SPI-Simulyzer

(Original operating instructions)

1 Regarding these operating instructions

1.1 Issues of this documentation

Issue	Last updated	Note
01	2023-12	First issue

Tab. 1 Issue history

1.2 Scope

This documentation applies to all Simulyzers as from version 2.3 with a model code beginning as follows:
Type SPI

1.3 Further documentation

You can find further documentation on our homepage: www.seskion.de
in the relevant product selection.

1.4 Customer feedback

Suggestions, wishes, or improvements from our customers are
very important to us.
Comments regarding the documentation can be inserted directly in the PDF document and sent to us via email at sales@seskion.de.

1.5 Presentation of information

1.5.1 Safety instructions

The safety instructions in these operating instructions specify hazards which
may occur when handling the product. They are listed as continuous text without emphasis.

1.5.2 Warnings

The warnings in these operating instructions contain specific signal words
(danger, warning, caution, notice) and a signal graphic.

The signal word should draw attention to the safety instruction and
designates the severity of the hazard or the danger of material damage.

The signal graphic (warning triangle with exclamation point) which precedes the signal words danger, warning, and caution indicates hazards to people.

⚠ CAUTION	Not observing this warning may result in moderate or minor physical injury.

The notice signal word on a blue background indicates the risk of material damage.

NOTICE	Not observing this warning may result in material damage.

1.5.3 Figures and drawings

The figures and drawings in these operating instructions are intended to support and clarify the text.

Some of these figures and drawings may contain details and/or configurations which are not present on the product and/or are designed differently. They may also contain components which are not included in the product's scope of supply.

1.5.4 Text emphasis

In order to display the textual information in a comprehensible manner, the following means of emphasizing text are used:

📄   Notice of further documentation

💡   This notice provides you with important information which you should observe.

- First-level list items are indicated with a solid bullet point
  - Second-level list items are indicated with an empty bullet point

Instructions
1. First step of an instruction
2. Second step of an instruction
   ➡ Result of the second step
3. Third step of an instruction

Notice: This is a notice concerning the third instruction.

💡   Instructions must be performed in the correct order!

1.5.5 Abbreviations

Abbreviations are used in this documentation. You can see what they mean in the table below

Abbreviation	Meaning
API	Application programming interface
CAN	Controller area network
CRC	Cyclic redundancy check
ECU	Electronic control unit
FPGA	Field-programmable gate array
GND	Ground
NC	Not connected

Tab. 2 Abbreviations

2 Safety provisions

2.1 Principles

The Simulyzer must only be used if it is in a perfect technical condition.

NOTICE	Use is prohibited if there is visible damage to the interfaces and/or on the housing!

2.2 Proper use

The Simulyzer is only intended for professional use.

Proper use of the Simulyzer consists of fast and easy reading out of sensor data from the PSI5 bus and peripheral devices as well as transmission of simulation data to control units.

2.3 Improper use

The following cases of misuse are prohibited and resulting damage is excluded from the warranty:

- Operation beyond proper use
- Operation beyond the stipulated technical data, see section 5.5
- Operation in an environment with spray water

2.4 Safety instructions

The following safety instructions must be observed when handling the Simulyzer:

- Only place the device on a flat surface, a sufficient distance away from falling edges or sufficiently secured against falling.
- Do not operate under the effect of spray water.
- Only operate in vehicles sufficiently secured against acceleration, shock and falling.

2.5 Personnel qualification

The Simulyzer is designed for people in the context of development and testing; among others, these include programmers, system testers, system architects, electronics technicians, and others.

2.6 Operational safety

Each piece of work equipment has to be tested at regular intervals according to the Betriebssicherheitsverordnung (German Industrial Safety Regulation) and as electrical equipment according to DGUV (German Social Accident Insurance) Regulation 3 by an electrician or under their supervision.

This includes the power supply unit provided in the scope of supply.

3 Warranty

All warranty claims shall be voided in the event of improper use and/or incorrect handling. All warranty claims shall also be voided if the Simulyzer is opened independently or attempts to open it are made.

4 Scope of supply and identification

4.1 Scope of supply

The scope of delivery of the SPI Simulyzer consists of the Simulyzer as a product and the following accessories:

- 1x power supply unit
- 1x USB cable
- 1x SUB-D mating connector
- 2x SUB-D ribbon cable connectors

The scope of delivery of the SPI simulyzer LVDS variant consists of the simulyzer as a product and the following accessories:

- 1x power supply unit
- 1x USB cable
- 1x SUB-D mating connector

The SPI-Simulyzer LVDS-single ended Pod with 2m cable is not included and must be ordered separately with article number 2.4101.

5 Overview
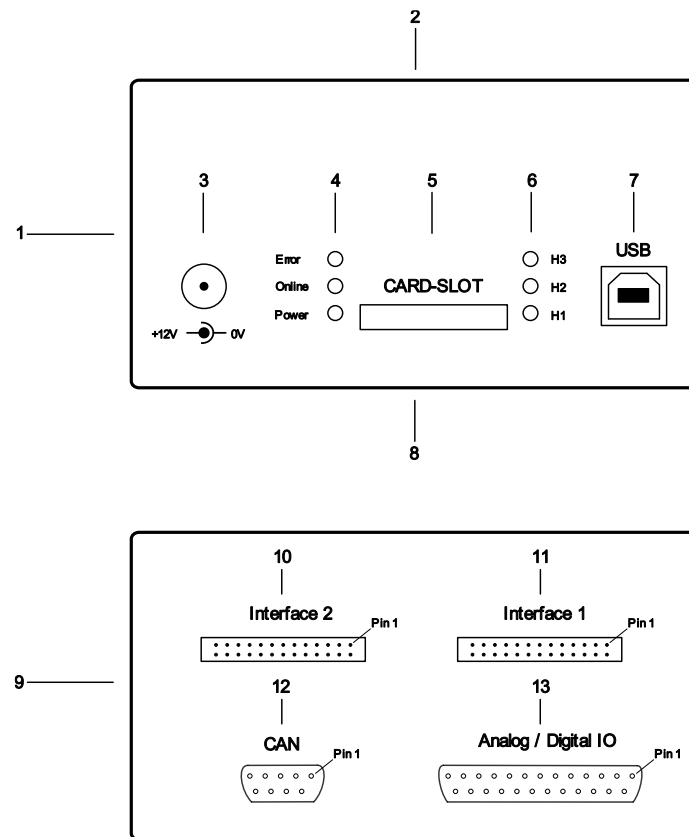
Fig. 1 Übersicht

1 – Front	8 – Bottom
2 – Top	9 – Rear
3 – External power supply	10 - Interface 2
4 – Status display 1	11 - Interface 1
5 – SD card slot	12 - CAN
6 – Status display 2	13 - Analog/Digital IO
7 - USB	

5.1 Functional description

The Simulyzer simulates and/or analyzes data from the SPI bus

Analyzed data can be visualized using the relevant software solution from Seskion. Alternatively, Seskion provides an API which users can independently connect to their system.

5.2   Interfaces

5.2.1   SD card slot

The SD card slot is intended to expand the storage space for optional recording of measurement data through the use of an SD card.

> 💡   The SD card is not included in the scope of supply.

5.2.2   USB

The USB 2.0 connection fulfills two functions. On the one hand, it configures the Simulyzer. On the other hand, it transfers measurement data to a PC.

5.2.3   External power supply

This connection is used to connect an external power supply to the Simulyzer.

5.2.4   CAN

> 💡   The CAN interface is available as standard. However, it must be activated with a license which can be purchased from Seskion.

The CAN interface enables the Simulyzer to be connected to any CAN bus interface.
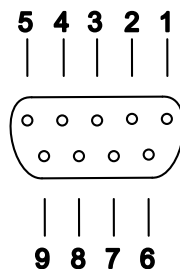
Fig. 2 CAN interface pin assignment

Pin	Assignment
1	NC
2	CAN Low
3	GND
4	NC
5	NC
6	GND
7	CAN High
8	NC
9	NC

Tab. 3 CAN interface pin assignment

> 💡   The terminating resistor between CAN High and CAN Low is not installed.

5.2.5   Interface 1+2

Data is exchanged with the SPI bus at the Sensor/ECU IO interface.
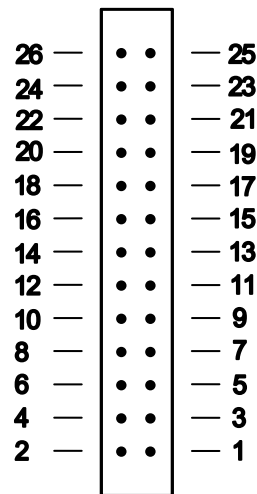
Fig. 3 Interface 1+2 - pin assignment

Pin	Assignment	Characteristic
1	GND	-
2	VDD	1,2 V …6,5 V
3	GND	-
4	CLK	0 V …6,5 V (VDD)
5	GND	-
6	MISO	0 V …6,5 V (VDD)
7	GND	-
8	MOSI	0 V …6,5 V (VDD)
9	GND	-
10	CS_0	0 V …6,5 V (VDD)
11	GND	-
12	CS_1	0 V …6,5 V (VDD)
13	GND	-
14	CS_2	0 V …6,5 V (VDD)
15	GND	-
16	CS3	0 V …6,5 V (VDD)
17	Not Connected	-
18	SensReset	0 V …6,5 V (VDD)
19	Not Connected	-
20	EClock	0 V …6,5 V (VDD)
21	Not Connected	-
22	DIo 3	0 V …6,5 V (VDD)
23	VDDA 1	0 V …6,5 V (VDD)
24	DIO 4	0 V …6,5 V (VDD)
25	U_SEN_1	0 V …6,5 V (VDD)
26	Not Connected	-

Tab. 4 Interface 1+2 - pin assignment

5.2.6 Pin assignment ribbon cable adaptation to 25-pin D-sub socket -Single ended -
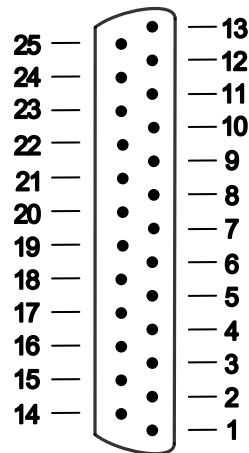
Fig. 4 Pin assignment ribbon cable adaptation to 25-pin D-sub socket - single ended -

Pin	Assignment
1	GND
2	GND
3	GND
4	GND
5	GND
6	GND
7	GND
8	GND
9	nc
10	nc
11	nc
12	VDDA_1 **NEW! Do not use connectors of older versions!**
13	USens1 **NEW! Do not use connectors of older versions!**
14	VDD
15	SCK
16	MISO
17	MOSI
18	CS0
19	CS1
20	CS2
21	CS3
22	SensReset
23	EClock
24	DIO3
25	DIO4

Tab. 5 Pin assignment ribbon cable adaptation to 25-pin D-sub socket - single ended -

5.2.7 Pin assignment LVDS-Version
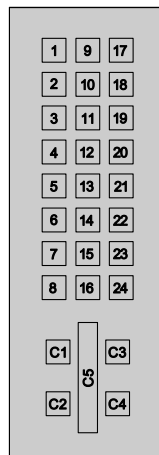
Fig. 5 LVDS-Version pin assignment

Pin	Signal
1	CS3-
2	CS3+
3	GND
4	CS2-
5	CS2+
6	!SO_MI_EXT
7	!OE_EXT
8	GND
9	CS1-
10	CS1+
11	GND
12	MOSI-
13	MOSI+
14	VDD
15	GND
16	+3,3 V
17	CS0-
18	CS0+
19	GND
20	MISO-
21	MISO+
22	GND
23	CLK+
24	CLK-
C1	SensReset
C2	EClock
C3	DAC3
C4	DAC4
C5	GND

Tab. 6 LVDS-Version pin assignment

The PIN assignment of the 25-pin SUB-D socket after the POD corresponds to the PIN assignment of the single-ended version!

5.2.8 Analog/Digital IO

General input/output signals are exchanged at the analog/digital IO interface.

Fig. 6 Analog/Digital IO - pin assignment
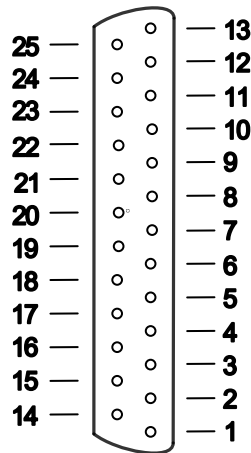
Pin	Assignment	Characteristic
1	DAC_1 / Analog Input 1	-10 V…+10 V
2	DAC _2 / Analog Input 2	-10 V…+10 V
3	DAC _3 / Analog Input 3	-10 V…+10 V
4	DAC _4 / Analog Input 4	-10 V…+10 V
5	GND	-
6	DIGE_1 / Digital Input 1	0 V…3,3 V or 5 V (VDDD)
7	DIGE_2 / Digital Input 2	0 V…3,3 V or 5 V (VDDD)
8	DIGE_3 / Digital Input 3	0 V…3,3 V or 5 V (VDDD)
9	DIGE_4 / Digital Input 4	0 V…3,3 V or 5 V (VDDD)
10	DIGE_5 / Digital Input 5	0 V…3,3 V or 5 V (VDDD)
11	DIGE_6 / Digital Input 6	0 V…3,3 V or 5 V (VDDD)
12	DIGA_1 / Digital Output 1	3,3 V or 5 V (VDDD)
13	DIGA_2 / Digital Output 2	3,3 V or 5 V (VDDD)
14	DIGA_3 / Digital Output 3	3,3 V or 5 V (VDDD)
15	DIGA_4 / Digital Output 4	3,3 V or 5 V (VDDD)
16	DIGA_5 / Digital Output 5	3,3 V or 5 V (VDDD)
17	DIGA_6 / Digital Output 6	3,3 V or 5 V (VDDD)
18	VDDDD	3,3 V or 5 V
19	VDDDA	Not Connected
20	AN_OUT1 / Analog Output 1	0 V…+5 V
21	AN_OUT2 / Analog Output 2	0 V…+5 V
22	AN_OUT3 / Analog Output 3	0 V…+5 V
23	AN_OUT4 / Analog Output 4	0 V…+5 V
24	GND	-
25	GND	-

Tab. 7 Analog/Digital IO - pin assignment

5.3   Display elements

The display elements are located on the front of the product.

Fig. 7 Display elements

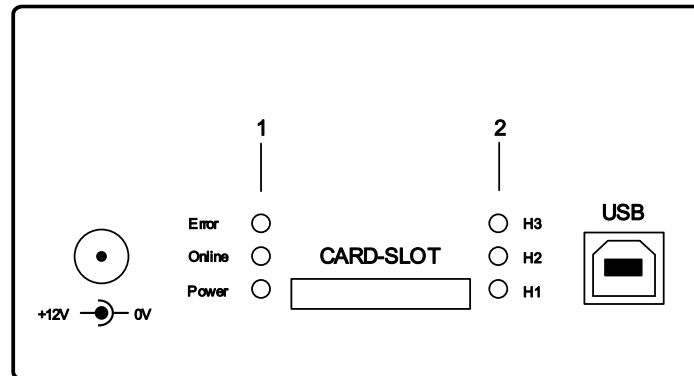1 – Status display 1   2 – Status display 2

Designation	Color	Status	Designation	Color	Status
Error	Red	Lights up -> error	H3	Yellow	Lights up -> measurement active
Online	Yellow	Lights up yellow -> OK	H2	Yellow	Optional
Power	Green	Lights up yellow -> OK	H1	Yellow	Optional

Tab. 8 Description of display elements

5.4 Operating modes

> The external power supply must be connected in each operating mode.
> Devices before V2.3 could be operated with USB supply voltage; this is no longer possible.

5.4.1 ECU-Mode

In "ECU mode", the Simulyzer simulates the ECU and supplies the sensors with voltage.

The data communication between the simulated ECU (SPI master) and the up to four sensors (SPI slaves) is displayed and recorded.
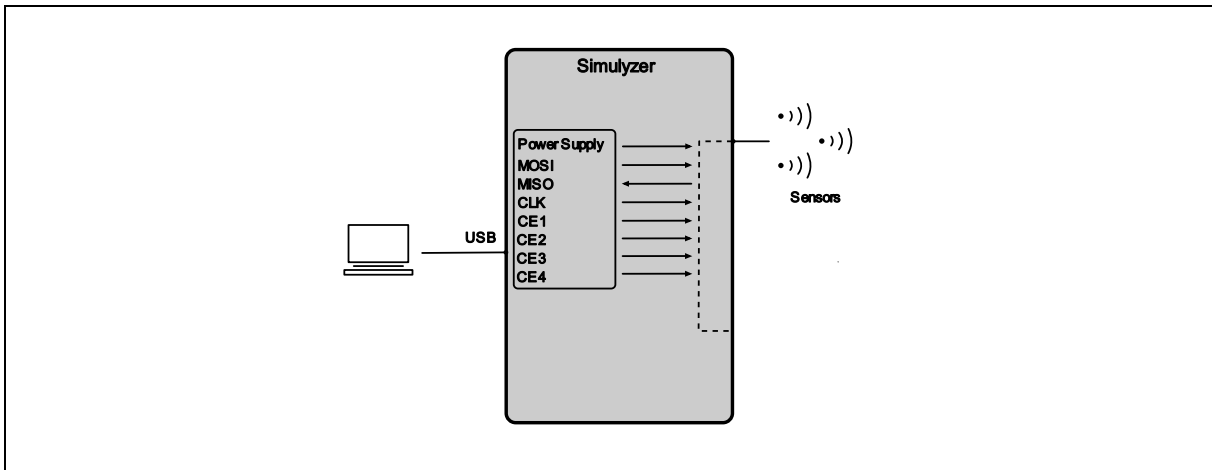
Fig. 8 ECU-Mode
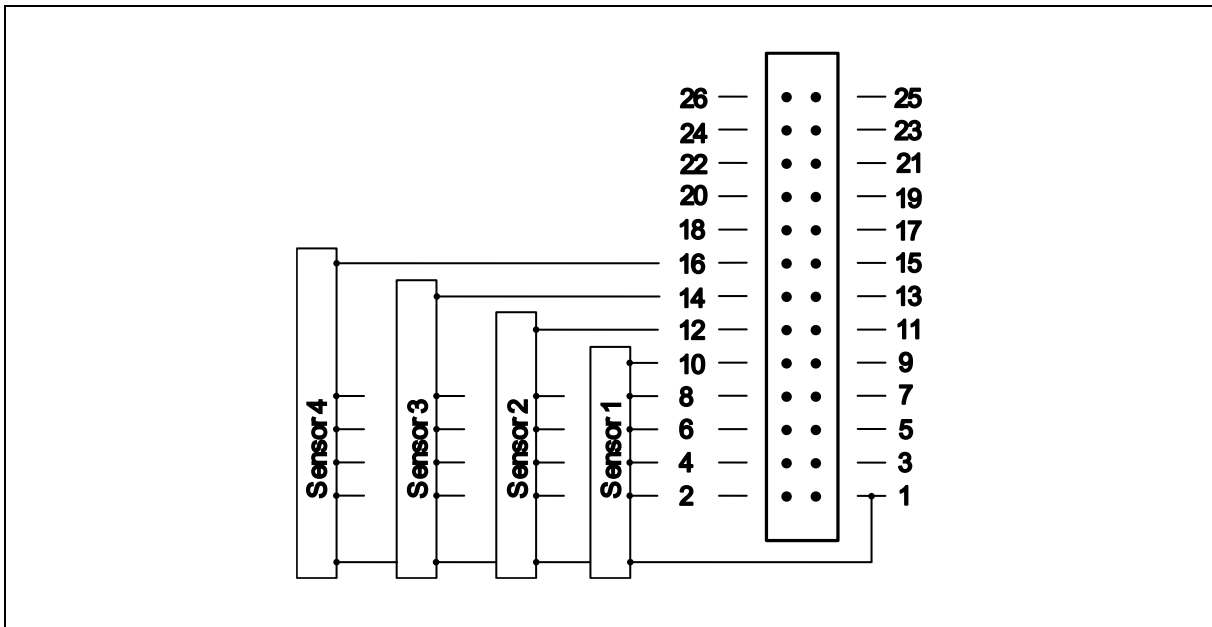
Abb. 9 ECU mode wiring

5.4.2 Sensor-Mode

In "Sensor mode", the Simulyzer simulates up to four sensors by generating corresponding data. The data communication between the ECU (SPI master) and the simulated sensors (SPI slaves) is displayed and recorded.
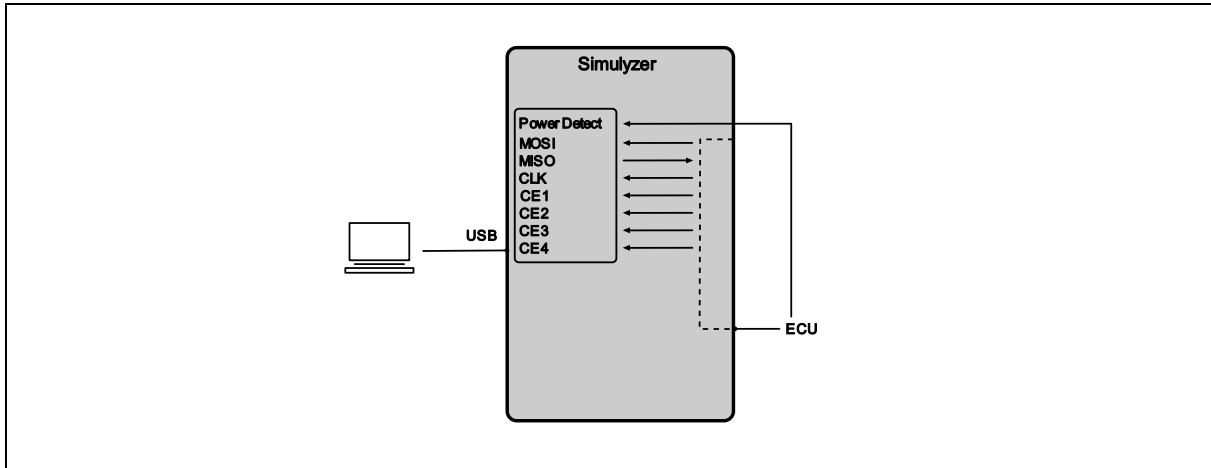
Fig. 10 Sensor-Mode
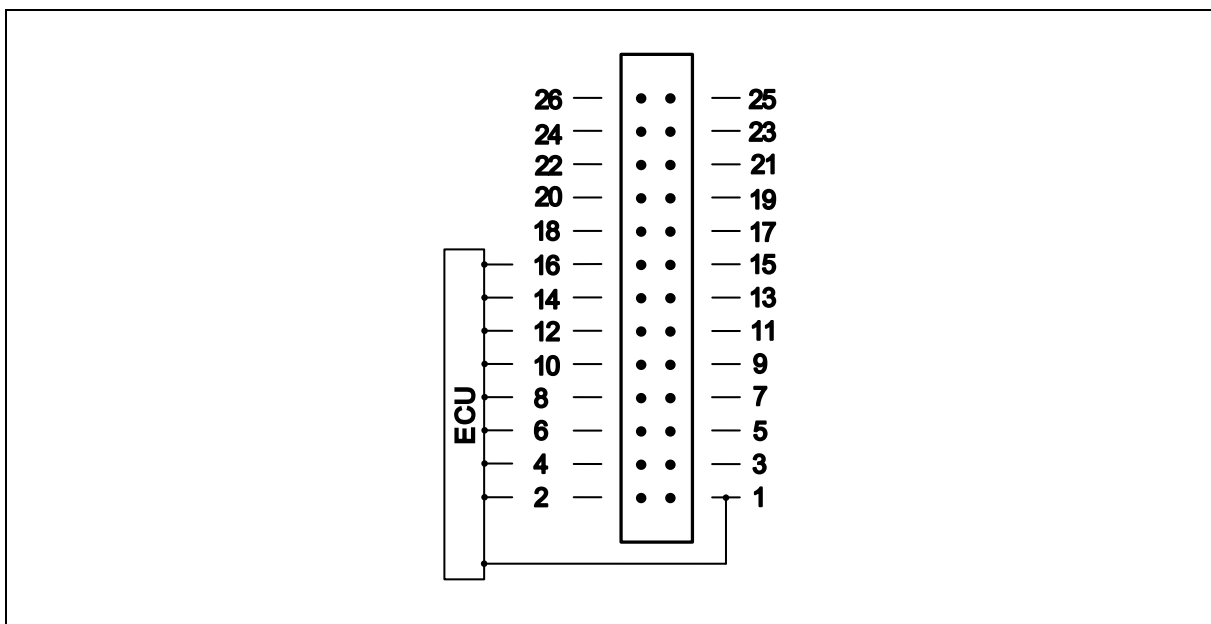
Fig. 11 Sensor mode wiring

5.4.3 Passiv-Mode

In "passive mode", the data communication between the ECU (SPI master) and the up to four sensors (SPI slaves) is displayed and recorded.
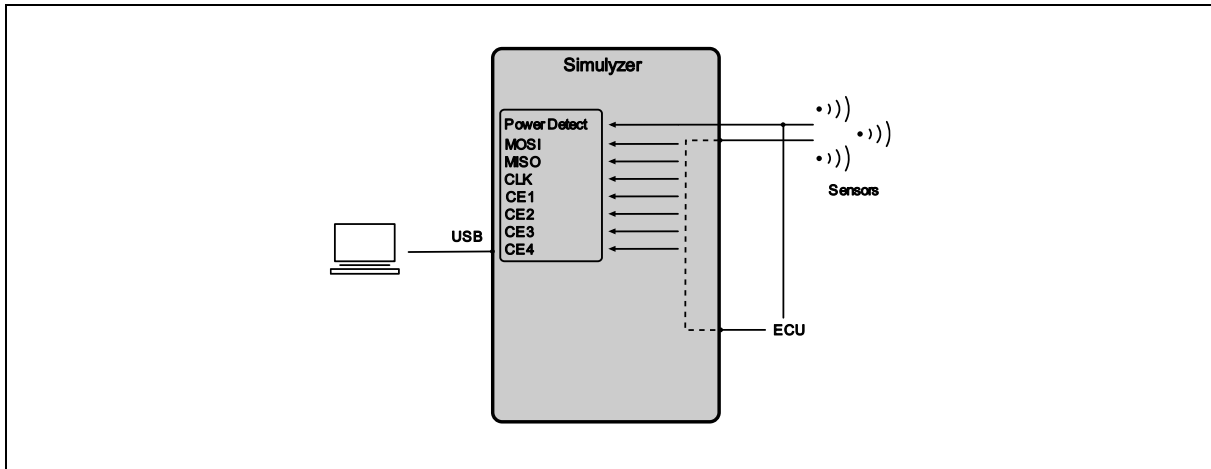
Fig. 12 Passiv-Mode
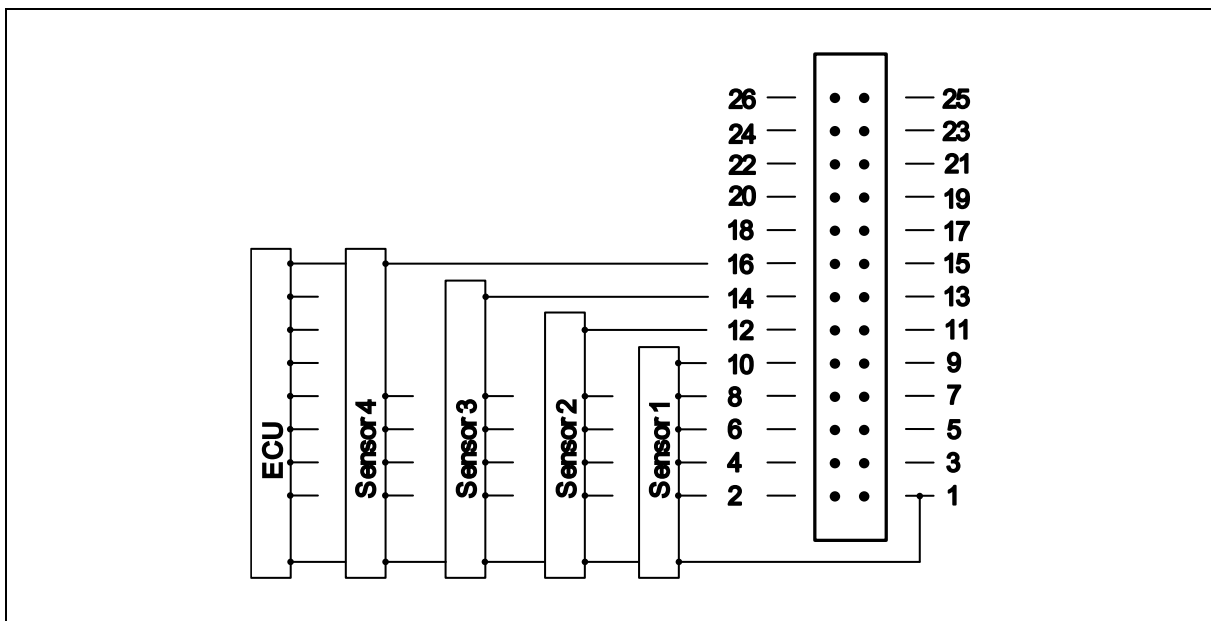

Fig. 13 Passive mode wiring

5.5 SPI-BUS parameters

Parameters	SPI-Simulyzer	LVDS-Version
Data length	8 … 64 bits per data packet	8 … 64 bits per data packet
SPI clock rate	10 Hz … 20MHz	10 Hz … 20MHz
Supply voltage of the external sensors (ECU mode)	1,2 V … 6,5 V (max. 200 mA)	2,5 V … 6,5 V (max. 200mA)

Tab. 9 SPI-BUS parameters

6   Technical data

6.1   Product

NOTICE	Applying external voltages greater than the maximum values specified here may destroy the Simulyzer!

Data	Value
General data	
Dimensions	165 x 105 x 60 mm
Housing material	Aluminum
Weight	1.1 kg
Operating temperature range	0°C to 40°C
Acceleration	Max. 3 g
Relative humidity	Max. 85% non-condensing
Electrical data	
Power consumption	Max. 1 A
Supply voltage for the external sensors in ECU mode	0 V … 6,5 V

Tab. 10 Technical data – product

6.2   Environmental conditions

The PSI5-Simulyzer is only suitable for use under laboratory conditions.

7 Measurement accuracies

Test condition: ambient temperature 20°C to 26°C

Time base

Measurement	Symbol	Type	Max	Unit	Note
Accuracy of the time base	$\Delta f/f$	±30	±50	ppm	-
Aging of the time base	$\Delta f/f_A$	±5		ppm/year	-
Temperature drift of the time base	$\Delta f/f_T$	±0.3	±0.7	ppm/°C	-

Measurements of the supply voltages (0 V … 6.5 V)

Measurement	Symbol	Type	Max	Unit	Note
Accuracy of the measured SPI voltage	U_{mea}	±0.8	±1.0	% of FSV 6,5 V	In range of 1 V … 6 V
Aging of the measured SPI voltages	U_{A-mea}		±0.1	%/year	In range of 1 V … 6 V
Resolution of the measured voltages		10 6,34		Bit mV/LSB	0 …1023

Generation of the supply voltages (0 V… 6.5 V)

Measurement	Symbol	Type	Max	Unit	Note
Accuracy of the generated voltage	U_{mea}	±0.8	±1.0	% of FSV 6,5V	In range of 1 V … 6 V
Aging of the generated voltages	U_{A-mea}		±0.1	% of FSV 6,5V / year	In range of 1 V … 6 V
Resolution of the generated voltages		8 25,39		Bit mV/LSB	0 … 255

Measurements of the 4x analog inputs (-10 V … +10 V, 100k ohm, 250k samples/s)

Measurement	Symbol	Type	Max	Unit	Note
Accuracy of the measured voltage	U_{mea}	±0.8	±1.0	% of FSV 20 V	
Aging of the measured voltage	U_{A-mea}		±0.05	%/year	
Resolution of the measured voltage		12 4.88		Bit mV/LSB	0 … 4095

Generation of the analog output voltage (0 V … +5 V)

Measurement	Symbol	Type	Max	Unit	Note
Accuracy of the generated voltage	U_{mea}	±0.8	±1.0	% of FSV 5 V	
Aging of the generated voltage	U_{A-mea}		±0.05	%/year	
Resolution of the generated voltage		12 1.22		Bit mV/LSB	0 … 4095

Tab. 11 Measurement accuracies

8   Transportation and storage

8.1   Transportation

⚠ CAUTION	**Risk of crushing by the product housing.** The Simulyzer may cause crushing injuries to the body and limbs if it falls over. ➡ Transport the Simulyzer safely at all times. ➡ Place Simulyzer on a flat surface. ➡ Ensure sufficient distance from falling edges.

The Simulyzer must be transported such that it is protected against impacts and falls.

8.2   Storage

The Simulyzer must be stored in dry condition.

9 Installation and commissioning

9.1 Installation

Place the Simulyzer on a flat surface, a sufficient distance away from falling edges.

9.2 Commissioning

⚠ CAUTION	**Risk of crushing by the product housing.** The Simulyzer may cause crushing injuries to the body and limbs if it falls over. ➡ Place Simulyzer on a flat surface. ➡ Ensure sufficient distance from falling edges.

NOTICE	The technical data in section 5.5 must be observed.

12 Assistance in the event of faults

Several potential faults can be remedied independently using the following table.

Fault	Cause	Remedy
Status display does not light up.	External power supply is not connected or fuse faulty.	Check power supply; send in Simulyzer if fuse is blown.
Status display 1 Online – status: off Power – status: lights up	Problems with the FPGA	Send in device
Status display 1 Online – status: lights up Power – status: lights up -> offline mode is displayed in the software.	Incorrect software downloaded or opened.	Download or open the right software from the website
Status display 1 Online – status: lights up Power – status: lights up -> device is not recognized.	Driver not installed.	Open Windows Device Manager and install driver.

Tab. 12 Troubleshooting and remedy

If the measures listed above do not remedy the fault, contact Seskion:

Tel.: +49 (0) 7 11 / 99 05 814
E-mail: support@seskion.de

13 Disposal

Individual components can be disposed of in the normal recycling process, taking into consideration the
relevant valid national regulations.

13.1 Recycling

The products can largely be recycled thanks to the high metal content. In order ensure optimal metal recovery, they must be disassembled into individual assemblies. Metals contained in the electrical and electronic assemblies can also be recovered by means of a special separation process.

13.2 Significant components

In essence, the Simulyzer comprises the following constituents:
- Steel, stainless steel, aluminum, copper, brass
- Plastics, insulating and composite materials
- Electronic components

Plastic parts of the products may contain flame retardants. Plastic parts are marked according to EN ISO 1043-1:2011 + A1:2016 and, if necessary, must be
recycled or disposed of separately according to the relevant statutory
provisions.

13.3 Packaging

Seskion packaging materials do not contain any problematic substances and can easily be recycled.
The following materials are used as packaging materials:
- Cardboard
- Styrofoam
- Bubble wrap
- Plastic packaging

13.4 Disposal by the manufacturer

Products manufactured by Seskion can be returned to Seskion for disposal. The products must be delivered in suitable packaging free domicile to the following address:

Seskion GmbH
Karlsruherstraße 11/1
70771 Leinfelden-Echterdingen, Germany

14 Appendix

14.1 Service address

Seskion GmbH
Karlsruherstraße 11/1
70771 Leinfelden-Echterdingen, Germany

E-mail: info@seskion.de
Telephone: +49 (0) 7 11 / 99 05 814

14.2 Spare and wearing parts

The Simulyzer does not have any spare and wearing parts.

14.3 Declaration of conformity

The declaration of conformity for the Simulyzer can be accessed at:

https://www.seskion.de/wp-content/uploads/2024/04/CE_Konform_SPI-Simulyzer.pdf