

Manual and Specification

SIL-9200-MUX4

(UHF **S**cemtec **I**ndustrial **L**ongRangeReader)



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Table of Contents

1	Introduction	3
2	System Description	4
3	Operating Modes	4
3.1	Self-Test (Diagnosis) and <i>STAND-BY</i> Operation	4
3.2	Reading / Writing Tags	4
4	Hardware	5
4.1	Voltage Supply	5
4.2	HF Unit	5
4.3	Recommended external antennas, antenna-holders and connecting-cables	6
4.4	Memory	6
4.4.1	Memory	6
4.5	Interfaces	6
4.5.1	RS232	6
4.5.2	Ethernet	7
4.5.3	USB	7
4.6	Inputs / Outputs	7
4.6.1	Binary Inputs	7
4.6.2	Binary outputs	8
5	Software	9
5.1	Firmware for the SIL-9200-MUX4 UHF LongRangeReader-System	9
5.2	STX / ETX Interface Protocol	9
6	Diagnosis	9
6.1	LEDs	9
6.1.1	External Diagnosis LEDs	9
6.2	Label / Type Plate	9
7	Mechanical Data / Housing	9
8	Electrical Data	10
9	Conformity	11
9.1	CE Conformity	11
10	Delivery Scope / Optional Equipment and Accessories	11
10.1	Manual, Test Software, Protocol Description	11
10.2	Optional Accessories / External Antenna(s)	11
11	Datasheet	12
12	Related Documents / Document History	12
12.1	Document History	12

1 Introduction

As with all electronic systems, the system described hereafter may also not be used for any applications critical for maintaining safety. This means, the products may not be used in life support applications or any other life critical applications that could involve potential risk of death, personal injury or severe property or environmental damage.

The user/operator is solely responsible for any damages resulting from an improper or unintended utilization of the system.

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General:

As this technology is based on radio frequency, one must exercise the following operational and mounting instructions to achieve best operation:

- Metal affects radio signals. Normally the antenna has to be as far away as possible from any metal object and its damping influence on the magnetic field. Only this leads to the best distribution of the magnetic field in the reading range. Very important as well is not to have “short circuits”, in the vicinity of the antenna, damping the magnetic field. A “short circuit” is any metal near the antenna, building a “metallic ring”, so that currents introduced by the RF-field can flow, destroying the energy needed for the tag to operate.
- Care must be exercised to reduce or eliminate unwanted signals (so called interference or noise) from external sources. The reading range may be reduced by following noise sources:
 - portable two way radio
 - cellular phones
 - switching power supplies
 - computer monitors
 - frequency converters (e.g. motor control systems)
 - WiFi/Wlan-Routers
- The read range is depending upon
 - performance of the reader
 - size of the antenna
 - size of the tag (the bigger the better)
 - orientation of the tag antenna plane to the reader antenna plane
 - quality of the tag
 - matching of reader antenna size and tag (-antenna) size
 - environmental, electrical noise
 - If influence of metal can not be fully avoided a tuning of the antenna is required and will improve reading range

2 System Description



This manual describes the SIL-9200-MUX4 UHF LongRangeReader-System, "Reader" for short.

This SIL-9200-MUX4 LongRangeReader-System is designed as a multi-tag system to read and write information stored on UHF-Transponders, "Tags" for short. The operating frequency of 865-868 MHz yields a relatively wide reading range of up to 10 meters depending on gain of the connected antenna system and UHF-Transponder -type and -size.

This first generation of SIL-9200-MUX4 LongRangeReaders is based on the hardware developed by **scemtec Transponder Technology** featuring an RF transmitting power of max. 1.0W conducted@ 50Ω-load. The transmission of data between the reader and a host computer via the asynchronous RS232 interface can be up to 115200 baud. A USB 2.0 full speed compatible interface and an Ethernet port is available as well.

The reader is compatible with standards EPC Class 1 Gen.2 (ISO/IEC 18000-6C)

3 Operating Modes

3.1 Self-Test (Diagnosis) and *STAND-BY* Operation

After the main power supply has been switched on, a green LED labeled *POWER* lights up, which also supplies power to the CPU unit. The reader is ready for operation after a short self-test. The reader carries out a short self-test each time it is switched on. This tests all key components and functions of the reader. Once the diagnosis routines have completed successfully, the software switches to *IDLE* mode, i.e. the program waits for input via one of the three described ports of the interface to switch to a different operating mode.

At this time, the antenna does not yet transmit since the carrier is still switched off. The hardware is in *STANDBY* operating mode, the carrier is not active, and the energy consumption of the reader is minimal. The carrier is automatically switched on once the reader receives a command from the host sent across the interface, which the reader can only carry out with activated carrier. If there is no input for a longer period of time after executing the command, the carrier is switched off again and the hardware enters the *STANDBY* mode again as well. The time until the carrier is switched off can be set with the software.

It is also possible to set the carrier to a stable on or off state using the software.

3.2 Reading / Writing Tags

Several tags in the field can be read or written simultaneously (**anti-collision**). The duration of the reading/writing process depends on the number of tags in the field. Generally, there is no max. number of tags that are permitted in the field at the same time.

4 Hardware

4.1 Voltage Supply

The standard version of the SIL-9200-MUX4 reader in standard housing is designed for an input voltage range of 12-30 Volt / = DC . The following input voltage ranges are thus possible with the rated current consumptions in different operating modes:

Input voltage ranges:	
= DC / direct current	12-30 Volt
Input voltage - tolerance	+/_ 1 Volt
Polarity of the input plug	+⦿-
Current consumption of the different operating modes:	
in <i>STANDBY</i> mode: @12 V / DC power supply	≤ 150 mA
while operating(carrier on):@12 V / DC power supply	≤ 800 mA

For the SIL-9200-MUX4 reader system is a suitable wall plug 12 volt =DC / 1000mA /+⦿- power supply also as optional accessory available and contactable to the SIL-9200-MUX4 over a 2.1-mm standard barrel connector.

4.2 HF Unit

The carrier frequency of 865-868 MHz (for the ETSI-standard) is generated in the HF power-unit of the SIL-9200-MUX4 reader-system and transmitted over the connected UHF-antenna. For the countries in which the ETSI-standard regarding the EN302208-1, -2 are allowed, it is only a radiated power in combination with the connected UHF-antenna and cable-length e.g 3,6 or 12 meters of max. 2 Watts ERP radiancy allowed. Detailed information in combinations with scemtecs standard accessories of UHF-antennas and different available cable-length are described in the following table:

Restrictions regarding allowed radiancy of 2 Watts ERP for ETSI-standard as cross-over table for applied scemtec standard antenna-types in combination with different antenna cable-length			
Reader-Type: SIL-9200-MUX4 (available power-steps 1-15)	CABLE-UHF-3m-SMA-N length 3 meters [order-no.: 999.0346]	CABLE-UHF-6m-SMA-N length 6 meters [order-no.: 999.0132]	CABLE-UHF-12m-SMA-N length 12 meters [order-no.: 999.0153]
SAT-A12/12-P-868MHz 120 * 120mm circular 5,5dBi patch antenna [order-no.: 400.2018]	no power-step limitation	no power-step limitation	no power-step limitation
SAT-A25/25-LR-P-UHF-cir 250 * 250mm circular 7,0dBi patch antenna [order-no.: 400.2525]	allowed up to power-step 14	no power-step limitation	no power-step limitation
SAT-A25/25-LR-P-UHF-lin 250 * 250mm linear 8,0dBi patch antenna [order-no.: 400.2526]	allowed up to power-step 12	allowed up to power-step 14	no power-step limitation
SAT-A26/26-LR-P-UHF-cir 260 * 260mm circular 9,0dBi patch antenna [order-no.: 400.2626]	allowed up to power-step 10	allowed up to power-step 12	no power-step limitation

4.3 Recommended external antennas, antenna-holders and connecting-cables

Recommended external scemtec standard UHF-antennas :

SAT-A12/12-P-868MHz	120 * 120mm	circular 5,5dBi patch antenna	[order-no.: 400.2018]
SAT-A25/25-LR-P-UHF-cir	250 * 250mm	circular 7,0dBi patch antenna	[order-no.: 400.2525]
SAT-A25/25-LR-P-UHF-lin	250 * 250mm	linear 8,0dBi patch antenna	[order-no.: 400.2526]
SAT-A26/26-LR-P-UHF-cir	260 * 260mm	circular 9,0dBi patch antenna	[order-no.: 400.2626]

Recommended external scemtec standard antenna-holders :

MOUNT-A12/12-P-UHF	[order-no.: 999.0129]
MOUNT-A25/25-LR-P-UHF	[order-no.: 999.0467]

Recommended external scemtec standard connecting-cables :

CABLE-UHF-3m-SMA-N	length 3 meters	[order-no.: 999.0346]
CABLE-UHF-6m-SMA-N	length 6 meters	[order-no.: 999.0132]
CABLE-UHF-12m-SMA-N	length 12 meters	[order-no.: 999.0153]

4.4 Memory

4.4.1 Memory

The utilized memory consists of flash memory. The flash memory firmware can be updated at any time using one of the three interfaces to be activated. A serial EEPROM to store the configuration data is standard equipment.

4.5 Interfaces



Interface-connectors of the SIL-9200-MUX4 UHF LongRangeReader-System

4.5.1 RS232

The RS232 interface serves to connect the SIL-9200-MUX4 UHF LongRangeReader-System with a host computer. The connection is made using the 9-terminal D-SUB plug labeled *RS232*. Each data transfer starts with a start bit followed by eight data bits and one stop bit. Parity is configured as *no parity*. Please consult the current *scemtec* STX/ETX protocol description and specification for additional information about the interface protocol.

The speed at which the entire reader system and the host computer are working is significantly affected by the data transfer between reader and host by adjusting this data transfer rate using the software of the SIR-9200-MUX4 reader-system. This involves a standard RS232 interface cable.

Configurable Data Transfer Rates
1200 bits/sec
2400 bits/sec
4800 bits/sec
9600 bits/sec
19200 bits/sec
38400 bits/sec
57600 bits/sec
115200 bits/sec

4.5.2 Ethernet

The SIL-9200-MUX4 LongRangeReader-System is equipped with a 10/100 T-Ethernet interface.

4.5.3 USB

The SIL-9200-MUX4 LongRangeReader-System is equipped with a USB 2.0 full speed port.

Please consult the separate SEC-1500 interface-specification for additional details!

4.6 Inputs / Outputs



Inputs/outputs of the SIL-9200-MUX4 LongRangeReader-System

4.6.1 Binary Inputs

Two binary inputs are available for customer-specific tasks. Both inputs are accessible with indirect-connected optoisolators and screw terminals (see terminal description below). Both inputs pins (photodiode) of the optoisolator are routed over a suitable dropping resistor to the screw terminals. This means a defined input voltage between min. 5V/=DC and up to max. 24 V/=DC is recommended. The state of both binary inputs must be imported unambiguously using the software; see software description STX/ETX protocol.

Terminal assignment:

Input designation:	Terminal designation:	Internal photodiode assignment:
Input 1	I 1 + (A)	Anode of the optoisolator input 1
	I 1 - (K)	Cathode of the optoisolator input 1
Input 2	I 2 + (A)	Anode of the optoisolator input 2
	I 2 - (K)	Cathode of the optoisolator input 2

All screw terminals are clearly marked with their specific terminal designation using a suitable label at the terminal. The screw terminals make possible contact via a wire cross section of max. 2.5mm².

Electrical data:

Parameter:	Input:	Symbol:	Min.	Typ.	Max.	Unit
Input voltage	Input 1	I1	5	-	24	Volt / =DC
Input voltage	Input 2	I2	5	-	24	Volt / =DC

4.6.2 Binary outputs

Two binary outputs in the form of potential-free contacts are available for customer-specific tasks. Both outputs are accessible with indirect-connected relays and screw terminals (see terminal description below). They are freely configurable with the software; see software description STX/ETX protocol. The following tables describes the terminal assignments and the electrical data (e.g. contact rating) of the individual contacts.

Terminal assignment:

Input designation:	Terminal designation:	Internal photodiode assignment:
Output 1	O 1 (no)	Make contact output of the potential-free contact of output 1
	O 1 (com)	Ref. point for make contact output of the potential-free contact output 1
Output 2	O 2 (no)	Make contact output of the potential-free contact of output 1
	O 2 (com)	Ref. point for make contact output of the potential-free contact output 1

All screw terminals are clearly marked with their specific terminal designation using a suitable label at the terminal. The screw terminals make possible contact via a wire cross section of max. 2.5mm².

Electrical data:

Parameter:	Output:	Symbol:	Min.	Typ.	Max.	Unit
Output switching voltage	Output 1	O 1	-	24	60	Volt AC / DC
Output switching current	Output 1	O 1	-	500	1000	mA
Output switching voltage	Output 2	O 2	-	24	60	Volt AC / DC
Output switching current	Output 2	O 2	-	500	1000	mA
Contact ratings of the output contacts	Output 1 / 2	O 1 / O 2	-	500	800	mWatt
Internal resistance of the output contacts	Output 1 / 2	O 1 / O 2	-	1	-	Ω/Ohm

5 Software

5.1 Firmware for the SIL-9200-MUX4 UHF LongRangeReader-System

The firmware for the SIR-9200-MUX4 UHF LongRangeReader-System contains all basic functions for reading and writing of tags of different manufacturers (air protocol), numerous control functions, as well as different diagnosis routines. These routines are used to test the key components and functions of the reader.

A standard demo software for Windows is also available for this device.

5.2 STX / ETX Interface Protocol

A special transfer protocol is available for the SIL-9200-MUX4 UHF LongRangeReader-System documented in the scemtec STX / ETX protocol. The required STX/ETX protocol description is also available for this device.

6 Diagnosis

6.1 LEDs

6.1.1 External Diagnosis LEDs

Three external LEDs provide users with a diagnosis of the most important monitoring functions "Power" , "Tag Detect" and "Error"

Three external LEDs to indicate important operating states			
LED	Color	Designation	Description
1	GREEN	<i>Power</i>	The voltage supply for the CPU is ensured
2	YELLOW	<i>Tag Detect</i>	A read or write process for the transponders in the transmission-field has concluded successfully
3	RED	<i>Error</i>	An Error accrued

6.2 Label / Type Plate

The SIL-9200-MUX4 UHF LongRangeReader-System features a system label that provides information about the specific scemtec system number "220.9200" and the consecutive serial number (four digits), e.g. "0001" of the production lot.

SIL-9200-MUX4	U_{in} : 12Volt / = DC / +⊖-
Syst.-Nr.: 220.9200	f_{Rf} : 865-868 MHz
Serial-Nr.: 0001	P_{Rf} : 1000mW
	(conducted@50Ω)
	T_{amb} : -10 to 60°C

7 Mechanical Data / Housing

An aluminum housing protection type IP 20 (in acc. with DIN EN 60529) is used. This housing is equipped with two lateral covers attached with screws.

Case dimensions (exterior)	
Length	185 mm (without connectors 160mm)
Width	105 mm
Height	38 mm

8 Electrical Data

Absolute Max. Parameters				
No. :	Parameter	Symbol	Value	Unit
1	Min. DC input voltage	V_{min}	11	Volt
2	Max. DC input voltage	V_{max}	31	Volt
3	Max. current consumption / @12Volt DCin	I_{max}	850	mA
4	Operating (ambient) temperature range	T_{amb}	- 10 to 60	°C
5	Storage temperature range	T_{stg}	- 20 to 70	°C

General Parameters									
No.	Parameter	Test condition	Symbol	Min.	Typ.	Max.	Unit	Min / Max values	Typ. values
6	Operating frequency	Defined in ISO document	F_{RF}	865	-	868	MHz		X
7	RF output-power (conducted @ 50Ω)	Terminal resistance 50Ω /25°C	P_{out}	-0.5dB	1000	+0.2dB	mW	X	
8	RF input sensitivity	$P_{out} = 1000mW$ $T_{amb} = 25°C$		-	tbd	-	dBm		X
9	Current consumption at $U_{in} = 12$ Volt	$RF_{out} = 1000mW$ $T_{amb} = 25°C$	I_{in}	500	650	800	mA	(X)	X
11	Current consumption at $U_{in} = 12$ Volt	STANDBY mode $T_{amb} = 25°C$	I_{in}	70	100	150	mA	(X)	X
12	Transmission rate RS232 interface	Defined in DIN 66020 $U_{in} = 12$ V/DC $T_{amb} = -10°C - 60°C$		1200	-	115200	bits/sec	X	
13	Input Voltage binary inputs I1/ I2	$U_{in} = 24$ V/DC $T_{amb} = -10°C - 60°C$	U_{in}	5	-	24	V	X	see 4.6.1
14	Output switching voltage binary outputs O 1 / O 2	$I_{out} = 500mA$ $T_{amb} = -10°C - 60°C$	U_{out} (AC/DC)	-	24	60	V	X	see 4.6.2
15	Output switching current binary outputs O 1 / O 2	$U_{out} = 24$ V/DC $T_{amb} = -10°C - 60°C$	I_{out}	-	500	1000	mA	X	see 4.6.2
16	Output switching output binary outputs O 1 / O 2	$U_{out} = 24$ V/DC $T_{amb} = -10°C - 60°C$	P_{out}	-	500	800	mW	X	see 4.6.2

9 Conformity

9.1 CE Conformity

The company **scemtec** Transponder Technology GmbH declares that the product device type **UHF LongRangeReader** with the type designation

SIL-9200-MUX4

complies with the basic requirements of Directive

1999/5/EC

of the European Council.

The following standards were used as the basis for this evaluation:

EN 302 208-1, -2 / EN 301 489-1, -3 / EN 50364

(in preparation: EN 60950)

10 Delivery Scope / Optional Equipment and Accessories

10.1 Manual, Test Software, Protocol Description

10.2 Optional Accessories / External Antenna(s)

For the SIL-9200-MUX4 UHF LongRangeReader-System is a suitable wall plug 12Volt=DC max.1000mA power supply as optional accessory available and contactable to the reader over a 2.1-mm standard barrel connector.

Recommended external scemtec standard wall-plug power supply 12V/1A :

Power supply 12 Volt / 1Amp EU-version / wall plug / 2.1mm-connector [order-no.: 999.1280]

Recommended external scemtec standard UHF-antennas :

SAT-A12/12-P-868MHz	120 * 120mm	circular 5,5dBi patch antenna	[order-no.: 400.2018]
SAT-A25/25-LR-P-UHF-cir	250 * 250mm	circular 7,0dBi patch antenna	[order-no.: 400.2525]
SAT-A25/25-LR-P-UHF-lin	250 * 250mm	linear 8,0dBi patch antenna	[order-no.: 400.2526]
SAT-A26/26-LR-P-UHF-cir	260 * 260mm	circular 9,0dBi patch antenna	[order-no.: 400.2626]

Recommended external scemtec standard antenna-holders :

MOUNT-A12/12-P-UHF	[order-no.: 999.0129]
MOUNT-A25/25-LR-P-UHF	[order-no.: 999.0467]

Recommended external scemtec standard connecting-cables :

CABLE-UHF-3m-SMA-N	length 3 meters	[order-no.: 999.0346]
CABLE-UHF-6m-SMA-N	length 6 meters	[order-no.: 999.0132]
CABLE-UHF-12m-SMA-N	length 12 meters	[order-no.: 999.0153]

11 Datasheet

See additional document : datasheet “ **SIL-9200-MUX4** “

12 Related Documents / Document History

[STXETX]

STX/ETX Protocol description

Scemtec's STX/ETX Protocol description is distributed with every Reader on the product CD

12.1 Document History

Version	Date	Changed by	Description
0.01	28.01.2014	M.Radermacher	Initial Version