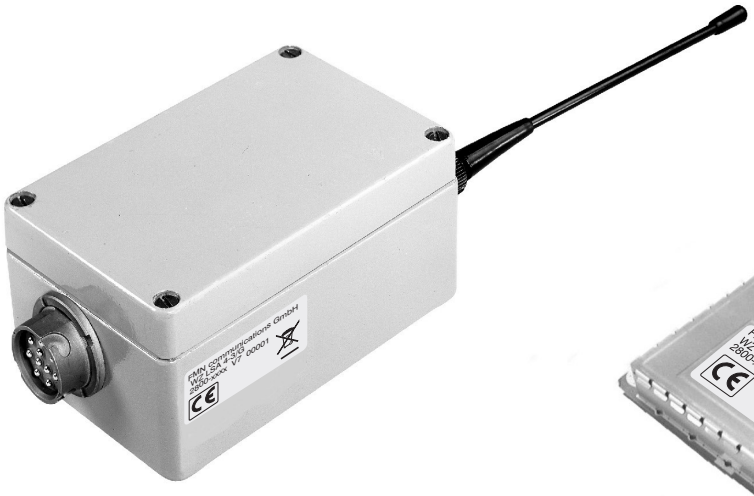
WZ LSA 4-3

User manual



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1. Safety precautions

ATTENTION!

- **Do not operate the units in rooms with explosive atmosphere, damp environments or rooms with aggressive air or increased electromagnetic requirements.**
- **Mind the instructions for putting the unit into operation.**
- **Fuse the unit at the voltage supply input UB_IN of the user interface by means of a fuse (min. 250 mA, max. 1 A).**
- **In case there is a danger of touching conductive parts due to improper use of the unit, the power supply has to be disconnected immediately.**
- **Do not open the unit, only permit repairs by the manufacturer.**

ESD protection measures
Comply with the ESD protection measures according to DIN EN 61340-5-1/2 when opening the unit (potential equalization between body and ground of the unit via high-value resistance (approx. 1 MOhm) e. g. over a usual wrist band.).

Read this user manual carefully to be ably to use the wealth of features of your new WZ LSA 4-3.
You can also find further information on our website http://www.fmncom.com.

2. General instructions

- **The compliance with the operating instructions and the instructions for putting the device into operation is also part of the intended use. Every other use is considered as not to be intended.**

  The manufacturer assumes no liability for damages resulting from such use.
- **All connection cables have to be equipped with an earth-connected shielding.**
  The antenna connection cable has to be equipped with a wave impedance of 50 Ohm.
- **The manufacturer recommends to mount devices in PCB version into a metal housing.**
- **Corresponding mechanisms are to be used for the detection of single bit errors during a data transmission (e. g. protocol with creation of check sum).**

Information regarding the used trademarks
Microsoft® and Windows® are registered trademarks of the Microsoft Corporation. All other trademarks and product names are trademarks or registered trademarks of the relevant companies.

3. General product description

3.1 Description of device-specific features

The unit WZ LSA 4-3 is a light signalling receiver with synthesizer which has been designed for data as well as for voice operation in the 4 m band. Because of its compactness, it is suitable for the integration into data systems where it depends on high data rates over greater distances.

Data rates up to 9600 bps are possible in connection with a GMSK modem and up to 2400 bps by means of a FFSK modem.

The unit complies with the requirements of the VDV guideline (Verband Deutscher Verkehrsunternehmen - Association of German transportation companies) and may be used for applications of this type anytime.

Numerous functions are part of the advanced features of the unit WZ LSA:

- Settings over an extended command interpreter by means of terminal program.
- 512 memories whose parameters are adjustable separately via software.
- Selecting the memories by means of hardware or software.
- Debounce time for hardware selection lines.
  The time can be adjusted via software.
- Displaying the analogue RSSI value (field strength value) via a terminal program.
  The measuring signal of the analogue RSSI value is available at the user interface.
- Displaying of error conditions of the unit.
  The time of the display is adjustable via software. (An LED with series resistor can e. g. be connected at the user interface. You get a detailed description in chapter 8.3 Information regarding troubleshooting.)
- File download from PC to the WZ LSA unit for setting the parameters.
- File upload from the WZ LSA unit to the PC for displaying the parameters by means of terminal program.
- File download from the PC to the WZ LSA unit for loading new WZ LSA software.

Adjustable parameters of the program software:

- Setting the output mode (to normal or extended).
- Setting the software handshakes to Xon / Xoff or NO.
- Displaying the input instructions by means of command echo.
- Setting the RS232 baud rate from 1.2 kBaud to 115 kBaud.
- Resetting the WZ LSA unit to factory setting.
- Setting the waiting time of the output ERROR of the user interface.

3.2 Designation of the functional elements

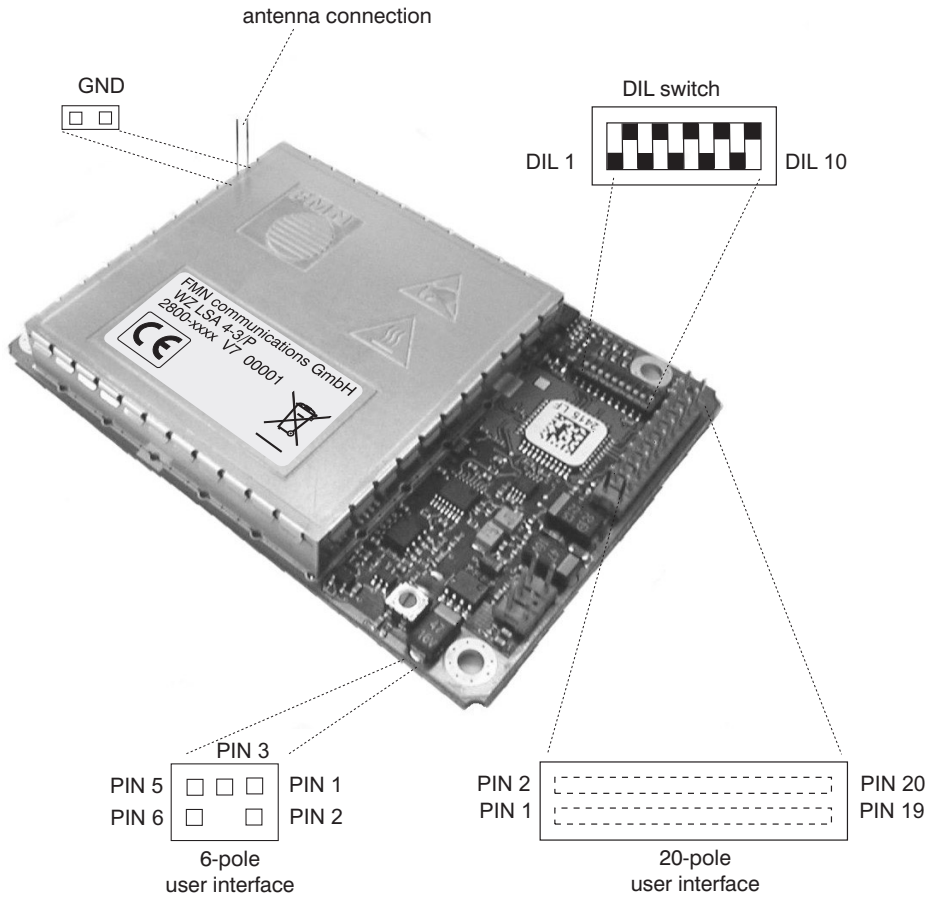


Figure 3-1: Designation of the functional elements (PCB version)

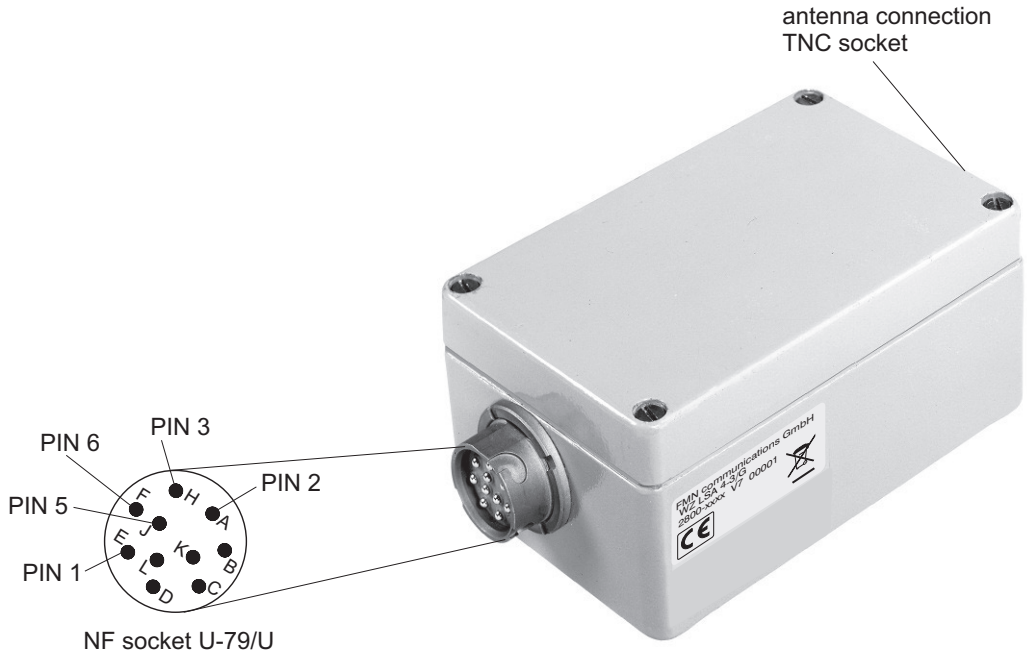


Figure 3-2: Designation of the 6-pole user interface (IP65 housing)

3.3 Interfaces at the unit

3.3.1 PIN configuration of the 6-pole user interface (IP65 housing)

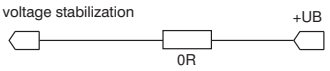
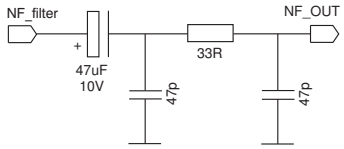
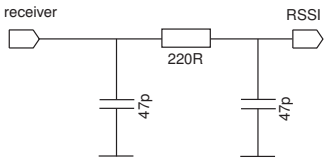
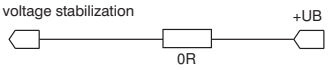
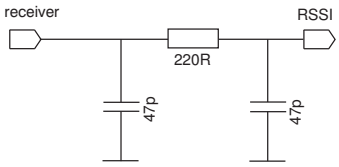
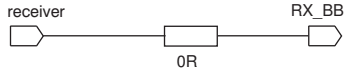
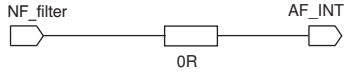
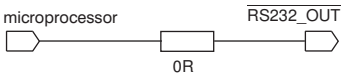
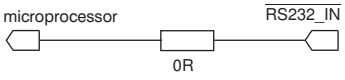
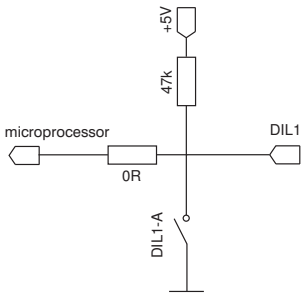
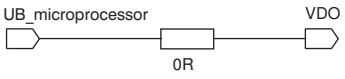
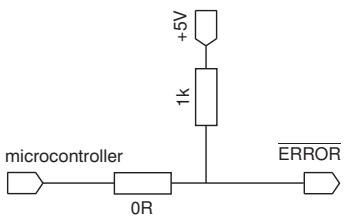
PIN	Assignment	Function	Interior wiring	Description	
1	UB_IN	Input		**Voltage supply 9 ... 15 VDC**	
2	**GND**	Ground		**Ground lead**	
3	**NF_OUT**	Output, analogue		**Demodulated NF signal** without DC voltage components (DC decoupled)	
4	not used				
5	**RSSI**	Output, analogue		**Signal strength:** the received field strength can be determined by measuring the analogue voltage.	
6	**GND**	Ground		**Ground lead**	

Table 3-1

3.3.2 PIN configuration of the 20-pole user interface (PCB version)

PIN	Assignment	Function	Interior wiring	Description	
1	**UB_IN**	Input		**Voltage supply**	
2	**GND**	Ground		**Ground lead**	
3	**RSSI**	Output, analogue		**Signal strength:** the received signal strength can be determined by measuring the analogue voltage.	
4	**RX_BB**	Output, analogue		Demodulated signal without filtering	
5	**AF_INT**	Output, analogue		**Data output with DC voltage components**	
6	reserved			not wired	
7	**DIL7**	Input, digital	see PIN 12	**Memory selection bit 6**, valency 2^6 see also chapter 4.2 Memory selection at the user interface	

PIN	Assignment	Function	Interior wiring	Description	
8	**DIL8**	Input, digital	see PIN 12	Memory selection bit 7, valency 2^7 see also chapter 4.2 Memory selection at the user interface	
9	**$\overline{\text{RS232\_OUT}}$**	Output, active HIGH		**Data output to the serial PC interface** log. level see table 3-1	1) 2)
10	**$\overline{\text{RS232\_IN}}$**	Input, active HIGH		**Data input from the serial PC interface** log. level see table 3-1	1) 3)
11	**DIL9**	Input, digital	see PIN 12	Memory selection bit 8, valency 2^8 see also chapter 4.2 Memory selection at the user interface	
12	**DIL1**	Input, digital		Memory selection bit 0, valency 2^0 LSB see also chapter 4.2 Memory selection at the user interface log. level see table 3-1	
13	**DIL2**	Input, digital	see PIN 12	Memory selection bit 1, valency 2^1 see also chapter 4.2 Memory selection at the user interface	
14	**DIL3**	Input, digital	see PIN 12	Memory selection bit 2, valency 2^2 see also chapter 4.2 Memory selection at the user interface	
15	**DIL4**	Input, digital	see PIN 12	Memory selection bit 3, valency 2^3 see also chapter 4.2 Memory selection at the user interface	
16	**DIL5**	Input, digital	see PIN 12	Memory selection bit 4, valency 2^4 see also chapter 4.2 Memory selection at the user interface	
17	**DIL6**	Input, digital	see PIN 12	Memory selection bit 5, valency 2^5 see also chapter 4.2 Memory selection at the user interface	
18	VDD	Output		Voltage supply for external modules signal level: 5 VDC ±5 % without load; 4.5 VDC ±5 % at max. load of 5 mA	
19	ERROR	Output, digital		This output conducts for approx. 2 seconds LOW level after faulty actions rest state: HIGH signal state: LOW for approx. 2 seconds	4)
20	**GND**	Ground		**Ground leads for all inputs and outputs**	

1) A level converter (e. g. MAX232) can be connected to these pins. A data exchange to the serial PC interface can be established.
2) Connect the output of the level converter to be connected with PIN 2 (RXD) at 9-pole interface or with PIN 3 (RXD) at 25-pole interface.
3) Connect the input of the level converter to be connected with PIN 3 (TXD) at 9-pole interface or with PIN 2 (TXD) at 25-pole interface.
4) The display time can be adjusted via software.

4. Putting the unit into operation

For connecting the interfaces, use chapters 3.2 Designation of the functional elements and 3.3 Interfaces at the unit. In chapter 11. Circuit diagrams, appropriate application circuits are given.

4.1 Initial state of the unit after starting

After starting the unit, the set memory corresponds to the selected switch position DIL1 ... DIL9.
The other parameters correspond to the delivery status of the unit.

The switch DIL0 is reserved and may not be changed.

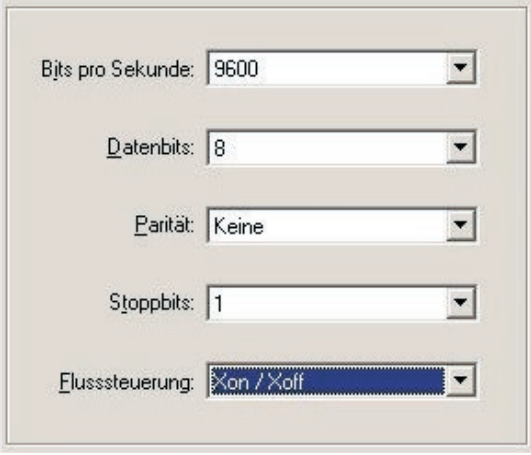
4.2 Memory selection at the user interface

The WZ LSA 4-3 has 512 memories (0 ... 511). The memory to be used for the operation is selected over the switch DIL1 ... DIL9 (see configuration list).

The selection of the memory can also be effected by the wiring of the inputs PIN 7, 8, 11 ... 17 with DIP switches or by the connection of the inputs with the outputs of a microcontroller. The switches DIL1 to DIL9 have to be set to the memory 511 (all DIP switches to OFF).

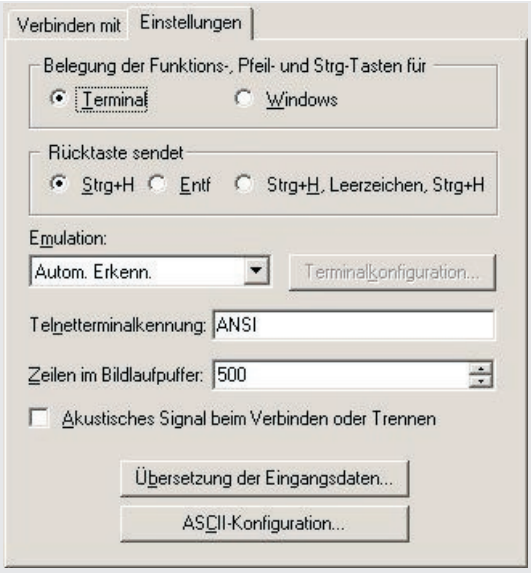
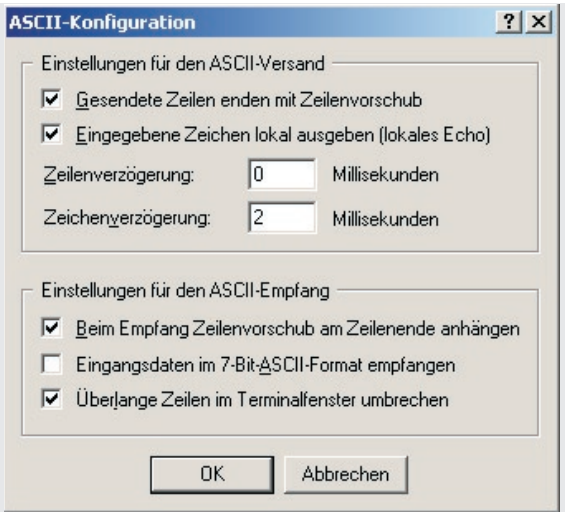
5. Settings at the terminal program

The parameterisation can be carried out with any terminal program.
The manufacturer recommends to use the program Hyperterminal from Microsoft® Windows.

1.	Start program Hyperterminal	
2.	Set the COM – Interface of the computer to which the WZ LSA unit is connected	
3.	Make the following settings Data rate: 9600 Baud Data bits: 8 Bit Parity: keine Stop bits: 1 Bit Flow control: Xon/ Xoff Xon: ASCII-HEX 0x11 [1)] Xoff: ASCII-HEX 0x13 [1)]	

1) The ASCII-HEX values can be changed via software.

Settings at the terminal program

4.	Click on the tab "Eigenschaften".	
5.	Select "Einstellungen".	
6.	Click on the button "ASCII-Konfiguration".	
7.	In the options window "ASCII-Konfiguration" select the following: "ASCII-Versand" (ASCII transmission) "- Gesendete Zeilen enden mit ... " "- Eingegebene Zeichen lokal ... " "- Zeilenverzögerung: 0 ms" "- Zeichenverzögerung: 2 ms" "ASCII-Empfang" (ASCII reception) "- Beim Empfang Zeilenvorschub ... " "- Überlange Zeilen im ... "	

After confirming the options, the terminal program is ready to send and receive.

When using another terminal program, the settings have to be made like explained in the example of the Hyperterminal program.

6. Settings at the unit

6.1 Entering software commands

Command syntax	Range of values	Description	Chapter
V		Displaying the version number	**6.1.1**
N	ASCII 16-digit	Displaying the serial number of the unit	**6.1.2**
EX	X = 0 ... 1	Echo of the commands (X = 0 -> no echo, X = 1 -> echo)	**6.1.3**
?EX	X = 0 ... 1	Output mode (X = 0 -> normal, X = 1 -> extended) (service command)	**6.1.4**
?SM	0 ... 511	Outputting current memory number (service command)	**6.1.5**, **6.1.6**
SMX	X = 0 ... 511	Software selection: selecting the memory and the appropriate RX channel	**6.1.6**
SM		Hardware selection: selection of the memories depends on the current hardware setting	**6.1.7**
A0	0 ... 1023	Output of the analogue measuring signal RSSI (input level)	**6.1.8**
XX	X = 0 ... 1	Xon / Xoff - protocol: X = 0 -> deactivating, X = 1 -> activating	**6.1.9**
F		Reset to factory setting	**6.1.10**

Table 6-1: Short overview command syntax

Please use the short overview for the following command explanations. A gradual execution of the given examples accelerates the process of learning all the commands quickly.

6.1.1 Displaying the version number

Example 1	**Input**	**Output** (example)
Displaying the name of the unit and the version	**V** +ENTER	WZ LSA 4-3 V2.00 01

Short description of the version:

WZ	**LSA 4-3**	**VX.XX**	**XX**
Product family	Model	Version number e. g. V2.00	Parameter version

6.1.2 Displaying the serial number of the unit

Example 1	**Input**	**Output** (example)
Displaying the serial number of the unit	**N** +ENTER	SN: 00000000SO000001

6.1.3 Displaying the command by means of echo

Example 1	**Input**	**Output**
Activating the command echo	**E**1 +ENTER	OK

An entered command is sent back to the PC interface by the unit for the control of the input.

Example 2	**Input**	**Output**
Deactivating the command echo	**E**0 +ENTER	E0 OK

6.1.4 Setting the output mode

Example 1	Input	Output
Activating the extended output mode see 8.2 Outputs in the extended output mode	**?E**1 +ENTER	OK

Example 2	Input	Output
Activating the normal output mode see 8.1 Outputs in normal output mode	**?E**0 +ENTER	OK

6.1.5 Displaying the number of the current memory

Example 1	Input	**Output** (example)
Setting the memory 2 by means of the selection switch (see 4.2 Memory selection at the user interface) displaying the memory number	**?SM** +ENTER	Memory: 00002 H

The displayed **H** in this output indicates that the current memory was set by means of hardware selection. In case of software selection, an **S** appears in the output.

6.1.6 Selecting a memory (software selection)

Example 1	Input	**Output** (example)
Selecting the memory 3	**SM**3 +ENTER	OK
As a check: Displaying the memory number	**?SM** +ENTER	Memory: 00003 S

6.1.7 Selecting the memory set by the hardware

see 4. Putting the unit into operation

Example 1	Input	**Output** (example)
Deactivating the software selection	**SM** +ENTER	OK
As a check: Displaying the memory number	**?SM** +ENTER	Memory: 00002 H

6.1.8 Displaying the analogue measuring signal RSSI (input level)

For determining the input level in dBm, proceed as follows:

Example 1	Input	**Output** (example)
Inquire the indicated value RSSI	**A**0 +ENTER	A0 RSSI = 00512

For determining the input level in dBm, proceed as follows:

1.	Calculate the RSSI voltage in volt RSSI voltage $= \frac{4{,}8\ \text{V}}{1023} *$ indicated value RSSI
2.	Determine the input level in dBm by means of figure 12-3: Typ. RSSI response over input level and temperature.

6.1.9 Setting software handshake

Example 1	Input	Output
Deactivating protocol Xon / Xoff (no protocol)	**X**0 +ENTER	OK

Example 2	Input	Output
Activating protocol Xon / Xoff	**X**1 +ENTER	OK

6.1.10 Resetting the unit to factory setting

Example 1	Input	Output
Setting the factory setting of the unit see 4.1 Initial state of the unit after starting	**F** +ENTER	OK

6.2 Factory setting

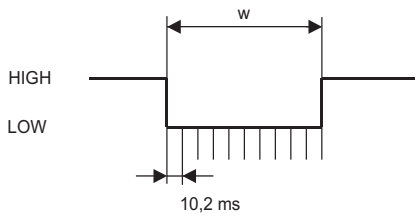
Setting	Default value	Single command
Xon / Xoff protocol	activated	**X**1
Command echo	deactivated	**E**0
Waiting time for error outputs (PIN 20 ERROR) Error output delay: w = x * 10,2 ms  	w = 1.3 s	Parameter change possible by the manufacturer
Debounce time delay selection line Changes in state at the selection lines < than x ms are not recognized as signal change.	x = 5.12 ms	Parameter change possible by the manufacturer
Output mode	normal	**?E**0

Table 6-2: Default values of the factory setting

7. Maintenance

The unit can be operated without maintenance.

8. Troubleshooting

8.1 Outputs in normal output mode

The WZ LSA unit is connected with the terminal program by means of a serial interface.

Output	Description
OK	Command is valid and was executed correctly
ERROR	Command is valid, but could not be executed correctly
CMD-ERROR	Command is invalid

Table 8-1: Output mode normal (“**?E**0“)

8.2 Outputs in extended output mode

The WZ LSA unit is connected with the terminal program by means of a serial interface.

	Input	Output
Activating the extended output mode	**?E**1 +ENTER	

Output	Range of values	Description
OK		Command is valid and was executed correctly
CMD-ERROR		Command is invalid
RX OK		Programming RX channel successful
ERROR XX	XX = 00 ... FF	Command is valid, but could not be executed correctly
RX ERROR XX	XX = 00 ... FF	Error at RX programming

Table 8-2: Output mode extended (“**?E**1“)
see 8.4 Explaining the error code in extended output mode

8.3 Information regarding troubleshooting

An LED with series resistor can be connected at the output ERROR (19) of the user interface for displaying error conditions. The output signal is LOW in case of an error.

Error description		Display	Remedy
The ERROR output is activated for 1.3 seconds (factory setting) [1].			
a	RX programming faulty	ERROR	see 9. Service and repair
b	Memory contains a faulty parameter	ERROR	see 9. Service and repair

[1] The operating time for error outputs can be set by means of parameters (factory setting 1.3 s).

8.4 Explaining the error code in extended output mode

For troubleshooting, inform the customer service of the manufacturer of the displayed output with the error code. The customer service will give you a specified instruction to clear the fault.

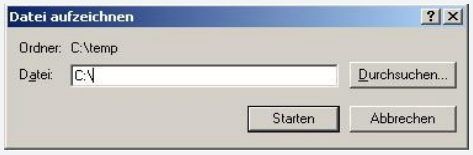
XX	**Meaning**	**Output ERROR** - LED
RS232 interface		
01	Communication error	on: active LOW [1)]
02	Communication error	on: active LOW [1)]
03	Communication error	on: active LOW [1)]
04	Communication error	on: active LOW [1)]
Frequency programming		
05	Error at frequency programming **Remedy:** Programm correct values	on: active LOW [1)]
Parameter memory		
0A	Error in the parameter memory	off
0B	Error in the parameter memory	off
0C	Error in the parameter memory	off
0D	Error in the parameter memory	off
0E	Error in the parameter memory	off
0F	Error in the parameter memory	off
10	Error in the parameter memory	off
11	Error in the parameter memory	off
12	Error in the parameter memory	off
Parameter memory		
16	Error in the parameter memory	on: active LOW [1)]
17	Error in the parameter memory	off
18	Parameter faulty	on: active LOW [1)]
Parameter memory		
1E	Memory in the parameter memory not found	on: active LOW [1)]
1F	Memory in the parameter memory not found Input value bigger than existing entries	off

Table 8-3: Short overview of error messages of the unit

[1)] The waiting time for error outputs (ERROR-LED) is adjustable by means of parameter (factory setting 1.3 s).

9. Service and repair

In case the message ERROR appears repeatedly, the manufacturer recommends to proceed as follows:

1.	Use options as described in chapter 5. Settings at the terminal program	
2.	In the menu Transmission in the hyperterminal, select the point „Text aufzeichnen“	
3.	Select text file or create new text file	 The content of the terminal window is registered in the text file after terminating the program.
4.	Activating the extended output mode **?E1** +ENTER	OK is displayed
5.	Process the commands of the points 6 to 26 step by step	
6.	**V** +ENTER	
7.	**N** +ENTER	
9.	**?SM** +ENTER	
13.	**Ui** +ENTER	
14.	**Ue0** +ENTER	
15.	**Ue1** +ENTER	
16.	**Ue2** +ENTER	
17.	**Ue3** +ENTER	
18.	**Ue4** +ENTER	
19.	**Ue5** +ENTER	
20.	**Ue6** +ENTER	
21.	**Ue7** +ENTER	
22.	**MD** +ENTER	
23.	**MR** +ENTER	
24.	**V** +ENTER	
25.	Provoking of the error messages that are appearing repeatedly.	
26.	**Send the text file to the customer service of the manufacturer.**	

The unit WZ LSA may only be repaired by the manufacturer.

In case the unit has a malfunction, please see chapter 8. Troubleshooting. In case the malfunction is not described, please contact the manufacturer and send him a short description of the malfunction. Please use the overview at the beginning of this chapter to specify the description.

Errors may only be removed by authorised specialists.

10. Technical data

10.1 Scope of delivery

- **unit WZ LSA 4-3**
- **configuration list**

If not given otherwise, the limits of the ETSI EN 300 113 and ETSI EN 301 489 apply.

HF modes: Simplex, semiduplex
Channel spacing: 20 kHz
Type of modulation: F1D, G1D, F2D, G2D

Interfaces:	Housing IP65	PCB version
Antenna connection:	TNC socket	2-pole SIL connector
Power supply:	LF socket U-79/U	6-pole SIL connector
LF/ RSSI output:	LF socket U-79/U	6-pole SIL connector
User interface:		20-pole SIL connector

HF channel setting: via DIL switch / RS232 interface
Memories: 512

Technical data general	Remarks	Min. value	Typical value	Max. value
Dimensions PCB version	L x W x H (in mm)		94 x 68 x 14 mm	
Dimensions housing version	L x W x H (in mm)		125 x 80 x 58 mm	
Weight PCB version			approx. 60 g	
Weight housing version			approx. 600 g	
Operating temperature		-25 °C		75 °C
Storage temperature		-40 °C		80 °C
Supply voltage		9 V	12.5 V	15 V
Frequency range		68.000 MHz		87.500 MHz
Frequency tolerance		-1.0 kHz		+1.0 kHz

Table 10-1: General technical data

10.2 Technical data WZ LSA 4-3

Technical data in general	Notes	Min. value	Typical value	Max. value
Sensitivity	Sensitivity BER 10^{-2}			
	Data	-102 dBm	-107 dBm	-110 dBm
Co-channel rejection		-12 dB	-3 dB	0 dB
Adjacent channel selection		70 dB	72 dB	75 dB
Blocking		84 dB	> 100 dB	
Spurious rejection		70 dB	> 100 dB	
Intermodulation rejection		65 dB	66 dB	
Spurious emission				-60 dBm
LF voltage	at 600 Ohm at -85 dBm HF level 2.1 kHz deviation			
	Data	-1.5 dBm	0.0 dBm	1.5 dBm
Distortion factor	at 600 Ohm at -85 dBm HF level 2.1 kHz deviation			
	Data		2.0 %	4.0 %
LF frequency response	at 600 Ohm relating to 1 kHz modulation frequency			
80 Hz		-1.0 dB	0.0 dB	1.0 dB
100 Hz		-1.0 dB	0.0 dB	1.0 dB
300 Hz		-1.0 dB	0.0 dB	1.0 dB
1 kHz		-1.0 dB	0.0 dB	1.0 dB
3 kHz		-5.5 dB	-4.0 dB	-2.0 dB
IF bandwidth			15 kHz	

Table 10-2: Technical data WZ LSA 4-3

11. Circuit diagrams

11.1 Standard wiring of the user interface

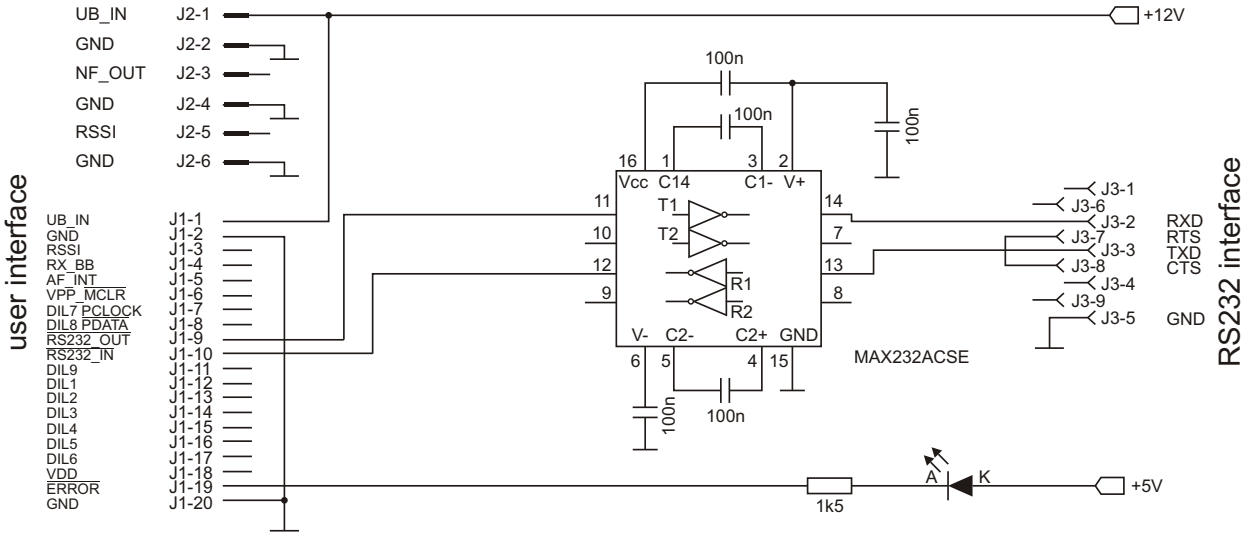


Figure 11-1

The user interface of the WZ LSA 4-3 is wired with a interface for the parameterisation of the software via a driver module MAX232. A light emitting diode LED with series resistor for the error indication is connected at the output ERROR.

11.2 User interface at data transmission

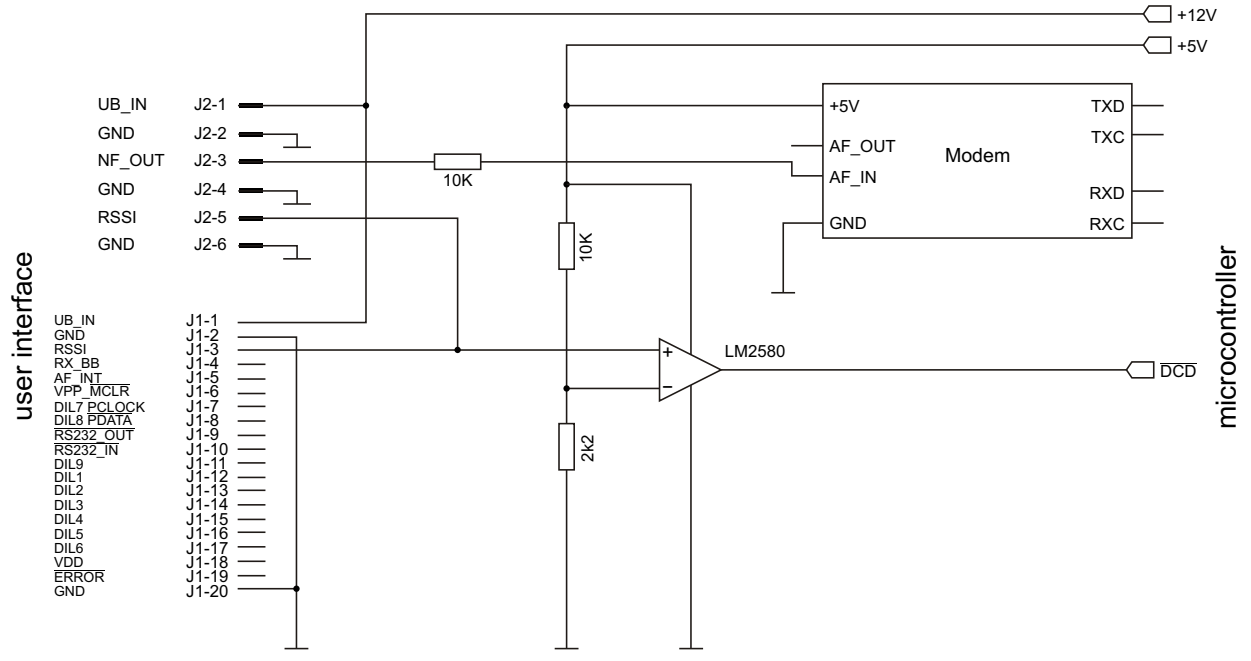


Figure 11-2

In addition to the standard wiring of the user interface of the WZ LSA 4-3, a modem with integrated FFSK or GMSK modulation can be connected at the data transmission. The modem is the interface to a microcontroller or to a computer.

11.3 User interface at speech transmission

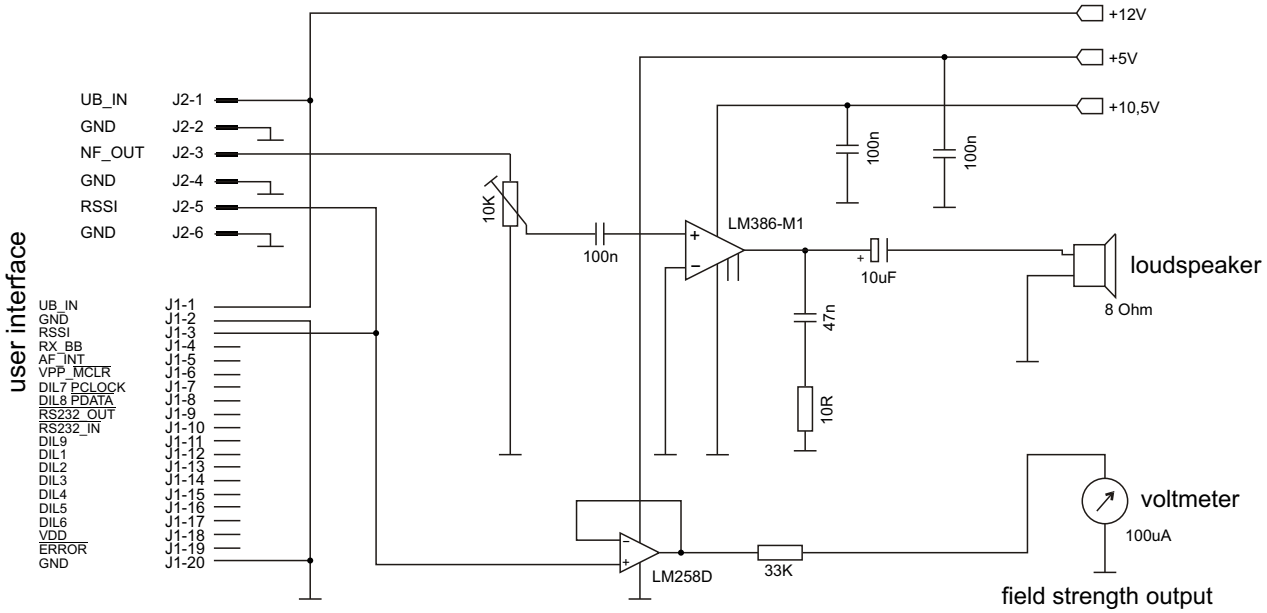


Figure 11-3

In addition to the standard wiring of the user interface of the WZ LSA 4-3, a loudspeaker can be connected for the speech transmission. A voltmeter at the output RSSI is used for measuring the field strength.

12. Time lapse diagrams of the unit

12.1 Typ. time response for receive mode as function of the received signal

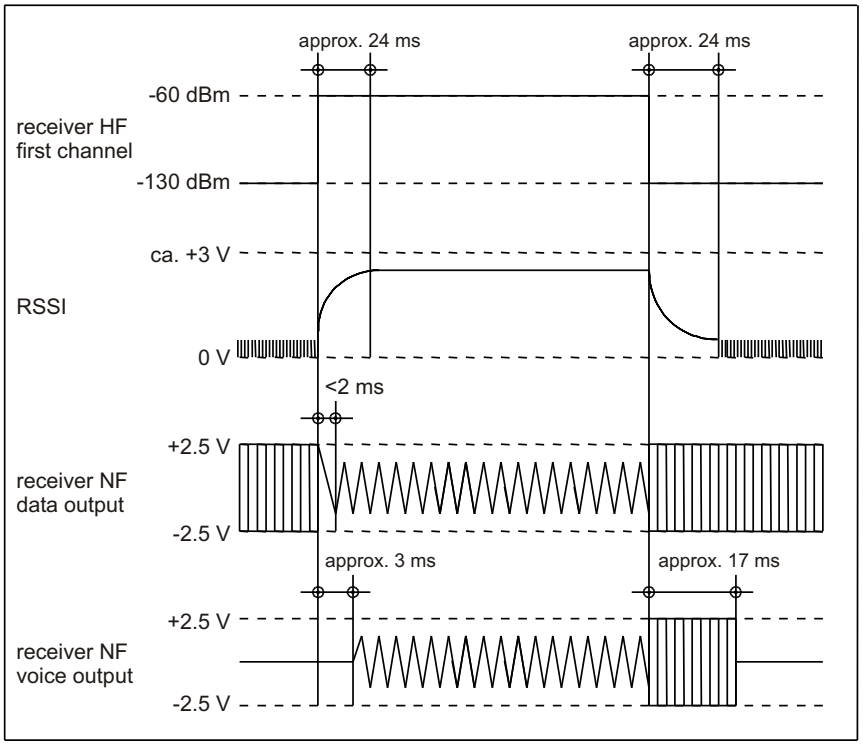


Figure 12-1

12.2 Typ. time response for receive mode as function of the channel

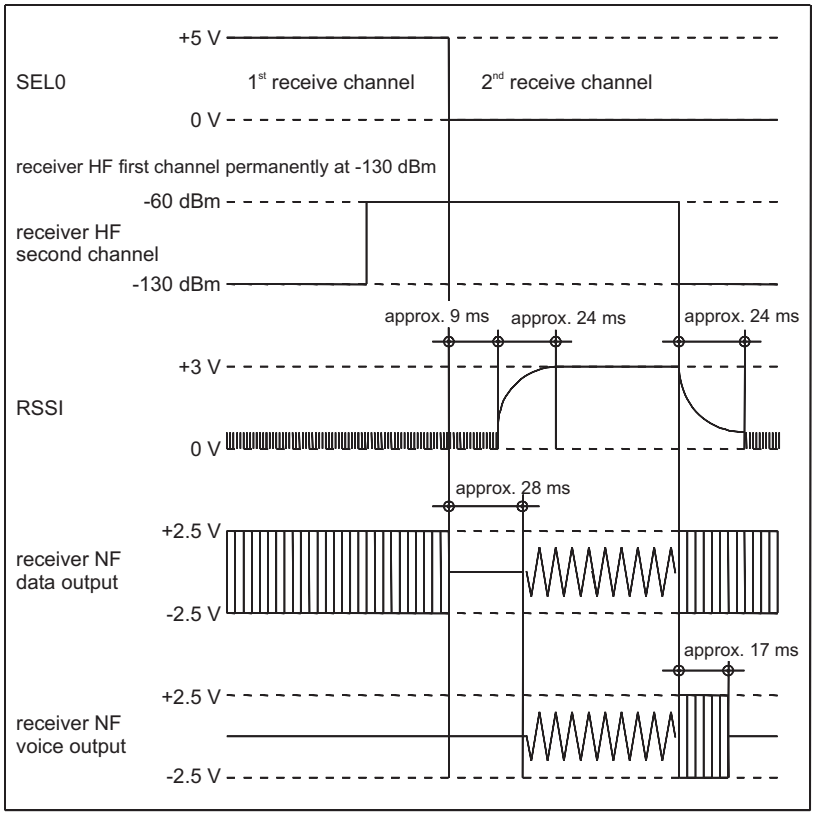


Figure 12-2

12.3 Typ. RSSI response over input level and temperature

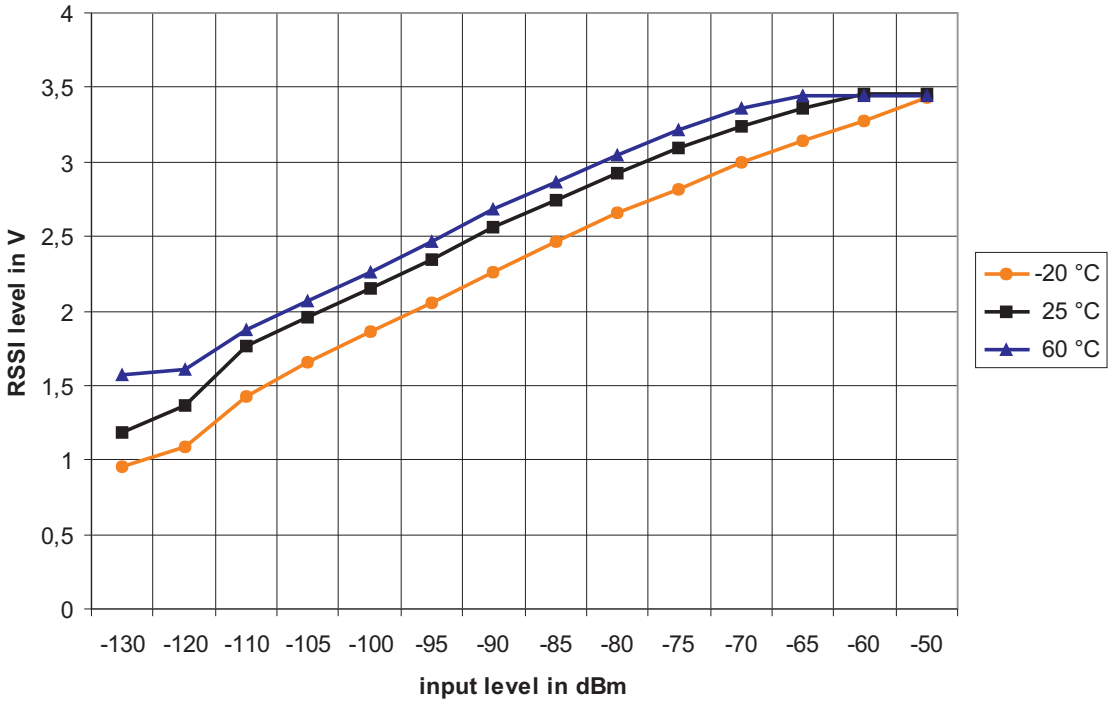


Figure 12-3

12.4 Typ. frequency response of the receiver

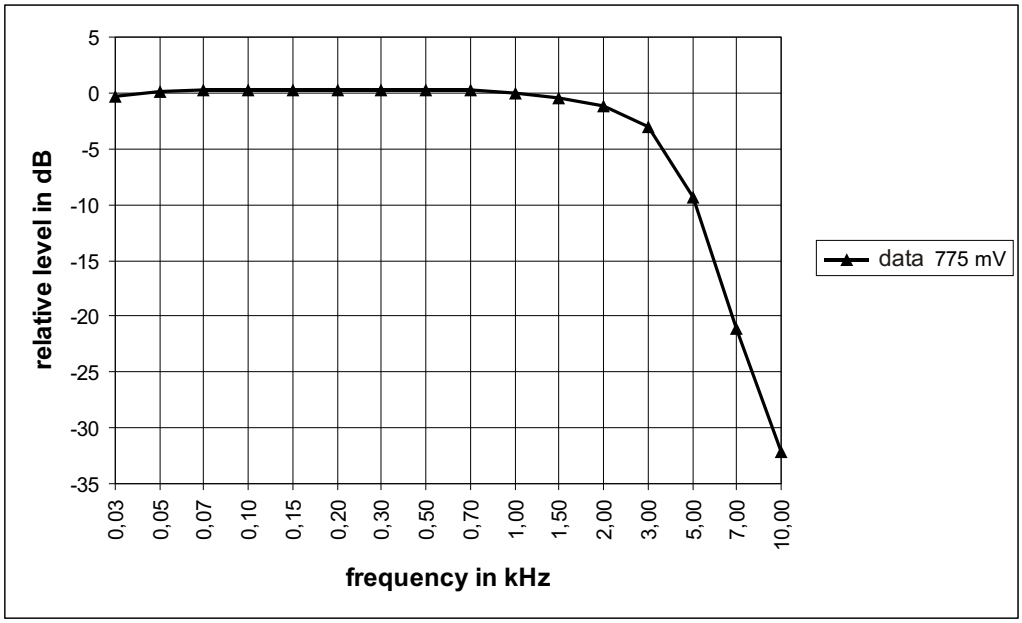


Figure 12-4: Frequency response at 2.4 kHz frequency deviation (at 775 mV_{eff} at data output)

13. Dimensions

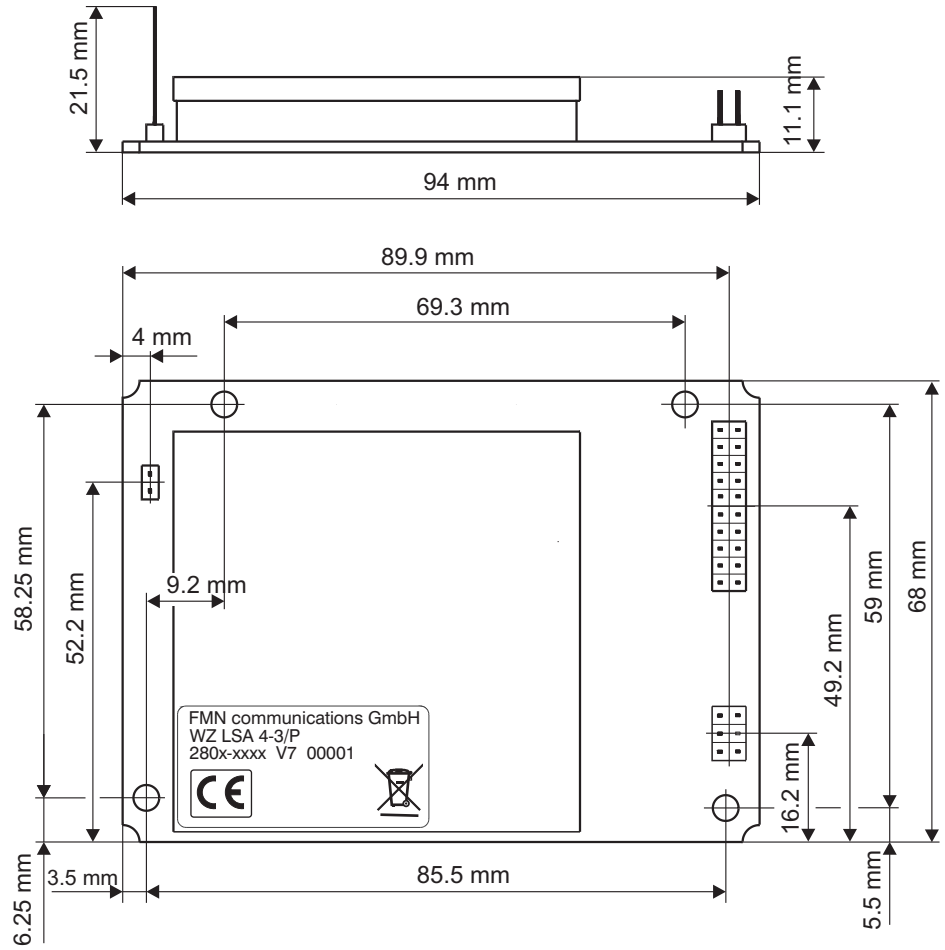


Figure 13-1: Dimensions PCB version

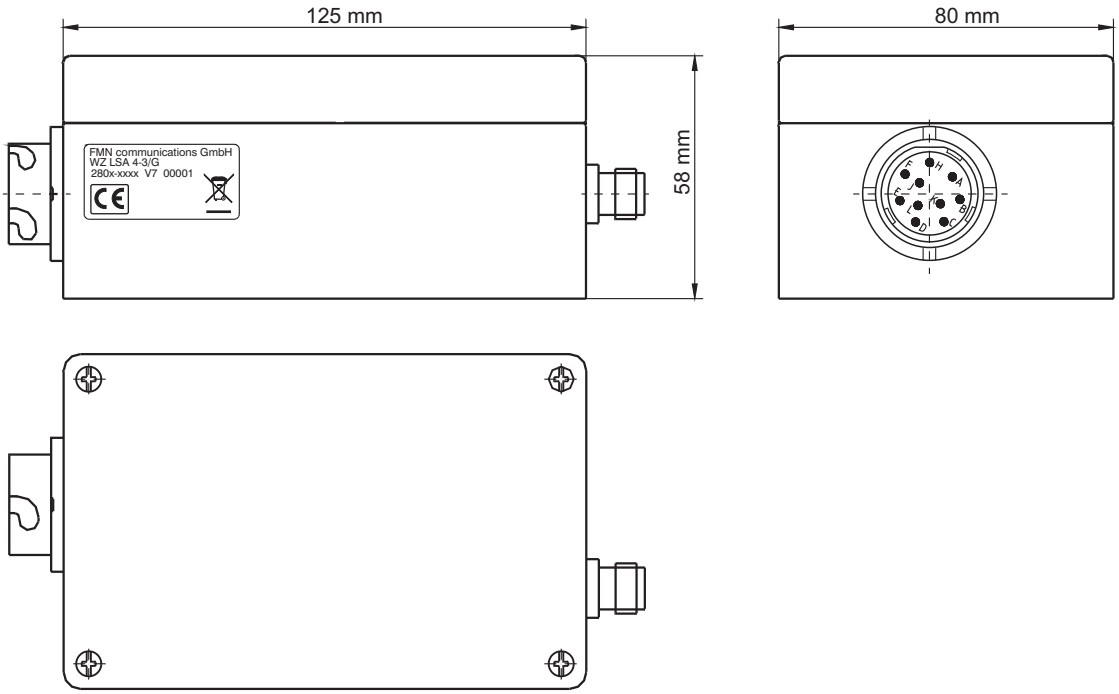


Figure 13-2: Dimensions in IP65 housing

14. Conformity

Herewith, the FMN communications GmbH declares that the unit WZ LSA 4-3 complies with the essential requirements and the other relevant provisions of the directive 1999/5/EG (R&TTE directive).

The unit WZ LSA 4-3 can be operated in the countries of the European Union (EU). Outside of the EU, the national regulations of the respective country apply.

The complete declaration of conformity can be downloaded in the Internet under http://www.fmncom.com.

15. Glossary

4 m band	Mobile radio 4 m band (private mobile, BOS radio, marine radio service) - 68 MHz - 87.5 MHz
ASCII	**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange
Download	Programmes or files are transferred to the radio unit during a download.
EEPROM	**E**lectrical **E**raseable **PROM**
ETS	**E**uropean **T**elecommunication **S**tandard
LED	**L**ight **E**mitting **D**iode
LSA	**L**ight **S**ignalling **R**eceiver
LSB	**L**east **S**ignificant **B**it
MSB	**M**ost **S**ignificant **B**it
RS232	**R**ecommanded **S**tandard **232 -** standardised serial interface
RSSI	**R**eceiver **S**ignal **S**trength **I**ndicator - acquisition of the radio receiving field strength
RX	Receiver
RXD	**R**eceive **D**ata
Simplex	Unidirectional data transmission (from transmitter to receiver)
Software handshake	Communication protocol that controls the data flow over the serial interface between computer and modem. Control characters (**Xon** ASCII-HEX 0x11 / **Xoff** ASCII-HEX 0x13) that are added to the data stream are used to stop or start the data flow.
Squelch	Controller for muting
TXD	**T**ransmit **D**ata
Upload	Programmes or files are transferred to the computer during an upload.
VCO	**V**oltage **C**ontrolled **O**scillator
VDV	**V**erband **D**eutscher **V**erkehrsunternehmen (Association of German transportation companies)

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