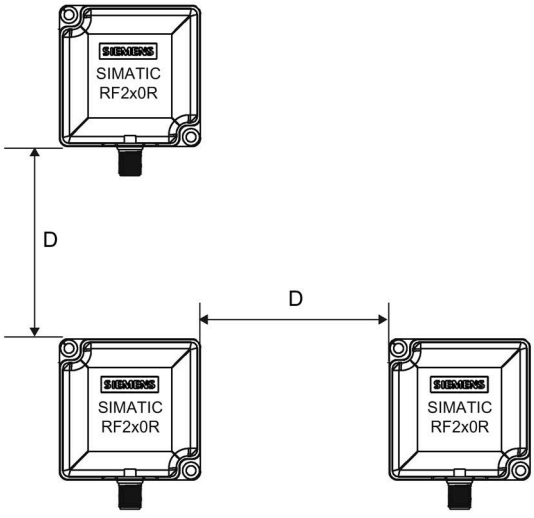
RF210R, RF220R or antennas face to face



RF210R	≥ 100 mm
RF220R	≥ 150 mm
RF250R with ANT 3	≥ 100 mm
RF250R with ANT 8	≥ 50 mm
RF250R with ANT 12	≥ 100 mm
RF250R with ANT 18	≥ 100 mm
RF250R with ANT 30	≥ 200 mm

Figure 6-2 Face-of-face distance between two RF210R, RF220R or antennas

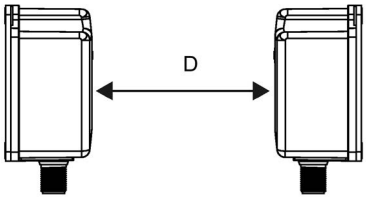
RF240R, RF260R side by side



RF240R ≥ 120 mm (with 2 readers)
≥ 200 mm (with more than 2 readers)
RF260R ≥ 150 mm (with 2 readers)
≥ 250 mm (with more than 2 readers)

Figure 6-3 Minimum distance between several RF240R, RF260R

RF240R, RF260R face to face



RF240R ≥ 400 mm
RF260R ≥ 500 mm

Figure 6-4 Face-of-face distance between two RF240R, RF260R

6.5 Dimensional drawings

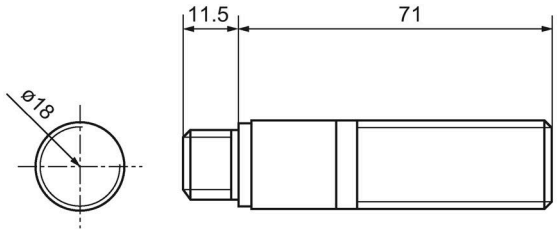


Figure 6-5 RF210R IO-Link dimension drawing

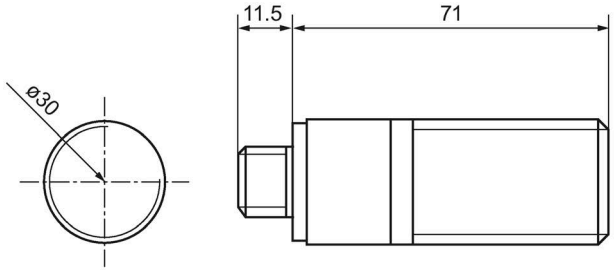


Figure 6-6 RF220R IO-Link dimension drawing

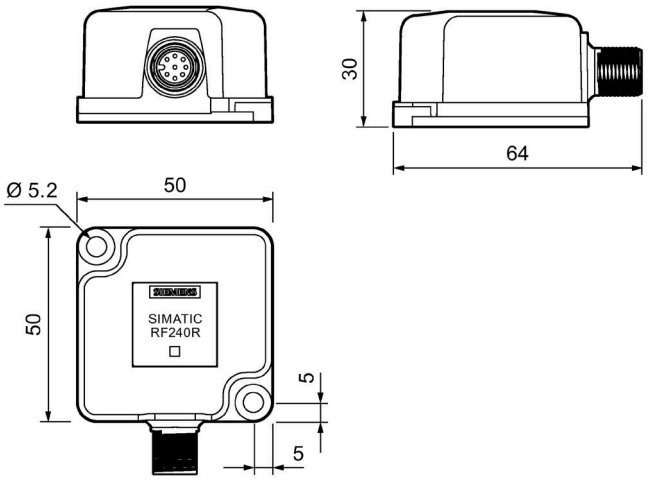


Figure 6-7 RF240R IO-Link dimension drawing

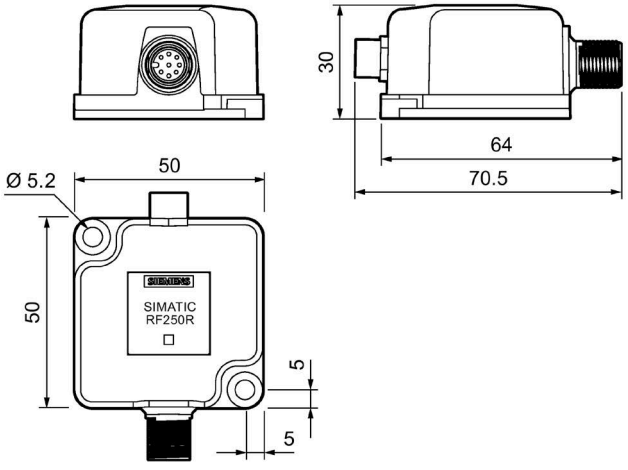


Figure 6-8 RF250R IO-Link dimension drawing

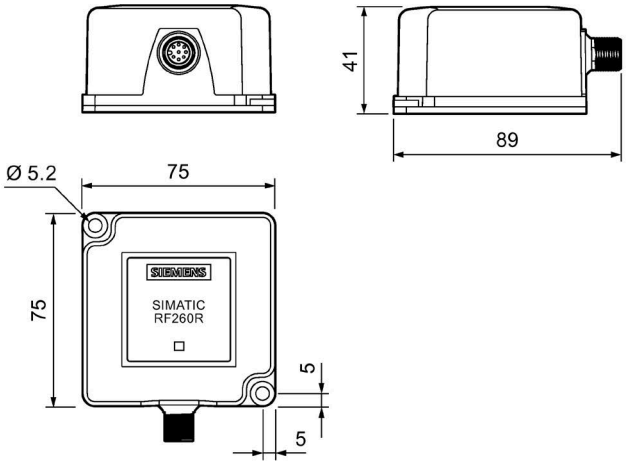


Figure 6-9 RF260R IO-Link dimension drawing

All dimensions in mm

Service and maintenance

7

7.1 Error messages of the RF200 IO-Link reader

You can identify errors with the RF200 IO-Link readers in several ways:

- Directly on the reader by counting the flashing pattern of the LED operating display.
- With the aid of the error codes in the PII byte 1 "error_RFID" (see section "IO-Link mode: Scan user data (Page 72)")
- With the aid of the IO-Link event message (compare section "Event error codes (Page 102)")

Table 7- 1 Error messages of the RF200 IO-Link reader

Flashing of the LEDs	Error code (hex)	Error description
00	0x00	No error
02	0x01	Presence error, possible causes: • The active command was not carried out completely • The transponder left the antenna field while the command was being processed • Communication problem between reader and transponder
05	0x05	Parameter assignment error, possible causes: • Unknown command • Incorrect parameter • Function not allowed
06	0x06	Air interface disrupted
13	0x0D	Error in the specified memory address (access attempted to non-existent or non-accessible memory areas).
17	0x11	Short circuit or overtemperature of the IO-Link communications interface • The communications interface switches itself off if there is a short circuit or overtemperature. • The interface is reset automatically.
18	0x12	Internal hardware fault, possible causes: • Connector contact problem on the reader • Hardware defective
20	0x14	Serious system fault (hardware fault) • Cycle power
21	0x15	Parameter assignment error: Bad parameter
24	0x18	Only "RESET" permitted
25	0x19	Previous command is still active

Flashing of the LEDs	Error code (hex)	Error description
28	0x1C	RF250R IO-Link: Antenna not connected, antenna cable or antenna damaged. Note: The RF250R can only be operated with antennas. As soon as the antenna is present again and correctly connected, the error "0x1C" is reset in the process image and the event "Antenna missing: going" is sent. The error LED however continues to flash with "0x1C" until a transponder leaves the antenna field or the command "ANT off" is sent. You can suppress this error message using the "Event indication" parameter.
--	0x1F	Active command canceled by "RESET"

Note

Error acknowledged/reset

These errors are acknowledged (= RESET) by the command antenna off or by the transponder leaving the antenna field. The errors 0x11, 0x12, 0x14 and 0x15 are only indicated by the LED "flashing" the "error_RFID" byte is not used.

So-called event messages are also passed on to the master (see section "Event error codes (Page 102)"). You can display these error messages using S7-PCT (diagnostics) or read them out using the "IO_LINK_DEVICE" function block. You can only reset event messages using S7 PCT or the "IO_LINK_DEVICE" function (system commands).

7.2 Device replacement

When operating the reader with an IO-Link V1.1 master, when replacing a device you do not need to take any measures in the user application. The parameter assignment of the IO-Link readers is stored on the master and on the device. After replacing a reader, the new reader automatically receives the original parameter assignment.

You can activate/deactivate the storage function in S7 PCT in the "Ports > Port Info > Backup Level" tab.

Technical data

8

8.1 Technical specifications of the RF200 IO-Link readers

Table 8- 1 Technical specifications of the RF210R-/RF220R IO-Link readers

	6GT2821-1BC32 **6GT2821-2BC32**
Product type designation	SIMATIC RF210R IO-Link SIMATIC RF220R IO-Link
Radio frequencies	
Operating frequency, rated value	13.56 MHz
Electrical data	
Protocol for wireless transmission	ISO 15693, ISO 18000-3
Cable length reader ↔ IO-Link master	max. 20 m
Maximum data transmission speed Point-to-point connection	230.4 kbps
Maximum data transmission speed Wireless transmission	26.6 kbps
Typical transmission time for user data per byte	
• with write access (with 28 byte block)	• 3.6 ms/byte
• with read access (with 28 byte block)	• 2.4 ms/byte
Read/write distances of the reader	see section "Field data (Page 26)"
Interfaces	
Interfaces for communication	IO-Link
Electrical connector design	M12, 4-pin
Antenna	integrated
Mechanical data	
Housing	
• Material	• Brass, nickel-plated / PBT
• Color	• Silver / pastel turquoise
Recommended distance to metal	0 mm
Supply voltage, current consumption, power loss	
Supply voltage	24 VDC (20.4 to 28.8 VDC)
Typical current consumption	50 mA

	6GT2821-1BC32 **6GT2821-2BC32**
Permitted ambient conditions	
Ambient temperature	
• During operation	• -20 ··· +70 ° C
• During transportation and storage	• -25 ··· +80 ° C
• During storage	• -25 ··· +80 ° C
Degree of protection to EN 60529	IP67
Shock acceleration to EN 60721-3-7, Class 7 M2	500 m/s²
Vibration acceleration to EN 60721-3-7, Class 7 M2	200 m/s²
Torsion and bending load	Not permitted
Design, dimensions and weights	
Dimensions (L x ∅)	RF210R: 83 × 18 mm RF220R: 83 × 30 mm (incl. 8-pin connector sleeve and plastic cap)
Weight	RF210R: 65 g (incl. two M18 nuts) RF220R: 140 g (incl. two M30 nuts)
Type of mounting	RF210R: 2 x nuts M18; thickness: 4 mm Tightening torque ≤ 20 Nm RF220R: 2 x nuts M30; thickness: 5 mm Tightening torque ≤ 40 Nm
LED display design	3-color LEDs (operating voltage, presence, error)
Standards, specifications, approvals	
Approvals	Radio to R&TTE directives EN 300 330, EN 301489, CE, FCC, UL/CSA
MTBF	RF210R: 505 years RF220R: 501 years

Table 8- 2 Technical specifications of the RF240R-/RF260R IO-Link readers

	6GT2821-4BC32 **6GT2821-6BC32**
Product type designation	SIMATIC RF240R IO-Link SIMATIC RF260R IO-Link
Radio frequencies	
Operating frequency, rated value	13.56 MHz
Electrical data	
Protocol for wireless transmission	ISO 15693, ISO 18000-3
Cable length reader ↔ IO-Link master	max. 20 m
Maximum data transmission speed Point-to-point connection	230.4 kbps
Maximum data transmission speed Wireless transmission	26.6 kbps
Typical transmission time for user data per byte	
• with write access (with 28 byte block)	• 3.6 ms/byte
• with read access (with 28 byte block)	• 2.4 ms/byte
Read/write distances of the reader	see section "Field data (Page 26)"
Interfaces	
Interfaces for communication	IO-Link
Electrical connector design	M12, 4-pin
Antenna	integrated
Mechanical data	
Housing	
• Material	• Plastic PA 6.6
• Color	• Anthracite
Recommended distance to metal	0 mm
Supply voltage, current consumption, power loss	
Supply voltage	24 VDC (20.4 to 28.8 VDC)
Typical current consumption	50 mA

	6GT2821-4BC32 **6GT2821-6BC32**
Permitted ambient conditions	
Ambient temperature	
• During operation	• -20 … +70 ° C
• During transportation and storage	• -25 … +80 ° C
• During storage	• -25 … +80 ° C
Degree of protection to EN 60529	IP67
Shock acceleration to EN 60721-3-7, Class 7 M2	500 m/s²
Vibration acceleration to EN 60721-3-7, Class 7 M2	200 m/s²
Torsion and bending load	Not permitted
Design, dimensions and weights	
Dimensions (L × W × H)	RF240R: 50 × 50 × 30 mm RF260R: 75 × 75 × 41 mm
Weight	RF240R: 60 g RF260R: 200 g
Type of mounting	2 x metal M5 screws; Tightening torque ≤ 1.5 Nm
LED display design	3-color LEDs (operating voltage, presence, error)
Standards, specifications, approvals	
Approvals	Radio to R&TTE directives EN 300 330, EN 301489, CE, FCC, UL/CSA
MTBF	RF240R: 430 years RF260R: 480 years

Table 8- 3 Technical specifications of the RF250R IO-Link readers

	6GT2821-5BC32
Product type designation	SIMATIC RF250R IO-Link
Radio frequencies	
Operating frequency, rated value	13.56 MHz
Electrical data	
Protocol for wireless transmission	ISO 15693, ISO 18000-3
Cable length reader ↔ IO-Link master	max. 20 m
Maximum data transmission speed Point-to-point connection	230.4 kbps
Maximum data transmission speed Wireless transmission	26.6 kbps
Typical transmission time for user data per byte	
• with write access (with 28 byte block)	• 3.6 ms/byte
• with read access (with 28 byte block)	• 2.4 ms/byte
Read/write distances of the reader	see section "Field data (Page 26)"
Interfaces	
Interfaces for communication	IO-Link
Electrical connector design	
• for communications interface	• M12, 4-pin
• for external antenna(s)	• M8, 4-pin
Antenna	external ANT 3, ANT 8, ANT 12, ANT 18 or ANT 30 connectable via M8 antenna connector
Mechanical data	
Housing	
• Material	• Plastic PA 6.6
• Color	• Anthracite
Recommended distance to metal	0 mm
Supply voltage, current consumption, power loss	
Supply voltage	24 VDC (20.4 to 28.8 VDC)
Typical current consumption	50 mA

	6GT2821-5BC32
Permitted ambient conditions	
Ambient temperature	
• During operation	• -20 ··· +70 ° C
• During transportation and storage	• -25 ··· +80 ° C
• During storage	• -25 ··· +80 ° C
Degree of protection to EN 60529	IP67
Shock acceleration to EN 60721-3-7, Class 7 M2	500 m/s²
Vibration acceleration to EN 60721-3-7, Class 7 M2	200 m/s²
Torsion and bending load	Not permitted
Design, dimensions and weights	
Dimensions (L × W × H)	50 × 50 × 30 mm
Weight	60 g
Type of mounting	2 x metal M5 screws; Tightening torque ≤ 1.5 Nm
LED display design	3-color LEDs (operating voltage, presence, error)
Standards, specifications, approvals	
Approvals	Radio to R&TTE directives EN 300 330, EN 301489, CE, FCC, UL/CSA
MTBF	430 years

8.2 Approvals

FCC information

Siemens SIMATIC RF210R IO-Link (MLFB 6GT2821-1BC32) FCC ID: NXW-RF210RIOL

Siemens SIMATIC RF220R IO-Link (MLFB 6GT2821-2BC32) FCC ID: NXW-RF220RIOL

Siemens SIMATIC RF240R IO-Link (MLFB 6GT2821-4BC32) FCC ID: NXW-RF240RIOL

Siemens SIMATIC RF250R IO-Link (MLFB 6GT2821-5BC32) FCC ID: NXW-RF250RIOL

Siemens SIMATIC RF260R IO-Link (MLFB 6GT2821-6BC32) FCC ID: NXW-RF260RIOL

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

Caution

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

IC information

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d`Industrie Canada applicables aux appareils radio exempts de licence. L`exploitation est autorisée aux deux conditions suivantes :

(1) L`appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l`appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d`en compromettre le fonctionnement.

cULus information

When using an ET200S IO-Link master, make sure that the power supply unit being used corresponds to a Class 2 device (limited current/limited voltage) and that it is listed in the UL file.

Connecting cable

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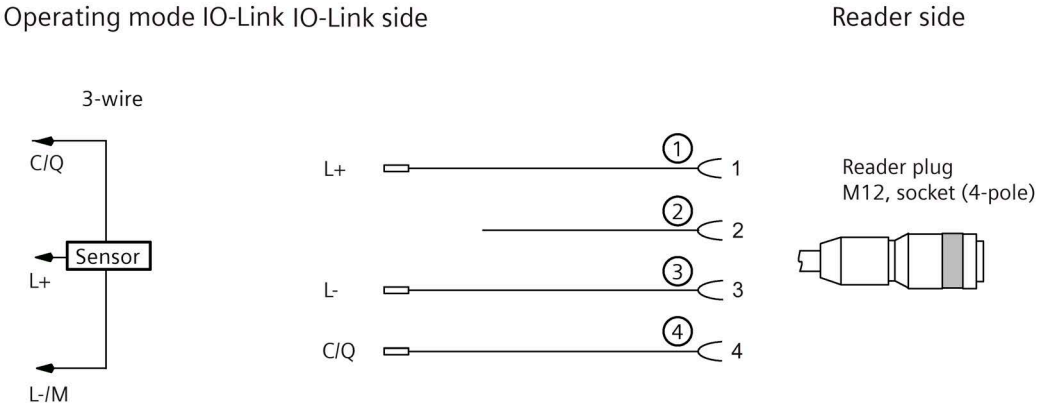
Cable with open ends for ET 200S and ET 200SP with CM 4xIO-Link master and S7-1200 with SM 1278 4xIO-Link master



	6GT2891-4Lxx0	6GT2891-4LH50-0AX0
①	Brown	Red
②	Reserved	Reserved
③	Blue	Black
④	Black	Orange

Figure 9-1 Design of the connecting cable between the IO-Link master and reader with single wire technology

Note: Pin "2" (reserved) must not be used.

Pin assignments of the IO-Link masters from Siemens

Table 9- 1 ET 200S

Terminal assignment for the 4SI IO-Link master electronic module (6ES7138-4GA50-0AB0)				
Terminal	**Assignment**	**Terminal**	**Assignment**	**Explanations**
1	C/Q port 1	**5**	C/Q port 2	• C/Q: Communications signal • L+: Supply voltage • L-/M: Ground
2	C/Q port 3	**6**	C/Q port 4	
3	L + port 1	**7**	L + port 2	
4	L + port 3	**8**	L + port 4	
A4	M port 1 (AUX)	**A8**	M port 2 (AUX)	
A3	M port 3 (AUX)	**A7**	M port 4 (AUX)	

Table 9- 2 ET 200SP

Pin assignment for the CM 4xIO-Link electronic module (6ES7137-6BD00-0AB0)					
Terminal	**Assignment**	**Terminal**	**Assignment**	**Explanations**	**Color labeling plate**
1	C/Q 1	**2**	C/Q 2	• C/Q: Communication signal • RES: Reserved, must not be used • L+: Supply voltage (positive) • M: Ground	 CC04 6ES7193-6CP04-2MA0
3	C/Q 3	**4**	C/Q 4		
5	RES	**6**	RES		
7	RES	**8**	RES		
9	L + 1	**10**	L + 2		
11	L + 3	**12**	L + 4		
13	M	**14**	M		
15	M	**16**	M		
L+	24VDC	**M**	Ground		

Usable terminal modules: Spring terminal (6ES7193-4CA50-0AA0), screw terminal (6ES7193-4CA40-0AA0) and Fast Connect (6ES7193-4CA80-0AA0)

Table 9- 3 S7-1200: SM 1278 4xIO-Link master

Pin assignment for the SM 1278 4xIO master electronic module (6ES7278-4BD32-0XB0)					
Pin	**X10**	**X11**	**X12**	**X13**	**Explanations**
7	M_1	M_2	M_3	M_4	• M_n: Ground to slave • C/O_n: Communication signal • L_n: 24 VDC to slave • M: Ground • L+: 24 VDC to master • RES: Reserved; must not be used
6	C/O_1	C/O_2	C/O_3	C/O_4	
5	L_1	L_2	L_3	L_4	
4	RES	RES	RES	RES	
3	Functional earth	RES	RES	RES	
2	M	RES	RES	RES	
1	L+	RES	RES	RES	

Connecting cable for ET 200eco PN, ET 200 AL, ET 200pro

For this IO-Link master (with IP67), there are preassembled cables available with M12 connectors at both ends (refer to the section "Ordering data (Page 99)").

Ordering data

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Table 10- 1 Ordering data readers with IO-Link interfaces

	Article number
SIMATIC RF210R with IO-Link interface V1.1	6GT2821-1BC32
SIMATIC RF220R with IO-Link interface V1.1	6GT2821-2BC32
SIMATIC RF240R with IO-Link interface V1.1	6GT2821-4BC32
SIMATIC RF250R with IO-Link interface V1.1	6GT2821-5BC32
SIMATIC RF260R with IO-Link interface V1.1	6GT2821-6BC32

Table 10- 2 Ordering data accessories

			Article number
Antennas			
ANT 3	incl. one plug-in antenna connecting cable 3 m		6GT2398-1CD40-0AX0
	without antenna connecting cable		6GT2398-1CD30-0AX0
ANT 8	incl. one plug-in antenna connecting cable 3 m		6GT2398-1CF10
	without antenna connecting cable		6GT2398-1CF00
ANT 12	incl. one plug-in antenna connecting cable 3 m		6GT2398-1CC00
	incl. one integrated antenna connecting cable 0.6 m		6GT2398-1CC10
ANT 18	incl. one plug-in antenna connecting cable 3 m		6GT2398-1CA00
	incl. one integrated antenna connecting cable 0.6 m		6GT2398-1CA10
ANT 30	incl. one plug-in antenna connecting cable 3 m		6GT2398-1CD00
Connecting cable			
Plug-in cable IO-Link, open end - M12		5 m	6GT2891-4LH50
		10 m	6GT2891-4LN10
Plug-in cable IO-Link M12 plug - M12 socket		1.5 m	3RK1902-4PB15-3AA0
		5 m	6GT2891-4MH50
		10 m	6GT2891-4MN10
Plug-in cable IO-Link, open end - M12; PVC cable jacket		5 m	6GT2891-4LH50-0AX0

Appendix

A

To understand the content described in the appendix, you require basic knowledge of handling the function block "IO_LINK_DEVICE".

A.1 IO-Link error codes

A.1.1 ISDU return error codes

S7-PCT, the function block "IO_LINK_DEVICE" and the IO-Link device (reader) use the frame transport layer "ISDU". The following table lists possible ISDU return error codes. The ISDU return error codes are not generated by the reader. You can display the error codes using the "IO_LINK_DEVICE" function block.

Table A- 1 ISDU error messages

Error code (hex)	Error description	Remedy
8000	Command error	--
8011	Index not available	Correct index
8012	Subindex not available	Correct subindex
8020	Service temporarily not available	Repeat query after a waiting time
8021	Service temporarily not available. Local control unit blocked.	Repeat query after a waiting time
8022	Service temporarily not available. Device is busy with another task.	Repeat query after a waiting time
8023	Access denied	Index can only be read
8030	Parameter value is outside the permitted range	Transfer the correct value
8031	Parameter value is above the limit	Transfer the correct value
8032	Parameter value is below the limit	Transfer the correct value
8033	Parameter length exceeded	Check parameter length
8034	Parameter not long enough	Check parameter length
8035	Function not available	Check call parameters
8036	Function temporarily not available	Repeat query after a waiting time
8040	Invalid parameter set	Transfer correct parameter set
8041	Invalid parameter set	Transfer correct parameter set
8082	Application not ready	--

A.1.2 Event error codes

The following event error codes are displayed if you have enabled the "Event message" parameter in S7-PCT.

The event error codes with the event type "entering state/exiting state" are signaled by the IO-Link reader and forwarded by the IO-Link master to the controller at the fieldbus level for diagnostics purposes. You can display these event error codes using the standard diagnostics of the controller. You can display the event type "Warning" using the "IO_LINK_DEVICE" function block or the PCT tool.

Table A- 2 Event error messages

Event type high word (hex)	**Error code low word (hex)**	**Error name**	**Device status [1)]**	**Error description**
Warning (64)	1822	Too many transponders in the antenna field	--	There are multiple transponders in the antenna field.
Warning (64)	1823	Command execution incomplete	0x0001	Presence error, possible causes: • The active command was not carried out completely • The transponder left the antenna field while the command was being processed • Communication problem between reader and transponder
Error entering state (F4)/ exiting state (B4)	1831	Parameter memory	0x0012	Internal hardware fault, possible causes: • Connector contact problem on the reader • Hardware defect
Error (74)	1833	Internal error	0x0005, 0x0006, 0x000D, 0x0015, 0x0018, 0x0019	Group error, classic RFID error Possible causes (in the "Acquisition user data" mode): • Parameter assignment error (05): – Unknown command (wrong information in the PIQ) – Bad parameter (for example address wrong, length wrong) – Function not permitted (for example sending a command in UID mode) • Air interface faulty (06) • Error in the specified memory address (0D) • Parameter assignment error (15) • Only "RESET" permitted (18) • Previous command is still active (19)

Event type high word (hex)	**Error code low word (hex)**	**Error name**	**Device status** [1]	**Error description**
Error entering state (F4)/ exiting state (B4)	1834	Invalid PIQ	0x0005	Command was written to the PIQ although this is not permitted. For example "read" command in the "Scan UID" mode
Error entering state (F4)/ exiting state (B4)	1835	Antenna missing	0x001C	RF250R IO-Link: Antenna not connected, antenna cable or antenna damaged.
Error (74)	1841	Overload	0x0011	Short circuit of the IO-Link communications interface • The communications interface switches itself off if there is a short circuit. • The interface is reset automatically.
Error entering state (F4)/ exiting state (B4)	4000	Overtemperature	0x0011	Overtemperature of the reader • The reader switches itself off if there is overtemperature. • The reader is reset automatically.
Error entering state (F4)/ exiting state (B4)	5100	Power supply	0x0011	Under-/overvoltage of the reader • Check the power supply.
Error (72)	5200	Service data length error	--	The permitted data length was exceeded.
Error (73)	5600	Service data error	--	General protocol errors
Error (73)	5800	Unknown service data job	--	The log content of the service data job is incorrect.
Error (F4)	6000	Firmware	0x0014	The firmware has detected an internal error (system error). For example illogical status or watchdog etc.
Error entering state (F4)/ exiting state (B4)	6320	Parameter assignment error	0x0015	Parameter assignment error: Bad parameter
Error entering state (F4)/ exiting state (B4)	8C00	Device reset	0x0014	Serious system fault (hardware fault); watchdog: • Cycle power

[1] The device status corresponds to the error codes in the section "Error messages of the RF200 IO-Link reader".

Note

Displaying, reading out and resetting event messages

You can display these event messages using S7-PCT or read them out using the "IO_LINK_DEVICE" function block. You can only reset event messages using S7 PCT or the "IO_LINK_DEVICE" function.

The event messages cannot be reset by "antenna off" or "move transponder out of field" as is possible with the error messages of the reader (compare section "Error messages of the RF200 IO-Link reader (Page 87)").

A.2 Overview of the service data

The RF200 IO-Link readers support the following indexes for service data and parameter assignment:

Note

Direct parameter 1 (0x00)

These parameters are only used internally in the system and do not normally need to be taken into account. When necessary, however, they can be read out using index 0x00 (see section "ISDU data traffic (Page 75)").

Table A- 3 Service data of the RF200 IO-Link readers

Index (hex)	Object name	Subindex	Length in bytes	Access	Parameter name	Description
0x00	Direct parameter 1	0x00	16	r	--	Entire index selected
		0x01	1	r	Master command	Switch the IO-Link operating mode (Fallback, Operate, Preoperate)
		0x02	1	r	Master cycle time	Master cycle time
		0x03	1	r	Minimum cycle time	Minimum device cycle time (reader)
		0x04	1	r	Frame Capability	Supported frame types for communication.
		0x05	1	r	IO-Link version ID	IO-Link protocol version implemented on the device
		0x06	1	r	Process Data Input Length	Number and structure of the data process image of the inputs to the master
		0x07	1	r	Process Data Output Length	Number and structure of the data process image of the outputs from the master
		0x08	1	r	Vendor ID 1 (MSB)	Unique vendor identification number SIEMENS: 0x002A
		0x09	1	r	Vendor ID 2 (LSB)	

Index (hex)	Object name	Subindex	Length in bytes	Acces s	Parameter name	Description
		0x0A	1	r	Device ID 1 (octet 2, MSB)	Unique device identification number. RF210R IO-Link: 0x0C0207 RF220R IO-Link: 0x0C0208 RF240R IO-Link: 0x0C0209 RF250R IO-Link: 0x0C020A RF260R IO-Link: 0x0C020B
		0x0B	1	r	Device ID 2 (octet 1)	
		0x0C	1	r	Device ID 3 (octet 0, LSB)	
		0x0D	1	r	Function ID 1 (MSB)	Reserved
		0x0E	1	r	Function ID 2 (LSB)	
		0x0F	1	r	--	Reserved
		0x10	1	r	System command	Unused, system command is activated via index 0x02.
0x02	System command	0x00	1	w	--	Control commands for parameter access: • 0x01: Start param upload • 0x02: End param upload • 0x03: Start param download • 0x04: End param download • 0x05: Save param download • 0x06: Cancel • 0x80: Reset device • 0x82: Restore factory setting
0x03 [1)]	Data storage	0x01	1	r/w	Data memory commands	Control commands for saving the parameter assignment (device replacement): • 0x00: Reserved • 0x01: Start DM upload • 0x02: End DM upload • 0x03: Start DM download • 0x04: End DM download • 0x05: Interrupt DM • 0x06 ... 0xFF: Reserved
		0x02	1	r	Status	Bit 0: Reserved Bit 1 and bit 2 Status • 0b00: Inactive • 0b01: Upload • 0b10: Download • 0b11: Data memory locked Bit 3 to bit 6: Reserved Bit 7: Upload status • "0": No upload • "1": Upload pending

Index (hex)	Object name	Subindex	Length in bytes	Access	Parameter name	Description
		0x03	4	r	Data memory size	Number of bytes for storing the parameters required for device replacement
		0x04	4	r	Data memory checksum	Checksum over all stored data
		0x05	variable	r	Parameter memory list	List of the stored parameters
0x0C	Device Access Locks	0x00	2	r/w	--	Locking functions for device access: • Bit 0: "1" = parameter access locked • Bit 1: "1" = data memory function locked • Bit 2 ... Bit 15: Reserved
0x10	Vendor Name	0x00	12	r	--	Vendor name: "SIEMENS AG"
0x11	Vendor Text:	0x00	12	r	--	Vendor text: "SIEMENS AG"
0x12	Product name	0x00	24	r	--	Product name: "SIMATIC RF2xxR IO-Link"
0x13	Product ID	0x00	16	r	--	Product ID: Article number of the reader e.g. "6GT2821-1AC32"
0x14	Product text	0x00	64	r	--	Product text: Information on reader properties
0x15	Serial number	0x00	12	r	--	Serial number is not supported
0x16	Hardware version	0x00	12	r	--	Hardware version is not supported
0x17	Firmware version	0x00	12	r	--	Firmware version (e.g. V1.0.0)
0x18	Application Specific Tag	0x00	32	r/w	--	User-specific data e.g. plant designation, function, maintenance data, location identifier
0x20	Error counter	0x00	2	r	--	Number of errors since turning on (number of events)
0x24	Device Status	0x00	1	r	--	Device Status: • 0x00: Device is OK • 0x02: Device not within the specification • 0x04: Error
0x25	Detailed Device Status	0x00	1	r	--	Currently pending event See Section "Event error codes"
0x28	Process image of the inputs	0x00	8	r	--	Read out last process image of the inputs
0x29	Process image of the outputs	0x00	8	r	--	Read out last process image of the outputs

Index (hex)	Object name	Subindex	Length in bytes	Access	Parameter name	Description
0x40	Reader parameters	0x00	8	r/w	--	Read out or write the reader parameters
			1	r/w	Event message	2: Event indication enabled (default) 4: No message
			1	r/w	Operating mode	4: Scan UID (default) 8: Scan user data
			1	r/w	Ready delay	2: Turn off (default) 4: Turn on additional backup mechanism for consistent data transfer
			1	r/w	Data holding time	Minimum time during which the process input data is not changed by the device. • 0x00: minimum (default) • 0x0A: 100 ms • 0x14: 200 ms • 0x32: 500 ms • 0x64: 1 s • 0xC8: 2 s
			1	r/w	RF parameters	Setting the RF parameters 2: ISO default (default) 4: Special settings
			1	r/w	Modulation	Setting for the modulation strength 0 ... 100 % (default 22 %)
			1	r/w	Subcarrier	Subcarrier 2: single (default) 4: double
			1	r/w	Data transfer	Data transmission speed 2: low 4: high (default)
0x43	IO-Link transmission speed	0x00	1	r	--	IO-Link transmission speed 8: 230.4 kbps
0x4A	Event progress	0x00	20	r	--	Entire index selected
		0x01	4	r	--	Last event
		0x02	4	r	--	Second last event
		0x03	4	r	--	Third last event
		0x04	4	r	--	Fourth last event
		0x05	4	r	--	Fifth last event

Index (hex)	Object name	Subindex	Length in bytes	Access	Parameter name	Description
0x5A	Reader status	0x00	18	r	--	Can only be read out entirely, only subindex 0x00 possible.
			4	r	Operating time since startup	Operating time of the reader since startup
			1	r	Transponders in the antenna field	Number of transponders located in the antenna field Here, only 1 transponder is permitted.
			1	r	Antenna status	Status of the antenna: • 0: Unknown • 1: Antenna on • 2: Antenna off
			4	r	Transponder change	Number of transponders that have passed through the antenna field since the reader was turned on
			1	r	Version of the IO link driver block	Version of the physical IO-Link driver block
			1	r	Passive error counter	RF field, error counter passive (for example interference pulses) Is reset when read out.
			1	r	Abort counter	RF protocol error, abort counter Is reset when read out.
			1	r	Code error counter	RF protocol error, code error counter Is reset when read out.
			1	r	Signature error counter	RF protocol error, signature error counter Is reset when read out.
			1	r	CRC error counter	RF protocol error, CRC error counter Is reset when read out.
			1	r	Current command status	Command status of the last command Is reset when read out.
			1	r	Error counter	Error counter for the RF interface

Index (hex)	Object name	Subindex	Length in bytes	Access	Parameter name	Description
0x5B	Transponder status	0x00	15	r	--	Can only be read out entirely, only subindex 0x00 possible.
			8	r	UID	Unified identifier of the transponder located in the antenna field.
			1	r	Transponder type	Transponder type (vendor, designation): • 0: Undetermined • 1: ISO 15693 general (not specified or unknown) • 3 ISO 15693 (Infineon, MDS D3xx) • 4: ISO 15693 (Fujitsu, MDS D4xx) • 5 ISO 15693 (NXP, MDS D1xx) • 6: ISO 15693 (TI, MDS D2xx) • 7: LRI2K (ST)
			1	r	Chip version	Chip version of the transponder
			2	r	Memory size in bytes	Memory size of the transponder in bytes
			1	r	Lock status	Lock status of the transponder, OTP information: One bit per block is used (4x4 bytes or 2x8 bytes). Bit = 1: Block is locked. e. g. 03 = block 1 and block 2 are locked.
			1	r	Memory block size	Block size of the transponder memory
			1	r	Number of blocks	Number of blocks of the transponder
0x5C	UID progress	0x00	40	r	--	Entire index selected
		0x01	8	r	--	List of the UIDs of the transponders that were last located in the field: Last UID
		0x02	8	r	--	Second last UID
		0x03	8	r	--	Third last UID
		0x04	8	r	--	Fourth last UID
		0x05	8	r	--	Fifth last UID

[1] The parameter "Data storage" is used for master-device communication and is not relevant from the point of view of the user.

System commands (index 0x02)

You can execute the system commands using the "IO_LINK_DEVICE" function block or the PCT. Among other things, with the system commands you can up-/download the parameter assignment, reset the device or restore the factory settings.

- 0x80: Reset device:

  The reader restarts. Corresponds to cycling power.

- 0x82: Restore factory setting

  The reader restarts. Before the restart, the following parameters are reset to their default values:

  – Reader parameters (0x40)

  – Application Specific Tag (0x18)

  – Device access protection 0x0C

Options for downloading (writing) parameter assignments

When downloading parameter assignments, a distinction is made between the 2 following options.

- Writing individual parameters

  With this option the changed parameter is checked immediately after it is written and takes effect directly e.g. when assigning parameters of application-specific tags (index 0x18).

- Writing several parameters in a sequence

  With this option, all changed parameters are only checked when the sequence has ended and they then take effect.

To start a sequence you use the command "0x03: Start param download". After writing the individual parameters, you then execute the command "0x04: End param download" to check the changed parameters and have them take effect.

To save the parameters on the IO-Link master, after completing the parameter assignment, you need to execute the command "0x05: Save param download". With this command, the download is ended automatically so that the command "0x04: End param download" does not need to be executed in addition.

If you replace a device, parameter assignments stored on the IO-Link master can be transferred quickly and simply to the new device.

Options for uploading (reading) parameter assignments

When uploading parameter assignments, a distinction is made between the 2 following options.

- Reading individual parameters
- Reading several parameters in a sequence

To start a sequence you use the command "0x01: Start param upload". After reading the individual parameters, you then execute the command "0x02: End param upload" to end the reading.

A.3 Certificates & approvals

CE marking

All the latest RFID radio approvals are available on the Internet (http://www.siemens.com/rfid-approvals).

Certificate	Description
CE	Conforms to R&TTE directive

The following applies to the system described in this documentation:

If a device has the CE marking, the corresponding approval has been obtained.

DIN ISO 9001 certificate

The quality assurance system for the entire product process (development, production, and marketing) at Siemens fulfills the requirements of ISO 9001 (corresponds to EN29001: 1987).

This has been certified by DQS (the German society for the certification of quality management systems).

EQ-Net certificate no.: 1323-01

Country-specific approvals

Safety

Labeling	Description
	Underwriters Laboratories (UL) according to standard UL 60950 (I.T.E) or to UL 508 (IND.CONT.EQ)
	Underwriters Laboratories (UL) according to Canadian standard C22.2 No. 60950 (I.T.E) or C22.2 No. 142 (IND.CONT.EQ)
	Underwriters Laboratories (UL) according to standard UL 60950, Report E11 5352 and Canadian standard C22.2 No. 60950 (I.T.E) or UL508 and C22.2 No. 142 (IND.CONT.EQ)
	UL recognition mark
	Canadian Standard Association (CSA) acc. to standard C22.2. No. 60950 (LR 81690) or acc. to C22.2 No. 142 (LR 63533)
 NRTL	Canadian Standard Association (CSA) acc. to American Standard UL 60950 (LR 81690) or acc. to UL 508 (LR 63533)
	This product meets the requirements of the AS/NZS 3548 Norm.
	USA (FCC) This device complies with part 15 of the FCC rules. FCC ID: NXW-RF...
Canada (IC)	Canada (IC) This device complies with Industry Canada licence-exempt RSS standard(s). IC ID: 267X-RF...
	EAC (Eurasian Conformity) Eurasian Economic Union of Republic of Armenia, the Republic of Belarus, the Republic of Kazakhstan, the Kyrgyz Republic and the Russian Federation Declaration of conformity according to the technical regulations of the customs union (TR CU)
 ANATEL 00975-16-04794	Brazil (ANATEL) Certificado de Homologação REPÚBLICA FEDERATIVA DO BRASIL AGÊNCIA NACIONAL DE TELECOMUNICAÇÕES Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL (www.anatel.gov.br). ANATEL IDs: • SIMATIC RF240R IO-Link, SIMATIC RF240RIOL: SIMATIC RF250R IO-Link, SIMATIC RF250RIOL: 00975-16-04794

Labeling	Description
ANATEL 02063-13-04061 ANATEL 02072-13-04061 ANATEL 02010-13-04061	Brazil (ANATEL) Certificado de Homologação REPÚBLICA FEDERATIVA DO BRASIL AGÊNCIA NACIONAL DE TELECOMUNICAÇÕES Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL (www.anatel.gov.br). ANATEL IDs: • SIMATIC RF210R IO-Link, SIMATIC RF210RIOL: 02063-13-04061 • SIMATIC RF220R IO-Link, SIMATIC RF220RIOL: 02072-13-04061 • SIMATIC RF260R IO-Link, SIMATIC RF260RIOL: 02010-13-04061 Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.
Mexico (COFETEL)	Mexico (COFETEL) Estados Unidos Mexicanos Comision Federal de Telecomunicaciones
ICASA	South Africa (ICASA) Independent Communications Authority of South Africa, Sandton Radio Equipment Type Approval Certificate
China (CMIIT)	China (CMIIT) Radio Transmission Equipment Type Approval Certificate In accordance with the provisions on the Radio Regulations of the People's Republic of China, the following radio transmission equipment, after examination, conforms to the provisions with its CMIIT ID. CMIIT ID: XXXXYYZZZZ
KC	South Korea (KCC) Korea Communications Commission Certificate of Broadcasting and Communication Equipments Republic of Korea
VCCI	Japan (VCCI)

You will find the EMC directives for the USA and Canada in the section "Approvals (Page 95)".

Service & Support

B

Industry Online Support

In addition to the product documentation, you are supported by the comprehensive online information platform of Siemens Industry Online Support at the following Internet address:
Link: (https://support.industry.siemens.com/cs/de/en/)

Apart from news, you will also find the following there:

- Project information: Manuals, FAQs, downloads, application examples etc.
- Contacts, Technical Forum
- The option to submit a support request:
  Link: (https://support.industry.siemens.com/My/ww/en/requests)
- Our service offer:

  Right across our products and systems, we provide numerous services that support you in every phase of the life of your machine or system - from planning and implementation to commissioning, through to maintenance and modernization.

You will find contact data on the Internet at the following address:
Link: (https://www.automation.siemens.com/aspa_app/?ci=yes&lang=en)

"Industrial Identification" homepage

You can find the latest general information about our identification systems on the Internet at our Homepage (www.siemens.com/ident).

Online catalog and ordering system

The online catalog and the online ordering system can also be found on the Industry Mall home page (https://mall.industry.siemens.com).

SITRAIN - Training for Industry

The training offer includes more than 300 courses on basic topics, extended knowledge and special knowledge as well as advanced training for individual sectors - available at more than 130 locations. Courses can also be organized individually and held locally at your location.

You will find detailed information on the training curriculum and how to contact our customer consultants at the following Internet address:

Link: (https://new.siemens.com/global/en/products/services/industry/sitrain.html)