Annex no. 5

Functional Description / User Manual

m. dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

Manual

SIL-2125 v0.8

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project manager	development manager	Managing director	customer
<project manager>	Burkhard Bröhl	Jürgen Kalbitzer	<customer>

Contents

1 Safety Informations

As with all electronic systems, the system described hereafter may not be used for any applications critical for maintaining safety. This means, the products may not 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.

2 General

Scemtec Transponder Technology GmbH (STT) reserves the right to make changes or to discontinue its products or services at any time without notice.

STT takes no responsibility for customer applications, products, or performance relating to systems or applications incorporating with STT products.

STT assumes no liability and is not responsible for infringement of patents and/or any other intellectual or industrial property rights of third parties, which may result from assistance provided by STT.

Please note, that the user is responsible for conformity with regulation issues (e.g. radio approval), when using antennas not provided by STT or using the system in countries, where the conformity with local regulations is not tested by STT.

All other products mentioned in this document might be brands or brand names of the different suppliers.

3 RFID Systems

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

- Metal affects radio signals. Normally the antenna has to be as far away as possible from any metal object and it's 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, absorbing the energy needed for the tag to operate.
- Care must be taken 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)
- 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

4 System Description

This manual describes the 13,56 MHz Long Rang Reader System „SIL-2125“, hereafter referred to as "Reader".

The 13,56 MHz Long Range Reader system „SIL-2125“ is designed as a multi-tag system for reading and writing information stored on transponders (TAGs). It is primarily designed to be operated with so called Gate-antennas. Therefore a splitter is integrated in the standard version, which divides the output-power generated by output stage symmetrically to two BNC antenna connectors. Nevertheless the standard version can be configured to operate with only one antenna attached to Antenna Port ANT1 with slightly reduced output power.

Beside this a MUX Version with integrated antenna multiplexer is available. This version offers 4/8 antenna ports with SMA connectors for attaching external antennas.

The Reader is designed for indoor usage only.

Transfer of data between the Reader and a host computer is possible via Ethernet, USB and an asynchronous RS232 interface. Furthermore a configurable “stand-alone” operation via so called Smart Read Feature is possible.

The Reader is compatible with the ISO/IEC 15693-2 and ISO 18000/3 “A” and “C” standards.

5 Quick Start

First Connect the Reader as shown below:

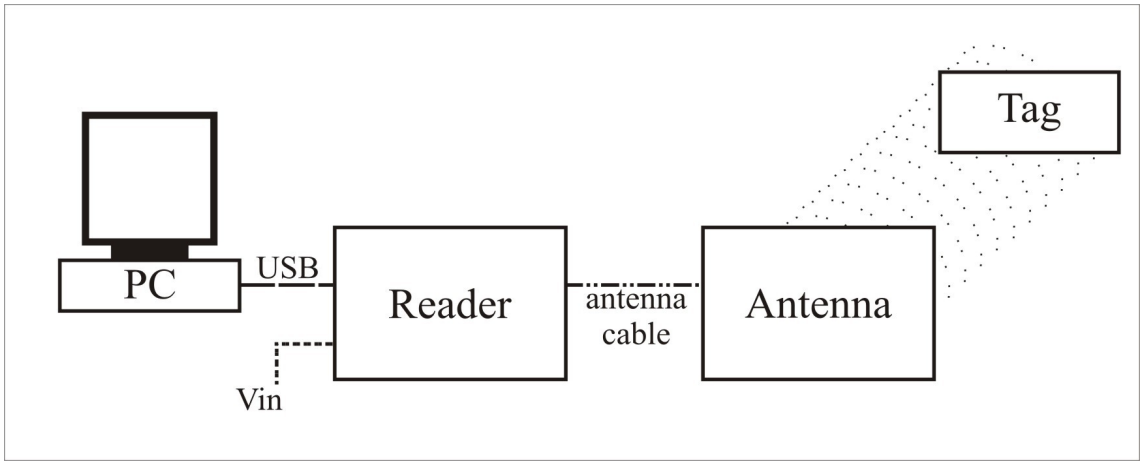

figure 1: Reader connection example

As example you can use the STT antenna “SAT-A40-LR-O-13MHz” [400.4020].

Now you can use a Software like “Uni - Demo” to control the Reader. For more details please refer to “Quick Start Guide read”. This Guide is available for download on www.stt-rfid.com.

6 Hardware

6.1 Voltage Supply

The Reader is designed for a voltage supply connectible via an standard 2.1-mm barrel connector.

Polarity of connector	

The reader may only be connected to a power supply with a maximum output current of 2 A, which is tested for safety according to appropriate standard (e.g. EN60950)

A suitable wall plug power supply is available as optional accessory. For best performance and safety, STT strongly recommends to use only this power supply

6.2 Interfaces

For communication with a host device (e.g. PC), the Reader provides three interfaces (RS232, USB, Ethernet). The interfaces are handled by an separate, built-in interface unit with an ARM7 microprocessor. This interface-unit can also be configured to operate the Reader in stand-alone mode (Smart Read feature).

The interfaces are intended to be used only with connection cables not longer than 3m.

6.2.1 Ethernet

The Reader is equipped with a 10/100 T-Ethernet interface.

By default the Reader gets his IP Address via DHCP. Nevertheless the Reader can also be configured with a static IP Address. Configuration can be done via a simple integrated web server, which can be reached by typing the actual IP Address in the address line of browser. After Login, configuration page for of Network settings is available.

Default Login Settings:

Username: admin

Password: scemtec

The actual assigned IP address of the reader can be determined using STT Demo Software (e.g. Unidemo). Clicking the “Search” Button in Ethernet connection window of the STX/ETX connector will show the actual IP address as well as MAC address of all STT devices available in the local network.

Network settings may also be configured by using STX-ETX commands. For details please refer to STX-ETX protocol description.

6.2.2 USB

The Reader is equipped with a USB 2.0 full speed (12 Mbits/sec) port. The connection is made via a standard USB-B connector.

Supported profiles	CDC-ACM (virtual COM-Port), HID (Keyboard emulation)

Appropriate drivers for Windows are available for download on www.stt-rfid.com.

6.2.3 RS 232 Interface

The Reader is equipped with a RS232 interface. The connection is made via a standard 9 pin D-Sub connector .

Terminal designation:	SUB-D Connector Pin	Terminal Function
TxD	2	Transmit Data
RxD	3	Receive Data
GND	5	Ground

The data transfer rate is adjustable via STX-ETX commands.

Configuration	8 Data Bits, 1 Stop Bit, no Parity, no flow control
Supported Data Rates [baud]	1200, 2400, 4800, 9600 (default), 19200, 38400 57600, 115200, 230400

In addition to the primary RS232 Interface described above, the Reader provides a secondary RS 232 Interface, intended to be used in stand alone mode as interface for connecting auxillary equipment (e.g. additional RFID reader, bar code scanner, …). The connection to the secondary RS232 ist also made via the 9 pin SUB D connector. Please contact STT for further Information regarding usage of the second RS232 in your application.

Terminal designation:	SUB-D Connector Pin	Terminal Function
TxD2	8	Transmit Data Secondary RS232
RxD2	7	Receive Data Secondary RS232
GND	5	Ground

Special Adapters cables for connecting external devices to the secondary RS232 are available from STT.

6.3 HF Unit

The carrier frequency of 13.56 MHz is generated in the HF unit. The final stage generates an output of typical 10 watt on nominal Z_F = 50 Ohm.

6.4 External Antenna

The Reader is only operational with external antenna(s).

Some key parameters of the Reader such as reading range for example depends on the used antenna, the used transponder type,size and quality, and the resulting magnetic coupling between the transponder resonant circuit and the transmission/receiver antenna.

The connected antenna(s) should be configured for the optimal resonance frequency of 13.56MHz with ohmic adjustment (nominal Z_F = 50 Ohm) to ensure the best possible system performance.

When using antennas not provided by STT, please make sure that the antenna quality factor is in the range between 20 and 50 and the antenna is optimally tuned. The resulting SWR value should be well below 2.

Antenna tuning should be checked at the final installation. Furthermore antenna detuning caused by heating of the antenna matching unit should also be observed

6.5 Reader Versions

The Reader is available in two versions. The standard version is equipped with a Splitter, which divides the output power to two antenna ports for operating two antennas simultaneously.

Beside this a version with integrated antenna Multiplexer (MUX) is available, which switches the output power to one of up to 4 or 8 antenna ports, for sequential operating of attached antennas.

6.5.1 Internal Splitter (standard)

For using the standard version of the Reader with two antennas (e.g. a Gate antenna) the Split-mode is available. In this mode the built in splitter divides this power symmetrically to the two antenna connectors. So typical 5 watt on nominal Z_F = 50 Ohm is available at each of the two antenna BNC connectors. For using the Reader with a single antenna setup, a Single-mode is available. In this mode a slightly reduced HF power of typ. 7,5 Watt on nominal Z_F = 50 Ohm is only available on antenna port ANT 1.

The desired operation mode can be selected via a software command. Furthermore the output power can be reduced by software commands in both operation modes.

6.5.2 Internal Multiplexer

In this version up to 4/8 antennas (Depending on the stage of expansion of the integrated MUX) can be connected to the Reader. The user can select each connected antennas with software commands. In this version a slightly reduced HF power of typ. 7,5 Watt on nominal Z_F = 50 Ohm is available on the selected antenna port at any one time.

Furthermore the output power can be reduced by software command.

The MUX Version is equipped with SMA antenna connectors. For using with BNC or N connectors, SMA-BNC or SMA-N Adapters are available from STT.

6.6 Inputs and Outputs

6.6.1 Binary Inputs

Two binary inputs are available for customer-specific tasks. Both inputs are accessible with indirect-connected opto-couplers and screw terminals (see terminal description below).

The state of both binary inputs must be imported unambiguously via software command.

In stand alone mode (SMART Read) the behavior of the Inputs can be configured freely (e.g. trigger Read event).

Input designation:	Terminal designation:	Internal opto-coupler assignment:
Input 1	I1 + (A)	Anode of the opto-coupler input 1
	I1 – (K)	Cathode of the opto-coupler input 1
Input 2	I2 + (A)	Anode of the opto-coupler input 2
	I2 – (K)	Cathode of the opto-coupler input 2

All screw terminals are clearly marked with their specific designation at the terminal. The screw terminals accepts wires of maximum conductor cross-section of 2.5mm².

The electrical data can be found in the table 'electrical specification'.

6.6.2 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 via software commands.

In stand alone mode (SMART Read) the behavior of the Outputs can be configured freely (e.g. change state when TAG is read).

Terminal assignment:

Input designation:	Terminal designation:	Internal assignment:
Output 1 (normally open)	O1.1	Contact 1 of the potential-free Output-port 1
	O1.2	Contact 2 of the potential-free Output-port 1
Output 2 (normally open)	O2.1	Contact 1 of the potential-free Output-port 2
	O2.2	Contact 2 of the potential-free Output-port 2

All screw terminals are clearly marked with their specific designation at the terminal. The screw terminals accepts wires of maximum conductor cross-section of 2.5mm².

The electrical data can be found in the table 'electrical specification'.

6.6.3 IO connection example

The following schematic is an example how to connect the Inputs and Outputs.

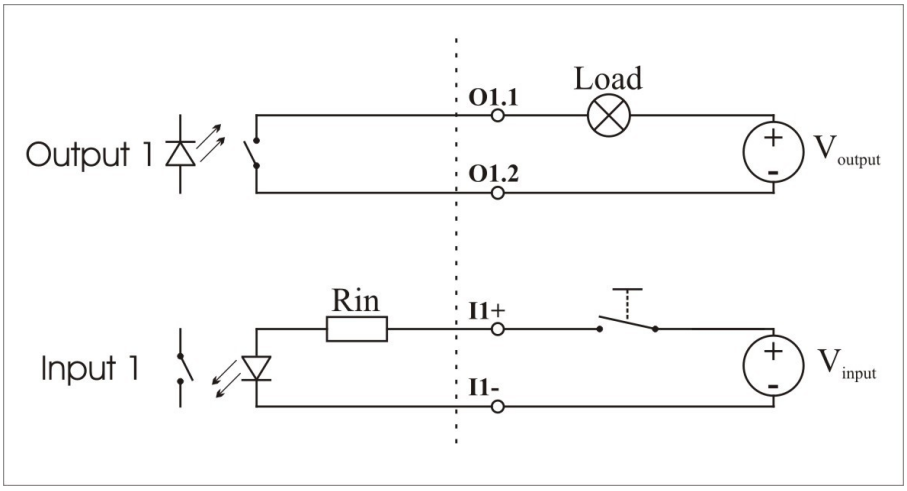

figure 2: IO connection example

6.7 Diagnosis LEDs

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

Three LED indicate important operating states			
Led	Color	Designation	Description
1	green	Power	The voltage supply for the CPU is ensured
2	yellow	Tag Detect	A read or write process for the transponders has concluded successfully
3	red	**EAS**	**EAS***Alarm is deployed

EAS** is an abbreviation of **Electronic* **A***rticle* **S***urveillance*

6.8 Processors

The Reader incorporates two Microprocessor. One handles the interface communications with the connected host systems as well as stand alone operations (interface processor).

The second processor (main processor) handles all actions related to Communication with Transponders

6.9 Memory

The firmware of the incorporated microprocessors is stored in a flash memory. It can be updated at any time via the USB or RS232 interface.

A serial EEPROM to store configuration and user data is also available.

7 Operating Modes

7.1 Standard (Host) Mode

In standard mode the Reader is completely controlled by a Host system connected to one of the available Interfaces via STX-ETX commands. For further information, please refer to the STX-ETX protocol description, which can be downloaded from www.stt-rfid.com.

7.2 Stand alone Mode (SMART Read)

In addition to controlling the Reader with a host system via one of the interfaces, it can also be configured for stand alone operation. Therefore the “Smart Read” feature is implemented.

For further Information about Smart Read please refer to the correspondent Smart Read manual, which can be downloaded from www.stt-rfid.com.

8 Software

8.1 Software utilities

Various software utilities for Windows for the Reader are available for download on www.stt-rfid.-com. Linux Versions are available on request.

Available Software utilities:

- UniDemo: Universal Demo Software for easily controlling the Reader with a Host system.
- STXTerm: Terminal program for controlling the Reader with a Host system by directly submitting STX-ETX commands. For submitting multiple STX-ETX commands a comprehensive Script utility is implemented
- Flasher: Utility for updating firmware on the incorporated Microprocessors
- SmartManager: Utility for configuration and using the Reader in Standalone mode (Smart Read).

8.2 Firmware

The firmware of the Reader contains all basic functions for reading and writing tags of different manufacturers (air protocol), numerous control and configuration functions, as well as different diagnosis routines.

Firmware can be updated by the user via USB or RS232 Interface. Therefore the latest Firmware files are available for download on www.stt-rfid.com.

8.3 STX-ETX Interface Protocol

For communication with the Reader STT STX-ETX protocol is used.

The required STX/ETX protocol description can be downloaded from www.stt-rfid.com

A list of supported STX-ETX commands can be read out from the Reader via the STX-ETX command ‘100E’ or via STX-ETX script ‘Get Fn List.stx’ (which will be installed together STXTerm software).

9 Electrical specification

Electrical specification (Ambient temperature: 25°C)						
Parameter	**Test condition**	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
DC input voltage	-	V_{IN}	23	24	25	Volt
Current consumption	Carry on (2x5W) V_{IN} = 24V	I_{IN}	-	-	2000	mA
Current consumption	Idle - mode V_{IN} = 24V	I_{IN}	-	-	500	mA
Operating frequency	-	F_{RF}	-	13,56	-	MHz
RF power (internal)	-	$P_{internal}$	- 1db	10	+ 1db	W
Input voltage binary inputs I1/ I2	-	V_{input}	18	24	30	Volt DC
Input current binary inputs I1/ I2	V_{input} = 24V/DC	I_{input}	-	22	-	mA
Series resistors binary inputs I1/ I2	-	R_{IN}	950	1000	1050	Ohm
Output switching voltage binary outputs O 1 / O 2	-	V_{output} (AC/DC)	-	-	30	Volt AC/DC
Output switching current binary outputs O1 / O 2	V_{output} =12 V/DC	I_{out}	-	-	1	A
Output power dissipation binary outputs O 1 / O 2	V_{output} =12 V/DC	P_{out}	-	-	500	mW
On resistance binary outputs O 1 / O 2	-	R_{on}	-	0,25	0,50	Ohm
Operating (ambient) temperature range	-	T_{amb}	0	-	40	°C
Storage temperature range	-	T_{stg}	-20	-	70	°C

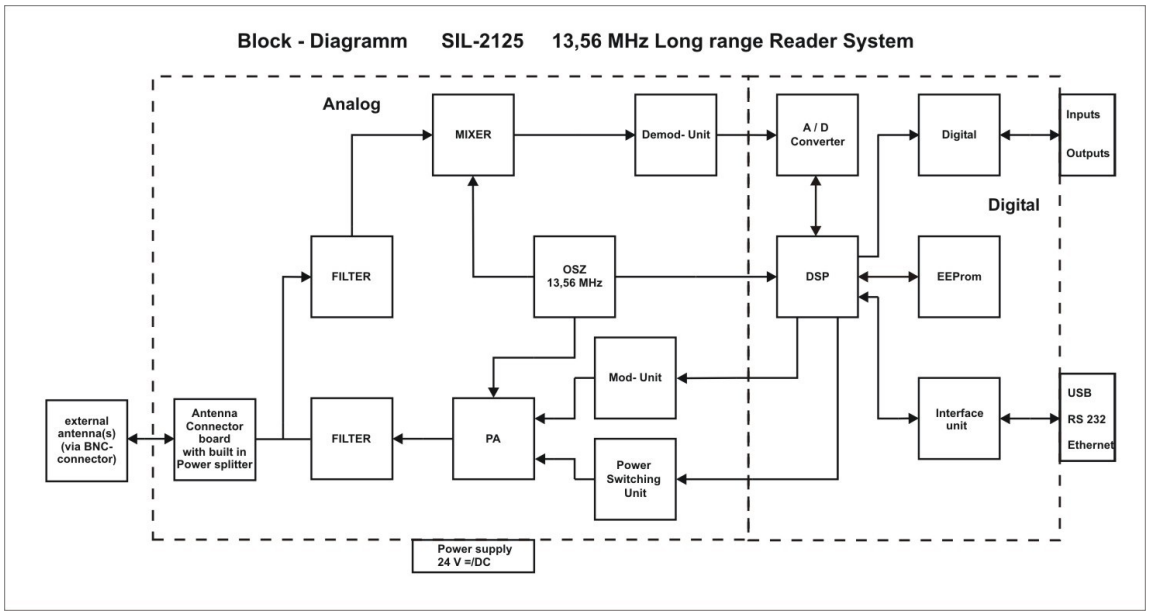

figure 3: Block diagram

10 Mechanical Specification & Mounting

10.1 Dimensions

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. For mounting the Reader the two included mounting brackets can be attached.

Housing dimensions	
Length	210 mm
Width	220 mm (without brackets)
High	68 mm
Color	Natural matte aluminum

10.2 Mounting

When mounting the Reader on a wall or ceiling, only the provided screw-holes has to be used. Fixing to the wall/ceiling has to be done with appropriate installation material (not included) using all of the foreseen mounting points.

When installing the Reader, please make sure that the maximum ambient temperature is not exceeded at any time. Therefore the Reader should only be installed in places where sufficient ventilation is assured. Any kind of possible heat accumulation should be avoided (e.g. the SIL should not be mounted in an additional housing or cabinet).

11 FCC Conformity: Information for USA

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, and
(2) this device must accept any interference received, including Interference that may cause undesired operation.
Usually this is followed by the following FCC caution:
Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this 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.

Professional Installation: To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification.
It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.

12 Delivery Scope / Optional Equipment and Accessories

12.1 Delivery Scope

- SIL-2125 Reader system
- 2 mounting brackets

12.2 Optional Accessories

For the SIL-2125 Reader system a suitable wall plug 24 volt =DC / max. 2000mA power supply as optional accessory is available and contactable to the SIL-2125 over a 2.1-mm standard barrel connector.

For connecting STT standard long range antennas (normally equipped with BNC Connectors) to the MUX version of the Reader, suitable SMA-BNC adapter cables are available.

13 Related Documents

- QuickStart Guide read
  - Short introduction for using the Reader with UniDemo
- Quick guide to STXETX-protocol
  - Short introduction of basic structure of STX-ETX protocol
- STX/ETX Protocol description
  - Detailed Description of command structure and available commands for controlling the Reader with a Host system
- SmartRead Manual
  - Description of functionality for stand alone operation
- SmartManager Manual
  - Description for using the SmartManager to configure a Reader for stand alone operation
- C# Demo with source code
  - Example code for integrating the Reader in your own application software

All documents are available for download on www.stt-rfid.com.

14 Contact STT

Scemtec **T**ransponder **T**echnology GmbH
Wehrstr. 1
D-51645 Gummersbach

Phone: + 49 (0) 22 61 / 80407 - 0
Fax: + 49 (0) 22 61 / 80407 - 55

e-Mail: info@stt-rfid.com
Website: www.stt-rfid.com

If you have any questions about our products, please do not hesitate to call us. Our specialists are always available for you and will provide professional support to find a solution to your specific problem.

15 Document History

Version	Date	Changed by	Description
0.1	05.01.2011	B. Broehl	Initial Version
0.2	11.11.2011	B. Broehl	Completely revised version
0.3	25.11.2013	B. Broehl	General mistakes corrected MUX version added Interface section corrected Entries of responsible persons on front page revised Chapter “Related Documents” revised
0.4	13.06 2013	B. Broehl	Revised and corrected version
0.5	18.09.2014	B. Broehl	Completely revised version
0.6	01.10.2014	B. Broehl	Secondary RS232 Description added
0.7	14.11.2014	B. Broehl	Chapter 2: Regulation issues supplemented Chapter 6.4: Information on antenna parameters supplemented Chapter 10.2: Information on mounting issues supplemented Company logo updated
0.8	10.12.2014	B. Broehl	Chapter 11: FCC Conformity: Information for USA supplemented