

User Guide

GenLoc OEM AOB



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The main modifications of this document compared to the previous version are easily identifiable on the screen by the blue color of the text.

TABLE OF CONTENTS

GENLOC OEM AOB..... 1

PRESENTATION..... 7

WARNING 8

COPYRIGHT 9

1 REFERENCES 10

1.1 REFERRED DOCUMENTS 10

1.2 ABBREVIATIONS 10

1.3 SYMBOLS..... 12

2 GENERAL PRESENTATION..... 13

2.1 DESCRIPTION..... 13

2.2 CHARACTERISTICS AND SERVICES 14

2.3 FUNCTIONAL DESCRIPTION..... 16

 2.3.1 Architecture 16

 2.3.2 RF characteristics 16

 2.3.3 Internal processor 17

 2.3.3.1 EGM presentation..... 17

 2.3.3.2 EGM Architecture 17

 2.3.4 Firmware 18

 2.3.4.1 Without library..... 18

 2.3.4.2 External mode 18

 2.3.4.3 Autonomous mode Application ERCO & GENER EaseLoc-01..... 18

 2.3.4.4 Owner application..... 18

2.4 CE CONFORMITY..... 18

2.5 ROHS STANDARDS 18

3 INTERFACES..... 19

3.1 DIL CONNECTOR..... 19

 3.1.1 Pins assignation..... 20

 3.1.2 Pins description..... 21

3.2 POWER SUPPLY 23

 3.2.1 General description 23

 3.2.2 Protections 24

 3.2.3 +VBAT..... 25

3.3 BOOT SIGNAL 26

3.4 CDE_GPS-RX..... 27

3.5 ON/OFF GPS 28

3.6 GPIO0 - GPIO6 29

3.7 SPI AUXILIARY BUS (SPI_CLK, SPI_IO AND SPI_AUX) 30

3.8 AUDIO INTERFACE 32

 3.8.1 Microphone MIC2+ and MIC2- 32

 3.8.2 Loudspeaker SPK2+ and SPK2- 33

 3.8.3 Buzzer outputs 35

3.9 ~RESET SIGNAL 36

 3.9.1 General presentation 36

 3.9.2 RESET sequence 38

3.10 WATCHDOG 38

 3.10.1 WDI signal 38

 3.10.2 ~WDO signal 39

 3.10.3 Scheme of the watchdog 40

3.11 SIM CARD INTERFACE 41

 3.11.1 Internal SIM card interface 41

 3.11.2 External SIM card interface 41

3.12 FLASH_LED 44

3.13 SERIAL LINK (UART1) 45

3.14 AUXILIARY SERIAL LINK (~RXD2 AND ~TXD2) 46

3.15 EXTERNAL INTERRUPT (~INTR) 47

3.16 REAL TIME CLOCK SUPPLY (VCC_RTC) 48

 3.16.1 Using a battery 49

 3.16.2 Using a lithium battery 49

3.17 ADC_IN 49

3.18 VCC OUTPUT (VCC_3V3) 50

3.19 ~ON/OFF GSM 51

3.20 AUXILIARY ADC (AUXV0) 52

3.21 GPS PINS 53

 3.21.1 GPS serial interface série (~TXD and ~RXD) 53

 3.21.2 Indication of the GPS activity status (TIMEPULSE) 54

4 RADIO DESIGN 55

4.1 ANTENNAS CHARACTERISTICS 55

 4.1.1 GSM/DCS Characteristics 55

 4.1.1.1 Frequency band 55

 4.1.1.2 RF Functioning 55

 4.1.1.3 GSM external antenna 56

 4.1.2 GPS characteristics 56

 4.1.2.1 GPS functioning 56

 4.1.2.2 GPS external antenna 57

4.2 RECOMMENDATIONS 58

4.3 CONNECTIONS 58

5 TECHNICAL SPECIFICATIONS..... 61

5.1 ENVIRONMENTAL CHARACTERISTICS..... 61

5.2 MECHANICAL SPECIFICATIONS..... 61

 5.2.1 Mechanical characteristics..... 61

 5.2.2 Mechanical diagram..... 62

5.3 ELECTRICAL CHARACTERISTICS..... 62

 5.3.1 Power supply 62

6 USING THE MODULE..... 64

6.1 GUIDE FOR THE CONCEPTION OF YOUR APPLICATION..... 64

 6.1.1 Hardware recommendations..... 64

 6.1.2 Antennas..... 65

 6.1.3 Minimum Hardware interface to start..... 65

6.2 USING THE GENLOC OEM AOB WITH A TERMINAL EMULATOR SOFTWARE 65

 6.2.1 Installation of a Terminal emulator software..... 66

 6.2.2 Example of AT commands..... 66

6.3 LEDS 67

 6.3.1 GSM led 67

 6.3.1.1 Without library..... 67

 6.3.1.2 With EGM standard library 67

 6.3.1.3 The application ERCO & GENER EaseLoc-01 67

 6.3.1.4 The owner application 67

 6.3.2 GPS led..... 67

6.4 CHECKING THE QUALITY OF THE GSM RECEPTION SIGNAL..... 67

6.6 CHECKING THE MODEM REGISTRATION ON THE GSM NETWORK..... 69

6.7 READING A CURRENT POSITION GIVEN BY GPS 70

6.8 GPS CONFIGURATION 72

 6.8.1 Powering on the GPS module 72

6.9 MANAGEMENT OF LOGICAL INPUTS/OUTPUTS 72

 6.9.1 Choosing the direction..... 73

 6.9.2 Management of the inputs 73

 6.9.3 Management of the outputs..... 74

6.10 MANAGEMENT OF THE ANALOG INPUTS 74

6.11 MAIN AT COMMANDS (HAYES) 74

6.12 TURNING THE DEVICE OFF..... 76

6.13 MODEM UPDATING PROCEDURE 76

7 TROUBLE SHOOTING 77

7.1 PROBLEM OF COMMUNICATION BETWEEN THE MODEM AND THE RS232 LINK (V24)..... 77

7.2 "ERROR" MESSAGE 78

7.3 "NO CARRIER" MESSAGE 79

8 STANDARDS/CONFORMITIES 80

9 SECURITY RECOMMENDATIONS 81

9.1 GENERAL SECURITY 81

9.2 SECURITY IN A VEHICLE 82

9.3 CARE AND MAINTENANCE 82

9.4 YOUR RESPONSIBILITY 82

10 RECOMMENDED ACCESSORIES 83

11 CLIENT SUPPORT 83

Presentation

Entirely dedicated to geo-localization and embedded data services, the modem GenLoc OEM AOB (Application On Board) combines both GSM/GPRS and GPS functions in a compact Socket board.

The GPS data can be transmitted by SMS or data GSM/GPRS communication.

This product includes the GPS function 50-channel. The high sensitivity GPS solution ensures the data collection in difficult environments.

The modem is Quad-Bands (850/900/1800/1900 MHz) and GSM/GPRS Class 10.

The GenLoc OEM AOB provides TCP / IP protocols. Moreover, the EGM development tool (Erco & Gener Middleware) allows the development of supplementary and personalized embedded applications.

The Socket Modem GenLoc OEM AOB has 3 operating modes:

- External mode (standard): The driving is made by an external application. The modem is used with AT commands (see EG_EGM_CL_xxx_yy of ERCO & GENER).
- Autonomous mode (optional): Once configured, the modem is autonomous; it cyclically records the positions and transmits them automatically to the client's application via different services: SMS, GSM Data, TCP socket GPRS (see EG_EaseLoc_CL_xxx_yy of ERCO & GENER).
Current development, contact us.
- Specific development Mode: the EGM development tool allows the development of supplementary and personalized applications. For further information concerning the tools and the training, please contact our sales department.

The GenLoc OEM AOB provides GPIOs allowing the creation of embedded telematic solutions with high added value.

This document describes and indicates the specificities of the GenLoc OEM AOB. It also contains the directives for the conception of the application and the recommendations for its use.

For more information concerning this document, ERCO & GENER puts at your disposal the following elements:

- Commands List
 - External mode EG_EGM_CL_xxx_yy
 - Autonomous mode EG_EaseLoc_01_xxx_yy
- Application Note EG_GenLocOem_1008_AN_xxx_yy
- Release Note EG_GenLocOem_1008_RL_xxx_yy
- Client support (Hot-Line)

Warning

- Erco&Gener advises to read carefully all the documents concerning the products GenLoc OEM AOB (User Guide, Application Notes, Command List).

 - ERCO & GENER cannot be held responsible for:
 - The problems due to an inappropriate use of the GenLoc OEM AOB.
 - The problems due to a wrong configuration
 - The problems due to a wrong use of an embedded software application developed and supplied by a third party.
 - The dysfunctions due to the absence or a bad coverage of the GSM, GPRS and GPS networks.
 - The dysfunctions if the product is used for the watching of physical persons where human life is engaged.

 - ERCO & GENER reserves the right to modify the functions of its products "GenLoc OEM AOB" and "EaseLoc" without previous notice.
-
- For any functioning, when the GenLoc OEM AOB is integrated inside a casing, this casing must be closed.
 - For any functioning, the casing must be closed.
 - No internal part can be repaired by the user. The **GenLoc OEM AOB** must be returned to the factory for any repair.
 - The **GenLoc OEM AOB** must be placed in a normally ventilated area, out of sources of heat.
 - The **GenLoc OEM AOB** must not be connected directly to the mains supply; a voltage adapter must be used.

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1 References

1.1 Referred documents

Commands List of

The standard library of ERCO & GENER:	EG_EGM_CL_xxx_yy
The embedded application EaseLoc of ERCO & GENER:	EG_EaseLoc_01_CL_xxx_yy
Application Notes GenLoc OEM AOB of ERCO & GENER:	EG_GenlocOEM_1008_AN_xxx_yy

GSM reference documents:

- GSM 07.05.
- GSM 07.07.

1.2 Abbreviations

Abbreviations Definition

AC	Alternative Current
ACM	Accumulated Call Meter
AT	Attention (prefix for modem commands)
BTS	Base Transceiver Station
CLK	Clock
CMOS	Complementary Metal Oxide Semiconductor
CS	Coding Scheme
CTS	Clear To Send
dB	Decibel
dBc	Decibel relative to the Carrier power
dB_i	Decibel relative to an Isotropic radiator
dB_m	Decibel relative to one milliwatt
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
DTR	Data Terminal Ready
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharges
ETSI	European Telecommunications Standards Institute
FIT	Series of connectors (micro-FIT)
FR	Full Rate
FTA	Full Type Approval
GCF	Global Certification Forum
GND	GrouND
GPIO	General Purpose Input Output

GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
HR	Half Rate
I	Input
IEC	International Electrotechnical Commission
IMEI	International Mobile Equipment Identification
I/O	Input / Output
LED	Light Emitting Diode
MAX	MAXimum
ME	Mobile Equipment
MIC	MICrophone
Micro FIT	Family of connectors from Molex
MIN	MINimum
MNP	Microcom Networking Protocol
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NOM	NOMinal
O	Output
Pa	Pascal (for speaker sound pressure measurements)
PBCCH	Packet Broadcast Control Channel
PC	Personal Computer
PCL	Power Control Level
PDP	Packet Data Protocol
PIN	Personal Identity Number
PLMN	Public Land Mobile Network
PUK	Personal Unblocking Key
RF	Radio Frequency
RFI	Radio Frequency Interference
RI	Ring Indicator
RMS	Root Mean Square
RTS	Request To Send
RX	Receive
SIM	Subscriber Identification Module
SMA	SubMiniature version A RF connector
SMS	Short Message Service
SNR	Signal-to-Noise Ratio
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level
SPK	SpeaKer
SRAM	Static RAM
TCP/IP	Transmission Control Protocol / Internet Protocol
TDMA	Time Division Multiple Access
TU	Typical Urban fading profile
TUHigh	Typical Urban, High speed fading profile
TX	Transmit
TYP	TYPical
UTC	Universal Time Clock
VSWR	Voltage Stationary Wave Ratio

1.3 Symbols

The following symbols are used to highlight the important information in the guide.



A symbol for the essential information concerning the module integration and performance.

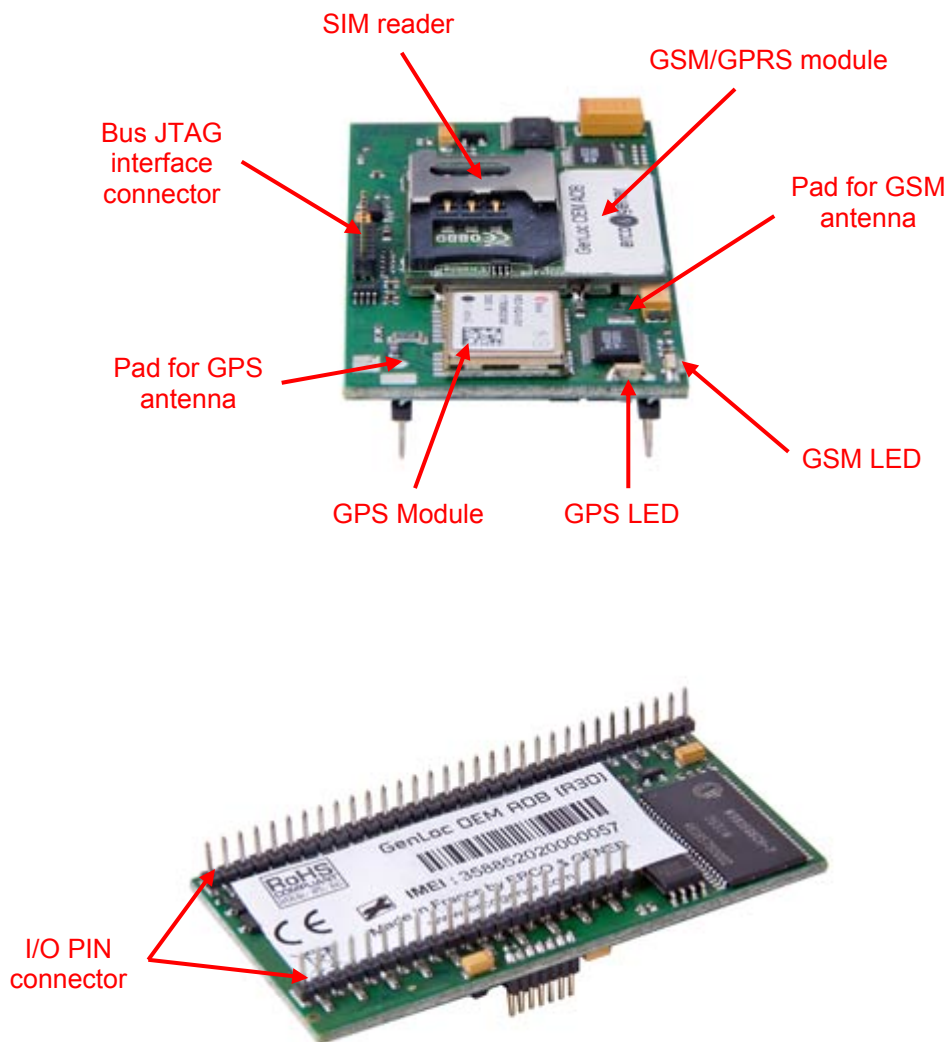


A warning symbol indicates the actions that could harm or damage the module

2 General presentation

2.1 Description

Description of the GenLoc OEM AOB, below:



2.2 Characteristics and Services

The GenLoc OEM AOB is:

- A Socket Modem GSM/GPRS Class 10 aimed to the transmission of binary data in asynchronous, SMS and voice.

- A module GPS dedicated to position tracking.

The available characteristics and services are summarized in the table below.

GSM Functions
- E-GSM Quad-Bands 850/900/1800/1900 MHz
- ETSI GSM Phase 2+ Class 4 (2W @ 850 / 900 MHz) Class 1 (1W @ 1800 / 1900 MHz)
- SIM Toolkit Release 99
VOICE Functions
- Voice (GSM mode)
- Telephony, Emergency call 112
- Full Rate, Enhanced Full Rate, Half Rate and AMR (FR/EFR/HF/AMR)
- Echo cancelation and noise reduction
- Full Duplex Free-hand
DATA Functions
- GPRS Class 10 (Up to 4Rx / 2Tx)
- PBCCH/PCCCH supported, Coding scheme : CS1 to CS4
- Library TCP/IP (PPP, TCP Socket, UDP Socket*, FTP, POP3, SMTP*)
- Asynchronous data circuit, transparent and non-transparent 9600 (Standard) at 14400bds (depending on network)
- SMS Text, PDU, point to point MT/MO and SMS Cell Broadcast
GPS Functions
- Civil frequency L1 (1575,42MHz)
- Receiver : 50 channels
- Precision : 2.5m CEP (DGPS 2m CEP)
- High sensitivity : -160dB
- Protocols : NMEA-0183, UBX Binary
- Compatible : A-GPS and GALILEO

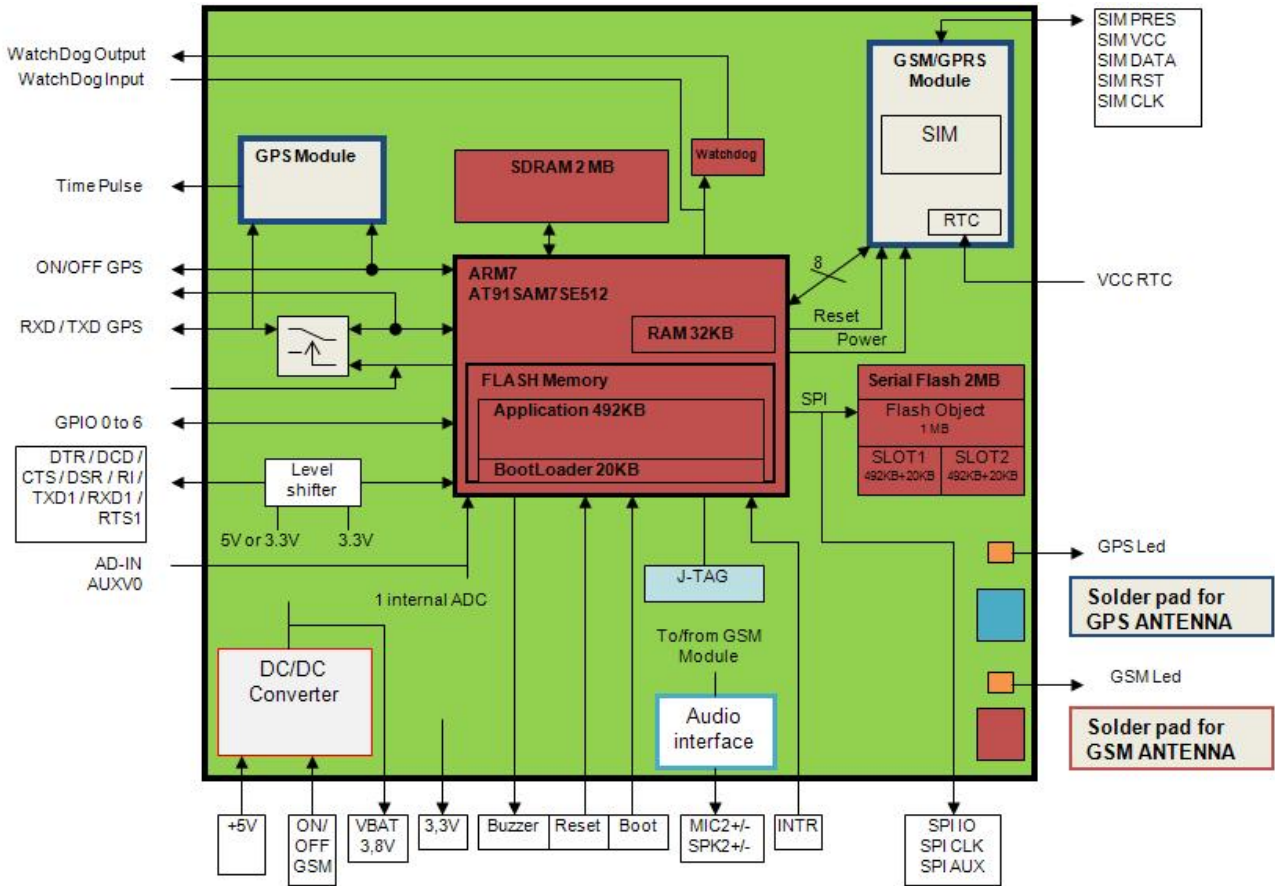
The interfaces and options/accessories available are described in the following table.

Interfaces
- GSM and GPS antenna: RF range supporting the connection of coaxial cables
- 64-pin DIL connector (pitch: 2mm)
- Power supply : +5 Vdc -4%, +10%
- GSM & GPS module supply switchable
- AT commands: GSM 07.05 and 07.07
- Specific AT commands
- V24 principal of logical level 5V
- V24 GSM & GPS accessible independently
- Internal SIM reader (SIM 1,8V / 3V)
- 7 GPIOs
- GSM and GPS activities (leds and outputs)
- SPI Bus
- JTAG Bus interface
- Buzzer output
- Watchdog
Options / Supplementary accessories (*)
- Software development Kit : cdrom SDK EGM
- Accessories: Antennas, cables, power supplies... (consult our website)

* consult us

2.3 Functional description

2.3.1 Architecture



2.3.2 RF characteristics

The RF functioning complies with the ETSI GSM 05.05 Phase II recommendations.

Table: Frequency band

Characteristics	GSM 850	E-GSM 900	DCS 1800	PCS 1900
TX frequency	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz
RX frequency	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz

2.3.3 Internal processor

2.3.3.1 EGM presentation

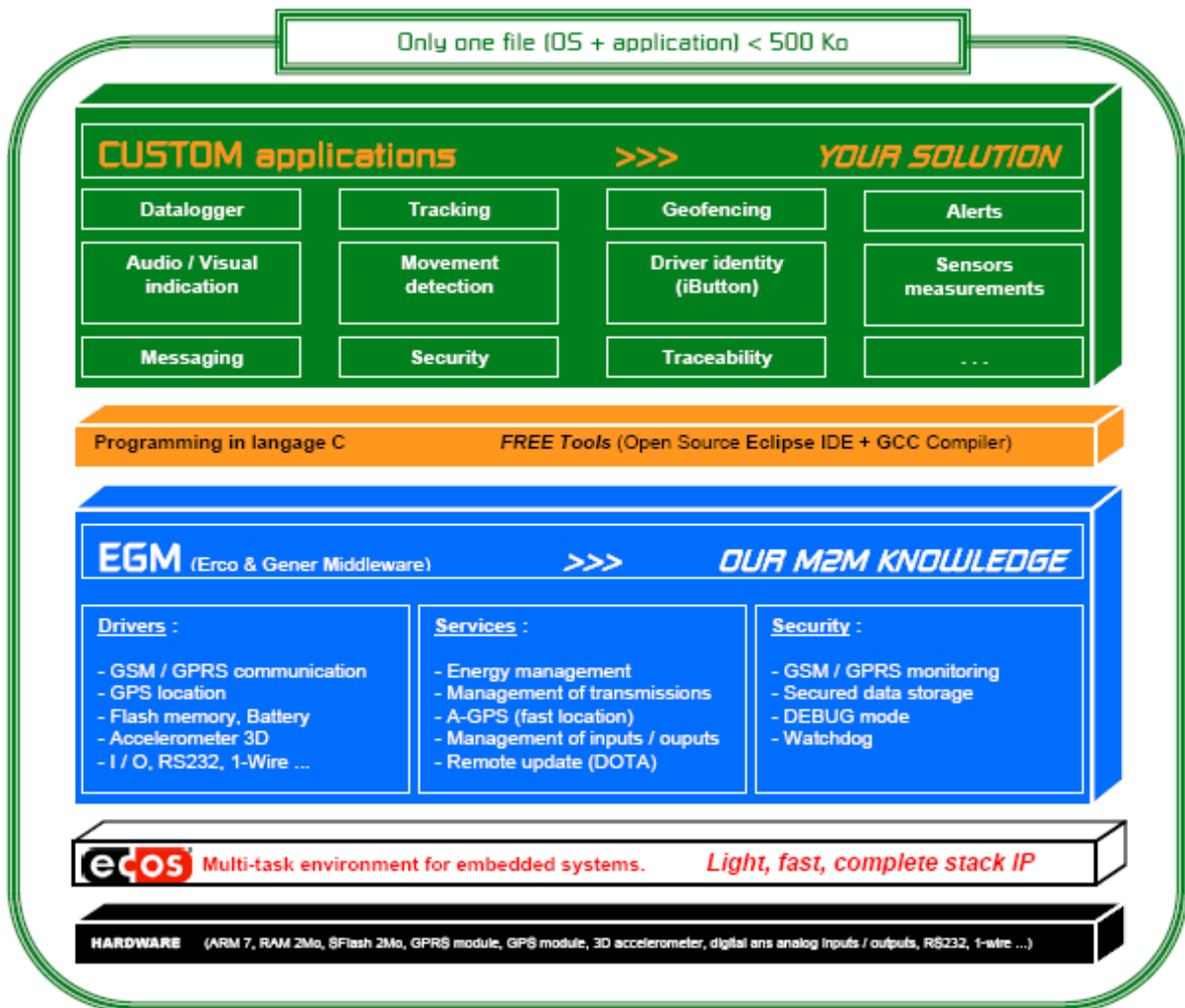
The GenLoc OEM AOB has an ARM7 processor that allows to have an embedded application developed from the EGM and based on eCos libraries.

The EGM libraries supplied by ERCO & GENER contain the following elements:

- EGM software library,
- eCos software library,
- A set of header files (.h) defining the EGM API functions,
- Source code samples.

2.3.3.2 EGM Architecture

The software architecture is described below.



For more information about EGM, see the documents ERCO & GENER for a description of the different functionalities.

2.3.4 Firmware

The GenLoc OEM AOB was designed to be integrated into different kind of applications.

For applications using an external processor, the Firmware provides a software interface based upon AT commands.

A software development kit (EGM) for the GenLoc OEM AOB is also available to develop your own client software application (contact us).

2.3.4.1 Without library

In this mode, the GenLoc OEM AOB is not functional. It is waiting for the loading of a library, an application.

2.3.4.2 External mode

In this mode, the driving is made by an external application. The modem is used with the AT commands set (see EG_EGM_CL_xxx_yy of ERCO & GENER).

2.3.4.3 Autonomous mode Application ERCO & GENER EaseLoc-01

This application is currently under development. For more information, contact us.

Autonomous mode: Once set, the modem is autonomous, it cyclically registers the positions and transmits them automatically towards a client application via different services: SMS, GSM Data, TCP socket GPRS (see EG_EaseLoc_01_CL_xxx_yy of ERCO & GENER).

2.3.4.4 Owner application

This is the autonomous mode: but the application is developed by you. It corresponds to your specification.

2.4 CE conformity

The CE mark appears on the GenLoc OEM AOB. This symbol guarantees the conformity of the conception and installation of the GenLoc OEM AOB according to the R&TTE directive.

However, once the GenLoc OEM AOB is integrated into the application, the final product must carry out the CE tests according to the R&TTE directive.

2.5 ROHS standards

The GenLoc OEM AOB complies with the RoHS standards (Restriction of Dangerous Substances into electric and electronic equipments) according to the Directive 2002/95/EC which limits the use of some substances considered as dangerous.

This directive states that: "from the 1st of July 2006, any new electric and electronic equipment put on the market must not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)".

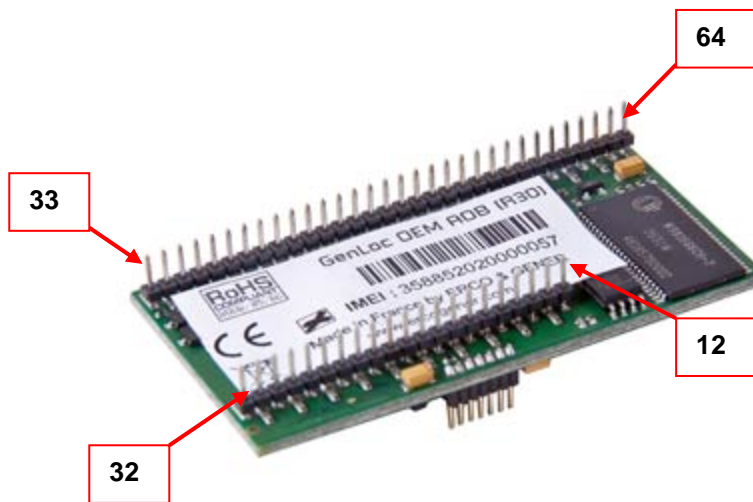
All modems which comply with this directive are identified with the logo RoHS.

3 Interfaces

This chapter describes the hardware interfaces of the GenLoc OEM AOB.

3.1 DIL connector

A standard connector (DIL 2mm pitch) is used to interface the main analogical and digital signals.



3.1.1 Pins assignation

1	No pin	BUZZER	64
2	No pin	GND	63
3	No pin	AUXVO	62
4	No pin	+5V	61
5	No pin	TIME_PULSE	60
6	No pin	ON/OFF_GSM	59
7	No pin	WDI	58
8	No pin	SPI_IO	57
9	No pin	SPI_CLK	56
10	No pin	~RXD_GPS	55
11	No pin	~TXD_GPS	54
12	~BOOT	Non Connecte	53
13	CDE_GPS_RX	~RXD2	52
14	ON/OFF_GPS	~TXD2	51
15	GPIO_5	GPIO_6	50
16	GPIO_4	+VCC_3V3	49
17	GPIO_3	VBAT	48
18	GPIO_2	Non Connecte	47
19	GPIO_1	ADC_IN	46
20	GPIO_0	VCC_RTC	45
21	SPI_AUX	~INTR	44
22	MIC2+	SPK2+	43
23	MIC2-	SPK2-	42
24	~RESET	GND	41
25	WDO	~DTR1	40
26	GND	~DCD1	39
27	SIM_PRES	~CTS1	38
28	SIM_VCC	~DSR1	37
29	FLASH_LED	~RI1	36
30	SIM_DATA	~TXD1	35
31	SIM_RST	~RXD1	34
32	SIM_CLK	~RTS1	33

3.1.2 Pins description

The following table describes the main characteristics of the 64 pins of the DIL connector.

Pin	Name	I/O	I/O TYPE	Level		Remarks
1	No pin					
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12	~BOOT	I	Digital	3.3V	From ARM 7	See § 3.3 BOOT signal
13 ¹	CDE_GPS-RX	O	Digital	3.3V	From ARM 7	See § 3.4 CDE_GPS-RX
14 ¹	ON / OFF GPS	O	Digital	3.3V	From ARM 7	See § 3.5 ON/OFF GPS
15 ¹	GPIO_5	I/O	Digital	3.3V	From ARM 7	See § 3.6 GPIO0 - GPIO6
16 ¹	GPIO_4	I/O	Digital	3.3V	From ARM 7	
17 ¹	GPIO_3	I/O	Digital	3.3V	From ARM 7	
18 ¹	GPIO_2	I/O	Digital	3.3V	From ARM 7	
19 ¹	GPIO_1	I/O	Digital	3.3V	From ARM 7	
20 ¹	GPIO_0	I/O	Digital	3.3V	From ARM 7	
21 ¹	SPI_AUX	O	Digital	3.3V	From ARM 7	See § 3.7 SPI Auxiliary Bus (SPI_CLK, SPI_IO and SPI_AUX)
22	MIC2+	I	Analog		GSM	See § 3.8.1 Microphone MIC2+ and MIC2-
23	MIC2-	I	Analog			
24	~RESET	I/O	Digital	3.3V	From ARM 7	See § 3.9 ~RESET
25	~WDO	O	Digital	3.3V	From ARM 7	See § 3.10.2 ~WDO signal
26	GND					
27	SIM_PRES	I	Digital	1.8V / 3V	GSM	See §3.11.2 External SIM card interface
28	SIM_VCC	O	Digital	1.8V / 3V		
29	FLASH_LED	O	Digital	3.8V	Transistor	See § 3.12 FLASH_LED
30	SIM_DATA	I/O	Digital	1.8V / 3V	GSM	See § 3.11.2 External SIM card interface
31	SIM_RST	O	Digital	1.8V / 3V		
32	SIM_CLK	O	Digital	1.8V / 3V		

Pin	Name	I/O	I/O TYPE	Level		Remarks
33	~RTS1	I	Digital	+5V		See § 3.13 Serial link (UART1) +3.3V available as an option (contact us)
34	~RXD1	O				
35	~TXD1	I				
36	~RI	O				
37	~DSR1	O				
38	~CTS1	O				
39	~DCD1	O				
40	~DTR1	I				
41	GND					
42	SPK2-	O	Analog		GSM	See § 3.8.2 Loudspeaker SPK2+ and SPK2-
43	SPK2+	O	Analog			
44	~INTR	I	Digital		From ARM 7	See § 3.15 External Interrupt (~INTR)
45	VCC_RTC	I	Analog		GSM	See § 3.16 Real Time Clock supply (VCC_RTC)
46	ADC_IN	I	Analog		To ARM 7	See § 3.17 ADC_IN
47	NC					
48	+VBAT	O	Analog	+3.8V		See § 3.2.3 +VBAT
49 ¹	+VCC_3V3	O	Analog	+3.3V		See § 3.18 VCC output (VCC_3V3)
50 ¹	GPIO_6	I/O	Digital	3.3V		See § 3.6 GPIO0 - GPIO6
51	~TXD2	I	Digital		To ARM 7	See § 3.14 Auxiliary serial link (~RXD2 and ~TXD2)
52 ¹	~RXD2	O	Digital		From ARM 7	
53	NC					
54	~TXD_GPS	I	Digital	3.3V	GPS	See § 3.21.1 GPS serial interface série (~TXD and ~RXD)
55	~RXD_GPS	O	Digital	3.3V		
56 ¹	SPI_CLK	O	Digital	3.3V	From ARM 7	See § 3.7 SPI Auxiliary Bus (SPI_CLK, SPI_IO and SPI_AUX)
57 ¹	SPI_IO	I/O	Digital	3.3V	To ARM 7	
58	WDI	O	Digital	3.3V	To ARM 7	See § 3.10.1 WDI signal
59	~ON/OFF_GSM	I	Digital	3.3V	From ARM 7	See § 3.19 ~ON/OFF GSM
60	TIMEPULSE	O	Digital	3.8V		See § 3.21.2 Indication of the GPS activity status (TIMEPULSE)
61	+5V	I	Analog		Power supply	See § 3.2
62	AUXV0	I	Analog	3.3V	To ARM 7	See § 3.20 Auxiliary ADC (AUXV0)
63	GND					
64	BUZZER	O	Digital		Transistor	See § 3.8.3 Buzzer output

¹ The total current on the outputs

- | | | |
|-------------------|---------------|--------------|
| 13 - CDE_GPS-RX | 18 - GPIO_2 | 50 - GPIO_6 |
| 14 - ON / OFF GPS | 19 - GPIO_1 | 52 - ~RXD2 |
| 15 - GPIO_5 | 20 - GPIO_0 | 56 - SPI_CLK |
| 16 - GPIO_4 | 21 - SPI_AUX | 57 - SPI_IO |
| 17 - GPIO_3 | 49 - +VCC_3V3 | 58 - WDI |

must be below 62 mA

3.2 Power supply

3.2.1 General description

The main power supply is provided via 4 pins of the connector:

- pin 61 for the tension + 5 V_{DC},
- pins 26, 41, and 63 for the ground (GND).

Inputs description

Signal	Pin number	I/O	Type I/O	Description	Level
+5V	61	I	Power	Power supply	5V
GND	26	I	Power	ground	0V
GND	41	I	Power	ground	0V
GND	63	I	Power	ground	0V

Electrical characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
+5V	Power supply		4.8	5	5.5	V



The inputs 26, 41 and 63 are also connected to the required ground plan for a correct RF functioning.

The power supply is one of the key-points in the conception of a GSM terminal. Because of the emission of Bursts in GSM/GPRS, the power supply must be able to provide short high current peaks.

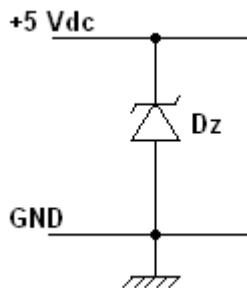
In communication mode, a GSM/GPRS class 2 modem transmits a Burst of 577µs every 4.615ms.

In communication mode, a GPRS class 10 modem transmits a Burst of 1154µs every 4.615ms.

A tension of + 5 V_{DC} -4%, +10%, 1.8 A peak is necessary to supply the Socket Modem in order to avoid any risks of dysfunction. However, the Socket Modem will not need a constant 1.8A current at + 5 V_{DC} for the supply.

3.2.2 Protections

The Socket Modem GenLoc OEM AOB does not provide protection against overvoltage. Adequate power supply protections must be designed into your circuit design.



Typical scheme



Dz = Zener Diode 5.6V 3W
 The power of the diode must be chosen according to the capacities previously validated.

3.2.3 +VBAT

This pin can be used as an output +3.8V for the supply of external components.

Output description

Signal	Pin number	I/O	Type I/O	Description	Level
+VBAT	48	O	Power		+ 3.8 V

Electrical characteristics

Symbol	Description	Conditions	Typ.	Reg. ligne.	I _{max}
+VBAT	External supply		+ 3.8V	27 mV	100 mA

As an option, contact us:

It can also be used as a direct supply input for autonomous systems

In this case, the supplied tension must comply with the specifications of the GSM module, depending on the kind of conversion.

Electrical characteristics Input tension +VBAT

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
+VBAT			3.3(*)	3.8	4.5(*)	V

(*)This value must be guaranteed during the bursts (with peaks of 1.8 A in GSM or GPRS mode).

The bursts may create tension peaks (Ripple) on the supply tension, so it must be efficiently filtered. It is recommended to place capacities of 1000 to 2000 µF next to the input-output connector of the modem.



Please note that the input tension level must not be able to drop below the minimum tension in any circumstances and particularly during the bursts.

3.3 BOOT signal



This signal must not be connected, neither used. Its use is strictly reserved to the manufacturer and distributors.

This input can be used to download the firmware software into the memory of the ARM7.
The internal boot procedure starts when this pin is down during a reset of the module.

Input description

Signal	Pin number	I/O	I/O type	Description	Level
~BOOT	12	I	to ARM7	Flash Downloading	3.3 V

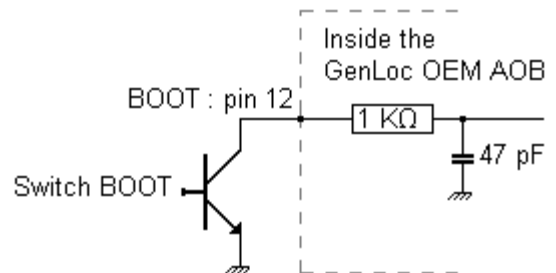
Electrical characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V_{IL}	Input Low level voltage		-0.3		0.8	V
V_{IH}	Input High level voltage		2.0		3.5	V
V_{HYS}	Hysteresis Voltage		0.4		0.7	V
I_{LEAK}	Input Leakage Current	Pull-up resistors disabled (Typ: TA = 25°C, Max: TA = 85°C)		20	200	nA
R_{PULLUP}	Pull-up Resistor		80	103	145	KΩ
C_{IN}	Input Capacitance				47	pF

In normal mode, this pin must be kept open.

In "internal boot" mode, this pin must be driven by an open collector:

BOOT(pin 12)	
0	For downloading mode
1	For normal mode.

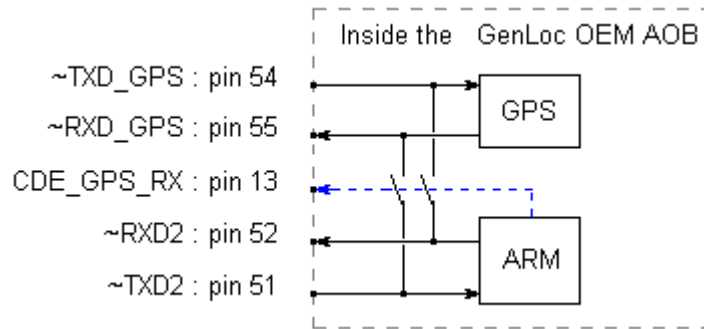


The Boot signal is not used for the downloading procedure of the Firmware via X-modem. The downloading procedure of the Firmware via X-modem is available and authorized.

3.4 CDE_GPS-RX

This output indicates the redirection status of the link GPS – ARM or the selection of the second UART of the ARM.

When an embedded application controls the GPS module, the serial link of the GPS is redirected towards the ARM. The redirection is indicated by the status of this pin.



When this function is selected, the pins 51, 52, 54 and 55 must not be connected.

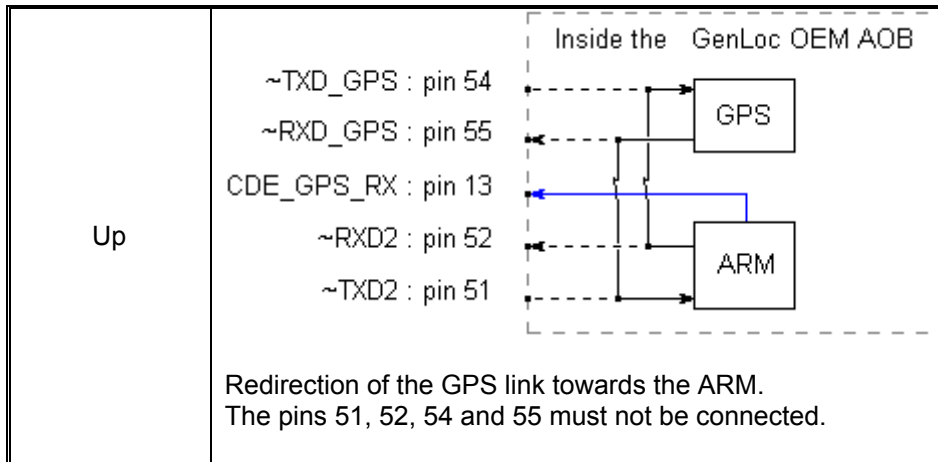
Output description

Signal	Pin number	I/O	Type I/O	Description	Level
CDE_GPS-RX	13	O	From ARM7	Selection of second UART	3.3V

Electrical characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V_{OL}	Output Low-level Voltage	$I_{O\ max}$			0.4	V
V_{OH}	Output High-level Voltage	$I_{O\ max}$	2.9		3.4	V
I_o	Output Current				8	mA

CDE_GPS-RX pin 13	Link
Down	<p>Access of the GPS link on the pins 54 - 55. Access of the second UART ARM on the pins 51 – 52.</p>



The integrator has the responsibility to protect the inputs / outputs from electric perturbations and to respect the functioning parameters values.



The total current on the outputs

- | | | |
|-------------------|---------------|--------------|
| 13 - CDE_GPS-RX | 18 - GPIO_2 | 50 - GPIO_6 |
| 14 - ON / OFF GPS | 19 - GPIO_1 | 52 - ~RXD2 |
| 15 - GPIO_5 | 20 - GPIO_0 | 56 - SPI_CLK |
| 16 - GPIO_4 | 21 - SPI_AUX | 57 - SPI_IO |
| 17 - GPIO_3 | 49 - +VCC_3V3 | 58 - WDI |

must be below 62 mA

3.5 ON/OFF GPS

This output indicates the supply status of the GPS module.

This output is driven via the ARM7.

Output description

Signal	Pin number	I/O	Type I/O	Description	Level
ON/OFF_GPS	14	O	From ARM7	GPS Power Management	3.3V

Electrical characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{OL}	Output Low-level Voltage	I _{O max}			0.4	V
V _{OH}	Output High-level Voltage	I _{O max}	2.9		3.4	V
I _o	Output Current				8	mA

ON/OFF_GPS	
Down	GPS module on
Up	GPS module off



The integrator has the responsibility to protect the output from electric perturbations and to respect the functioning parameters values.



The total current on the outputs

- | | | |
|-------------------|---------------|--------------|
| 13 - CDE_GPS-RX | 18 - GPIO_2 | 50 - GPIO_6 |
| 14 - ON / OFF GPS | 19 - GPIO_1 | 52 - ~RXD2 |
| 15 - GPIO_5 | 20 - GPIO_0 | 56 - SPI_CLK |
| 16 - GPIO_4 | 21 - SPI_AUX | 57 - SPI_IO |
| 17 - GPIO_3 | 49 - +VCC_3V3 | 58 - WDI |

must be below 62 mA

3.6 GPIO0 - GPIO6

The GenLoc OEM AOB provides generic Inputs/Outputs. These Inputs/Outputs are controlled and driven by the ARM7.

At powering on, these pins are positioned in inputs.



By default, there is no Pull Up resistance on the inputs. They can be set with a software.

Inputs/Outputs description

Signal	Pin number	I/O	Type I/O	Description	Level
GPIO6	50	I/O	From ARM7	General Purpose Input/Output	3.3V
GPIO5	15	I/O	From ARM7	General Purpose Input/Output	3.3V
GPIO4	16	I/O	From ARM7	General Purpose Input/Output	3.3V
GPIO3	17	I/O	From ARM7	General Purpose Input/Output	3.3V
GPIO2	18	I/O	From ARM7	General Purpose Input/Output	3.3V
GPIO1	19	I/O	From ARM7	General Purpose Input/Output	3.3V
GPIO0	20	I/O	From ARM7	General Purpose Input/Output	3.3V



The integrator has the responsibility to protect the inputs / outputs from the electric perturbations and to respect the functioning parameters values.

Electrical characteristics of the inputs/outputs

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{IL}	Input Low level voltage		-0.3		0.8	V
V _{IH}	Input High level voltage		2.0		3.5	V
V _{HYS}	Hysteresis Voltage		0.4		0.7	V
I _{LEAK}	Input Leakage Current	GPIO0 - GPIO3 Pull-up resistors disabled (Typ: TA = 25°C, Max: TA = 85°C)		40	400	nA
		GPIO4 – GPIO6 Pull-up resistors disabled (Typ: TA = 25°C, Max: TA = 85°C)		20	200	nA
R _{PULLUP}	Pull-up Resistor		80	103	145	KΩ
R _{PULLDOWN}	Pull-down Resistor		8	15	28	KΩ
C _{IN}	Input Capacitance				14	pF
V _{OL}	Output Low-level Voltage	I _{O max}			0.4	V
V _{OH}	Output High-level Voltage	I _{O max}	2.9		3.4	V
I _O	Output Current	GPIO0 – GPIO3			16	mA
		GPIO4 – GPIO6			8	mA

The total current on the outputs



- | | | |
|-------------------|---------------|--------------|
| 13 - CDE_GPS-RX | 18 - GPIO_2 | 50 - GPIO_6 |
| 14 - ON / OFF GPS | 19 - GPIO_1 | 52 - ~RXD2 |
| 15 - GPIO_5 | 20 - GPIO_0 | 56 - SPI_CLK |
| 16 - GPIO_4 | 21 - SPI_AUX | 57 - SPI_IO |
| 17 - GPIO_3 | 49 - +VCC_3V3 | 58 - WDI |
- must be below 62 mA

3.7 SPI Auxiliary Bus (SPI_CLK, SPI_IO and SPI_AUX)

All the signals necessary for the connection of an external device are available.

A SPI Chip Enable (SPI_AUX) can be used to add a SPI device.

Inputs/Outputs description

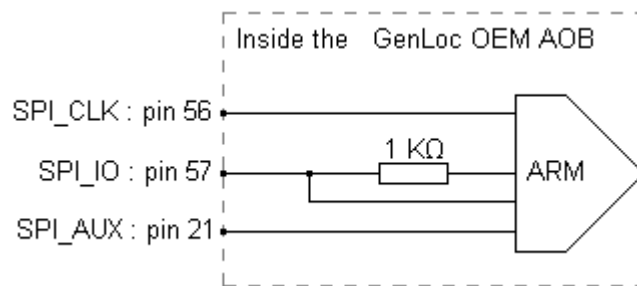
Signal	Pin number	I/O	Type I/O	Description	Level
SPI_CLK	56	O	from ARM7	SPI Serial Clock	3.3V
SPI_IO	57	I/O	from ARM7	SPI Data	3.3V
SPI_AUX	21	I	from ARM7	Aux. Enable	3.3V

Electrical characteristics of the input

SPI_IO	Description	Conditions	Min.	Typ.	Max.	Units
V _{IL}	Input Low level voltage		-0.3		0.8	V
V _{IH}	Input High level voltage		2		3.5	V
I _{LEAK}	Input Leakage Current				2.4	μA
C _{IN}	Input Capacitance				20	pF

Electrical characteristics of the outputs

SPI_AUX SPI_CLK	Description	Conditions	Min.	Typ.	Max.	Units
V _{OL}	Output Low-level Voltage				0.4	V _{DC}
V _{OH}	Output High-level Voltage		2		3.4	V _{DC}
F	Frequency			4		MHz
V _{HYS}	Hysteresis Voltage		0.4		0.7	V
I _O	Output Current				8	mA



The integrator has the responsibility to protect the inputs / outputs from electric perturbations and to respect the functioning parameters values.



The total current on the outputs

- | | | |
|-------------------|---------------|--------------|
| 13 - CDE_GPS-RX | 18 - GPIO_2 | 50 - GPIO_6 |
| 14 - ON / OFF GPS | 19 - GPIO_1 | 52 - ~RXD2 |
| 15 - GPIO_5 | 20 - GPIO_0 | 56 - SPI_CLK |
| 16 - GPIO_4 | 21 - SPI_AUX | 57 - SPI_IO |
| 17 - GPIO_3 | 49 - +VCC_3V3 | 58 - WDI |

must be below 62 mA

3.8 Audio Interface

A microphone input and a loudspeaker can be interfaced.

The echo cancelation and some particularities of noise reduction are also available to perform the audio quality in the case of a free-hand application.

The audio interface is standard to connect a telephone handset (the GenLoc OEM AOB contains the standard library; in this case, the command **AT\$VSELECT** allows to select the Handset, see the document "EG_EGM_CL_xxx_yy" of Erco & Gener).

3.8.1 Microphone MIC2+ and MIC2-

The microphone inputs are assembled in differential in order to reduce the noise in common mode and the TDMA noise.

By default, they include the functionality for a microphone like Electret (0.5 mA and 2 Volts). This Electret microphone can be directly connected to these inputs allowing an easy connection to a telephone handset.

The gain of the microphone inputs is internally adjusted by a differential amplifier and can be adjusted with the command **AT+PREAMP** in the case where the GenLoc OEM AOB contains the standard library. (See the document "EG_EGM_CL_xxx_yy" of Erco & Gener). The amplifier has a 25.6 dB gain and a Bias generator that supplies an external tension of 2 or 2.5V for the microphone Bias.

Inputs description

Signal	Pin number	I/O	Type I/O	Description	Level
MIC2+	22	I/O	Analog	Microphone positive input	
MIC2-	23	I/O	Analog	Microphone negative input	

Characteristics of polarization for a Microphone HANDSET

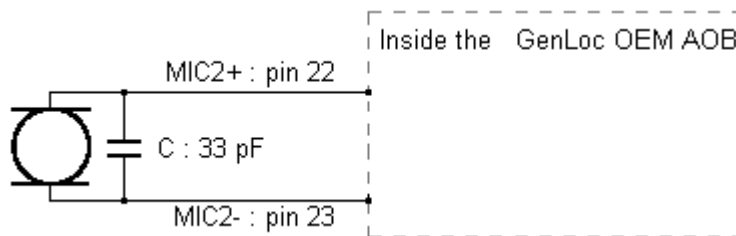
Polarization output	Parameter/Conditions	Min	Typ	Max	Units
Polarization tension	Set to 2.0 V	1.9		2.1	V
	Set to 2.5 V	2.4		2.6	V
Polarization current				2.0	mA

Characteristics for a Microphone HANDSET

Input HANDSET	Parameter/Conditions	Min	Typ	Max	Units
Maximum Input Range – Mic(+) to Mic(-)	Inputs 3 dBm0 (Max. digital sample amplitude when PGA gain set to 0 dB)			32.5	mV _{RMS}
Nominal Ref. Level – Mic(+) to Mic(-)	Differential MIC		-10		dBm0
Differential Input Resistance – Mic(+) to Mic(-)	Differential MIC, MICAMP gain = 25.6 dB		36		kΩ
Microphone Pre-Amplifier Gain	Differential MIC		25.6		dB



The integrator has the responsibility to protect the inputs from electric perturbations and to respect the functioning parameters values.



Decoupling capacity of the microphone (Example)

3.8.2 Loudspeaker SPK2+ and SPK2-

The outputs are assembled in differential in order to reduce the noise in common mode and the TDMA noise. These outputs can be directly connected to a loudspeaker (Earphone).

Outputs description

Signal	Pin number	I/O	Type I/O	Description	Level
SPK2-	42	O	Analog	Speaker negative output (EARN)	
SPK2+	43	O	Analog	Speaker positive output (EARP)	

Characteristics recommended for the loudspeaker

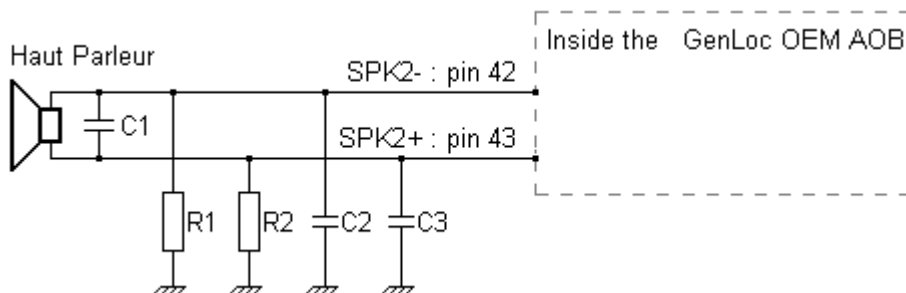
Handset Spkr Output	Parameter/Conditions	Min	Typ	Max	Units
Maximum Differential Resistive Load	Output Swing 3.9 V _{PP}		120		Ω
	Output Swing 1.5 V _{PP}		33		Ω
Maximum Differential Capacitive Load				100	pF
Common Mode Minimum Resistive Load	At Internal Speaker (+) or (-)		200		kΩ
Common Mode Maximum Capacitive Load	At Internal Speaker (+) or (-)			50	pF
Amplifier Gain	EARG = 1		1		dB
	EARG = 0		-11		dB

Parameters	Test Conditions	Min	Typ	Max	Units
Earphone output swing at EARP-EARN	Distortion ≤ 2% and 120 Ω, VSP input level = +3 dBm0, amp gain = -11 dB		0.98		V _{P-P}
	Distortion ≤ 2% and 33 Ω, VSP input level = -5.34 dBm0, amp gain = -11 dB		0.38		V _{P-P}
	Distortion ≤ 2% and 120 Ω, I2S input level = +3 dBm0, amp gain = -11 dB		0.93		V _{P-P}
	Distortion ≤ 2% and 120 Ω, VSP input level = +3 dBm0, amp gain = -1 dB	3.1	3.92		V _{P-P}
	Distortion ≤ 2% and 33 Ω, VSP input level = -5.34 dBm0, amp gain = -1 dB	1.2	1.5		V _{P-P}
	Distortion ≤ 2% and 120 Ω, I2S input level = +3 dBm0, amp gain = -1 dB	2.96	3.7		V _{P-P}
Amplifier Gain	EARG = 1		1		dB
	EARG = 0		-11		dB
Earphone amplifier state in power down			High Z		
Earphone amplifier power supply rejection	1 kHz, 100 mVp-p		50		dB



The integrator has the responsibility to protect the inputs from electric perturbations and to respect the functioning parameters values.

Example of assembling scheme for the loudspeaker output



Component	Value
C1	CONDENSER 100 pF
C2, C3	CONDENSER 47pF
R1, R2	RESISTANCE 200 KOhms



An external amplifier is necessary for a charge < 16 Ω or if the volume is not adapted.

3.8.3 Buzzer outputs

By default, the GenLoc OEM AOB provides a Buzzer output on the output 64. This output supplies a frequency; it is then dedicated to drive a **Transducer**.

Output description

Signal	Pin number	I/O	Type I/O	Description	Level
Buzzer -	64	O	Analog	Buzzer output	Open collector

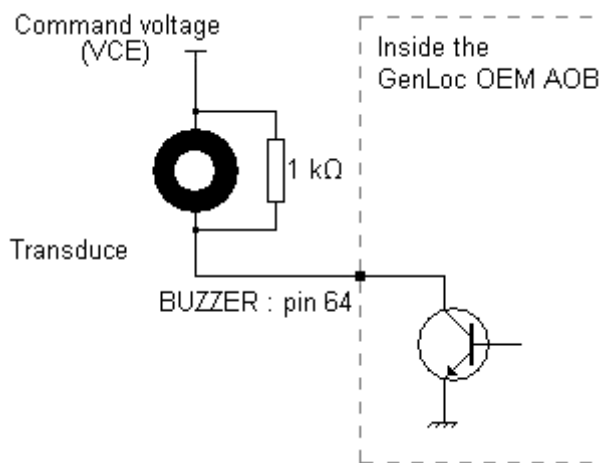
Output characteristics

Characteristics	Symbols	Conditions	Min.	Typ.	Max.	Unit
collector-base voltage	V_{CB0}	Transmitter open			75	V
collector-emitter voltage	V_{CE0}	Open base			40	V
collector current (DC)	I_C				600	mA
peak collector current	I_{CM}				800	mA
Collector Cutoff Current	I_{CB0}	$I_E = 0; V_{CB} = 60 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$			10	nA
		$I_E = 0; V_{CB} = 60 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$			10	μA
collector-emitter saturation voltage	V_{CEsat}	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA} *$			300	mV
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA} *$			1	V
transition frequency	f_T	$I_C = 20 \text{ mA}; V_{CE} = 20 \text{ V}; f = 100 \text{ MHz}$			300	MHz
collector capacitance	C_C	$I_E = I_e = 0; V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$			8	pF
total power dissipation	P_{Tot}	$T_{amb} \leq 25 \text{ }^\circ\text{C}$			225	mW

Example of transducer tested with the GenLoc OEM AOB

Buzzer characteristics	Values
Type	Transducer AT-2720-T-R
Consumptions	1-30V peak/3.5mA max.
Resonance frequency	2.048Hz ±500HZ
Sound pressure level (SPL)	Min.88dBA @10cm

The output assembly of the module is in **open collector**.



3.9 ~RESET Signal

3.9.1 General presentation

This signal allows to make a Hardware RESET of the modem. In fact, this pin is used to force a RESET of the modem, doing a low level during at least 10ms.

This signal must be used only in case of emergency RESET.

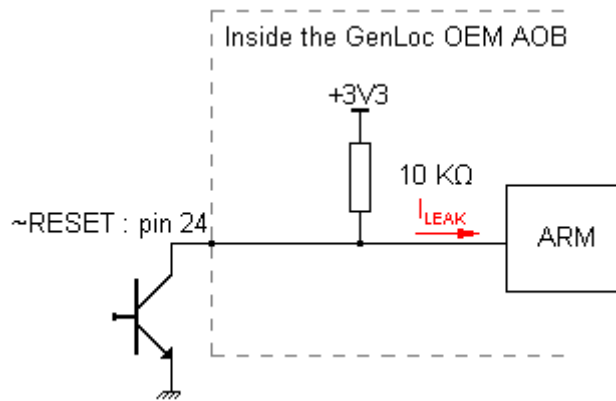
Input description

Signal	Pin number	I/O	Type I/O	Description	Level
~RESET	24	I	To ARM	Module Reset for ARM7	3.3V

Electrical characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{IL}	Input Low level voltage		-0.3		0.8	V
V _{IH}	Input High level voltage		2.0		3.5	V
V _{HYS}	Hysteresis Voltage		0.4		0.7	V
I _{LEAK}	Input Leakage Current	(Typ: TA = 25°C, Max: TA = 85°C)		40	300	nA
R _{PULLUP}	Pull-up Resistor			10		KΩ
C _{IN}	Input Capacitance				14	pF

~RESET	
0	Reset of the Modem
1	For normal mode.



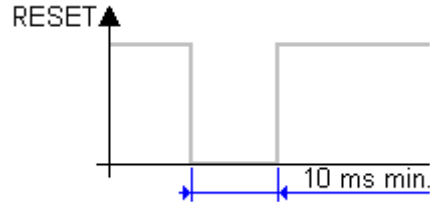
This signal must be used only in case of emergency RESET. A Software RESET is always preferable to a Hardware RESET. It is strongly unadvised to execute this fonction whilst in communication or dialog, without having previously detached it from the operator network.



For more information about the Software RESET, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER and refer to paragraph to turn the device off and detach correctly the modem from the operator network.

3.9.2 RESET sequence

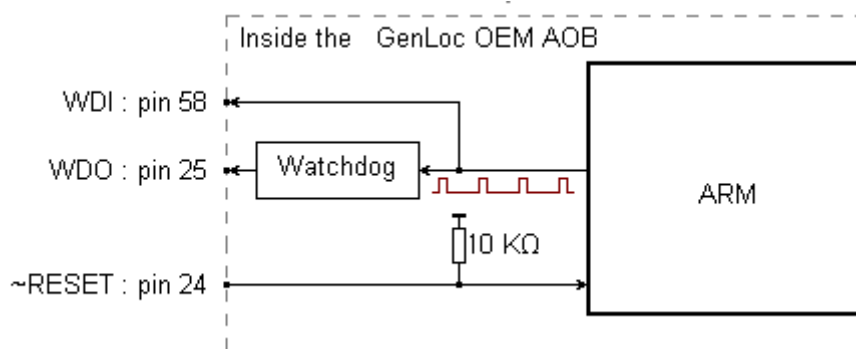
To activate the emergency RESET sequence, the RESET signal must be put to a low level during at least 10 ms.



As soon as the modem has been RESET, if a SIM card is inserted inside the SIM reader, you must wait for the end of the initialization before accessing again to the GSM network. Moreover, the acquisition time of a GPS position will have to be taken into consideration.

3.10 Watchdog

An internal command of the ARM allows to tell the supervision circuit that the application is operational, thanks to a switching from a status to another within a time less than 60 seconds.



Scheme of the watchdog (Hardware)

3.10.1 WDI signal

This output corresponds to the input of the watchdog. (scheme below)

Output description

Signal	Pin number	I/O	Type I/O	Description	Level
WDI	58	O	From ARM7	Watchdog Control	3.3V

Electrical characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{OL}	Output Low-level Voltage	I _{O max}			0.4	V
V _{OH}	Output High-level Voltage	I _{O max}	2.9		3.4	V
I _O	Output Current				8	mA



The total current on the outputs

13 - CDE_GPS-RX	18 - GPIO_2	50 - GPIO_6
14 - ON / OFF GPS	19 - GPIO_1	52 - ~RXD2
15 - GPIO_5	20 - GPIO_0	56 - SPI_CLK
16 - GPIO_4	21 - SPI_AUX	57 - SPI_IO
17 - GPIO_3	49 - +VCC_3V3	58 - WDI

Must be below 62 mA

3.10.2 ~WDO signal

This signal comes from an independent WatchDog circuit which must be activated at regular interval in order to inhibit the switching of the output. The minimal temporization for triggering is 60 seconds and the maximal is 180 seconds.

This circuit can be directly driven from the ARM.

This pin is in direct relation with the pin WDI (pin 58), see above.

Output description

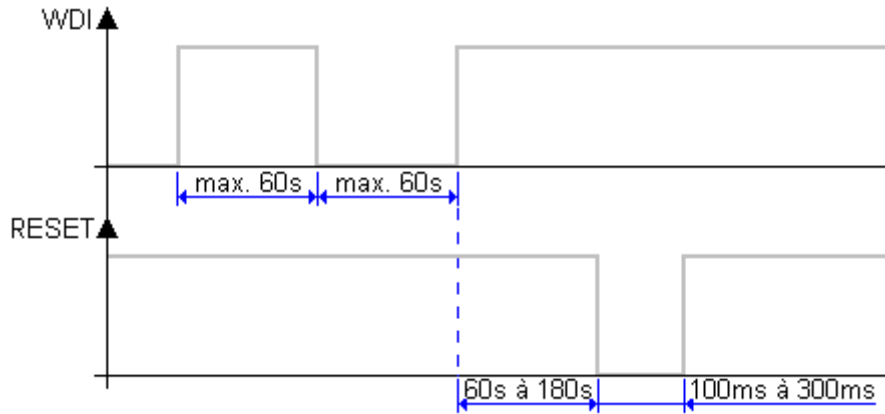
Signal	Pin number	I/O	Type I/O	Description	Level
~WDO	25	O	open collector	Reset output (Watchdog)	Active low

Electrical characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{OL}	Output Low-level Voltage	I _{SINK} = 1.2 mA			0.3	V
V _{OH}	Output High-level Voltage		2.64		3.4	V
I _O	Output Current				20	mA

Dynamic characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
T _{WDO}	Watchdog Output Pulse Width		100		300	ms
T _{WD}	Watchdog timeout		60		180	S

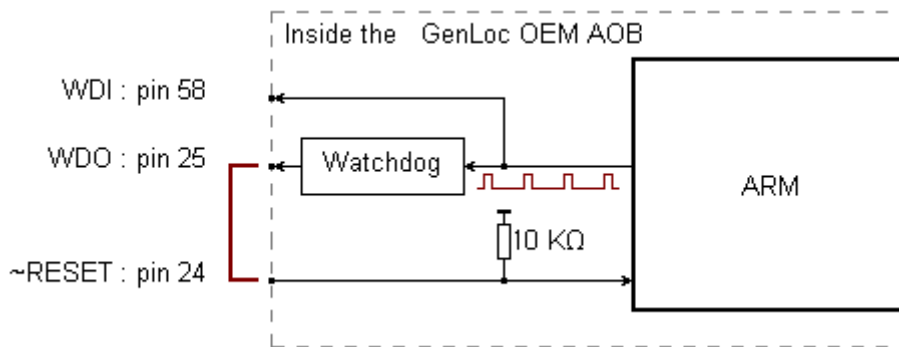


Chronograms of the watchdog

3.10.3 Scheme of the watchdog

Auto RESET : WDO reset the ARM7.

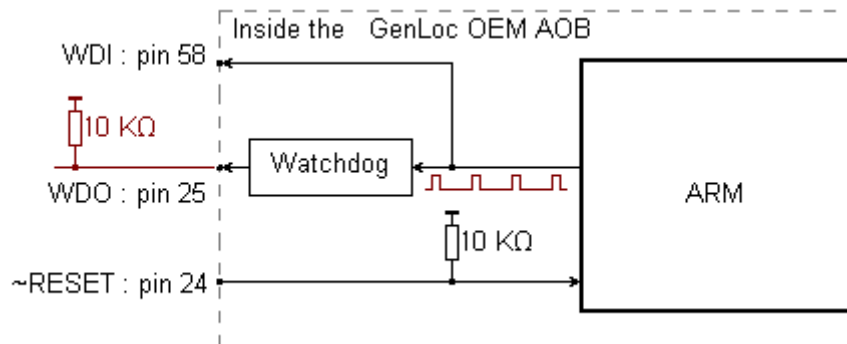
It is not necessary to connect the pullup resistance.



Scheme: Auto RESET

WDO is used by the exterior.

In this case, it is necessary to connect the pullup resistance.



Scheme: WDO for exterior

3.11 SIM card interface

3.11.1 Internal SIM card interface

The internal SIM interface allows to use the SIM card 1.8V/3V.



This interface is entirely compatible with the recommendations concerning the SIM functions.

If the SIM card is inserted while the device is on, to take it into account, the GenLoc OEM AOB must be reset by a On / Off, an action on the input ~RESET (see paragraph **3.9.2 RESET sequence**) or by sending the Reset command: **AT\$RESET** if the Genloc OEM AOB contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER).

3.11.2 External SIM card interface

The external SIM card interface is available only on the GenLoc OEM AOB. It is then possible to deport the SIM reader using the dedicated signals.

The module provides the regulated power tension necessary for the SIM card and the circuit to detect the SIM card insertion or extraction.

The module includes a hardware interface dedicated to the Universal Subscriber Identity Module (USIM).

This interface is entirely compatible with the recommendations concerning the SIM functions.

Inputs/outputs description

Signal	Pin number	I/O	Type I/O	Description	Level
SIM_PRES	27	I	From GSM	SIM Card Detect (SIM_DTC)	
SIM_VCC	28	O	From GSM	SIM Power Supply (SIM_VDD)	
SIM_DATA	30	I/O	From GSM	SIM Data (SIM_I/O)	
SIM_RST	31	O	From GSM	SIM Reset (SIM_RST)	
SIM_CLK	32	O	From GSM	SIM Clock (SIM_CLK)	

Electrical characteristics

U SIM	Parameter/Conditions	Min	Typ.	Max	Unit
VDD	SIM VDD voltage	1.65	1.8	1.95	V
		2.7	2.85	2.95	V
VIH	High level input voltage	1.15			V
VIL	Low level input voltage			0.61	V
VOH	High level output voltage, IO = 4 mA	3.35			V
VOL	Low level output voltage, IO = 1 mA			0.4	V
II	Input leakage current			±1	µA
Iout	Output current		4		mA
PU	PU resistance			32	kΩ
PD	PD resistance		30		kΩ
Iz	Leakage current			± 30	µA
	Time unit (SIM-card insertion)		0.5		mS
Card Detect	Debouncing time (SIM-card insertion)		0.5		mS
	Debouncing time (SIM-card extraction)		15		mS
	Pull-up resistor (resistor + resistive switch)		475		kΩ



Protection for the external SIM interface

It is recommended to add TVS (Transient Voltage Suppressor) diodes on the signals used of the external SIM reader, to protect against Electrostatic Discharges.

The TVS diodes with low capacity (less than 10 pF) must be connected on the signals SIM_CLK and SIM_DATA in order to avoid any interference.

This kind of diode is compulsory for the certifications and must be placed as close as possible to the external SIM reader.



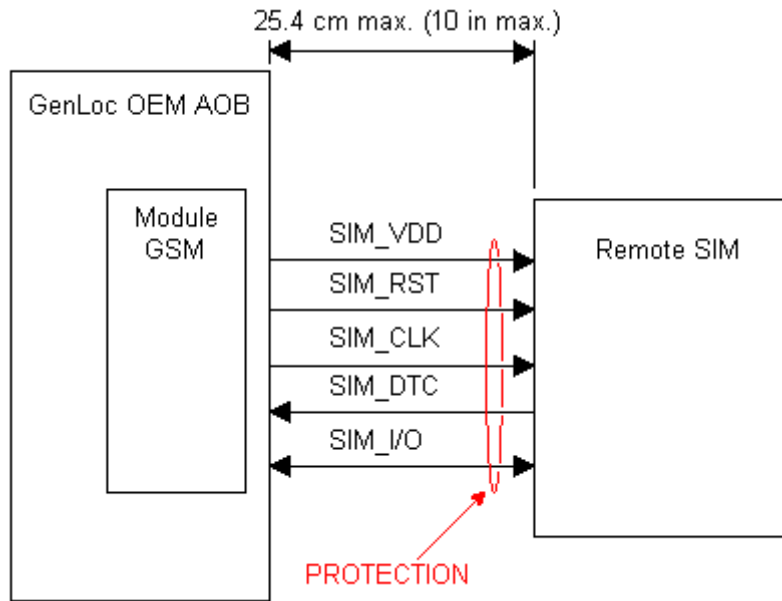
PCB Constraint for the SIM interface

- For the SIM interface, the implementation distance between the GSM/GPRS module and the SIM reader must be as short as possible. Indeed, the maximal recommended distance is 25.4 cm.
- The ESD protections are compulsory on the signals useful for the SIM in case of an external use.
- The tracks must be parallel and of the same length with a ground track between/and around each signal.

Only in the case of an external SIM assembly, for the pin SIM_PRES

- When it is not used, the pin SIM_PRES must be left upwards.
- When it is used, a change of status means:

SIM_PRES	
From up to down	The SIM card is inserted
From down to up	The SIM card is removed



3.12 FLASH_LED

The LED is managed by the ARM7. This output indicates the GenLoc OEM AOB status as well as the activity status of the GSM signal.

This output can directly drive a LED.

The modem status is also indicated by the GSM LED status situated next to the main board (see paragraph 2.1 Description).

The table below explains the signification of the different available status of the GSM LED.

GSM LED status	LED activity	Modem status
On	LED fixed on	Under development. Contact us.
Flashing	LED flashing	Under development. Contact us.
Off	LED off	Under development. Contact us.

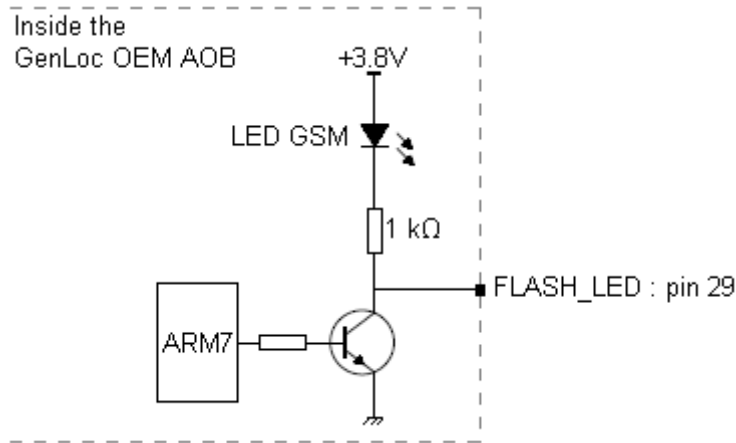
Output description

Signal	Pin number	I/O	Type I/O	Description	Level
FLASH_LED	29	O	Transistor	Activity Status indication	

Electrical characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{CBO}	collector-base voltage	open emitter			75	V
V _{CEO}	collector-emitter voltage	open base			40	V
I _C	collector current (DC)				600	mA
I _{CM}	peak collector current				800	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C			250	mW
I _{CBO}	collector cut-off current	IE = 0; VCB = 60 V			10	µA
		IE = 0; VCB = 60 V; T _j = 125 °C			10	µA
V _{CEsat}	collector-emitter saturation voltage	IC = 150 mA; IB = 15 mA; (*)			300	mV
		IC = 500 mA; IB = 50 mA; (*)			1	V

(*) Pulse test: tp ≤ 300 µs; δ ≤ 0.02.



3.13 Serial link (UART1)

The serial link complies with the V24 protocol of logical level 5V.

As an option, contact us, the logical level can be 3.3V.

The available signals on the serial link are:

- TX data (CT103/TXD1): Data transmission,
- RX data (CT104/RXD1): Data reception,
- Request To Send (CT105/RTS1): Request to send,
- Clear To Send (CT106/CTS1): Ready to send,
- Data Terminal Ready (CT108-2/DTR1): Data terminal ready,
- Data Set Ready (CT107/DSR1): Data set ready,
- Data Carrier Detect (CT109/DCD1): Signal detection,
- Ring Indicator (CT125/RI): Ring indicator.

Inputs/outputs description

Signal	Pin number	I/O	Type I/O	Description	Level
CT105 / RTS1	33	I		Request to Send	5.0V
CT104 / RXD1	34	O		Receive serial data	5.0V
CT103 / TXD1	35	I		Transmit serial data	5.0V
CT125 / RI	36	O		Ring Indicator	5.0V
CT107 / DSR1	37	O		Data Set Ready	5.0V
CT106 / CTS1	38	O		Clear To Send	5.0V
CT109 / DCD1	39	O		Data Carrier Detect	5.0V
CT108-2 / DTR1	40	I		Data Terminal Ready	5.0V
CT102 / GND	41			Ground	

Electrical characteristics of the inputs/outputs

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{IH}	Input High Voltage		4.6		5.3	V
V _{IL}	Input Low Voltage		-0.3		0.4	V
V _{OH}	Output High Voltage	I _{OH} = 20 μA	4.6			V
V _{OL}	Output Low Voltage	I _{OL} = 20 μA			0.4	V
C	Capacitance	f = 1 MHz		6		pF

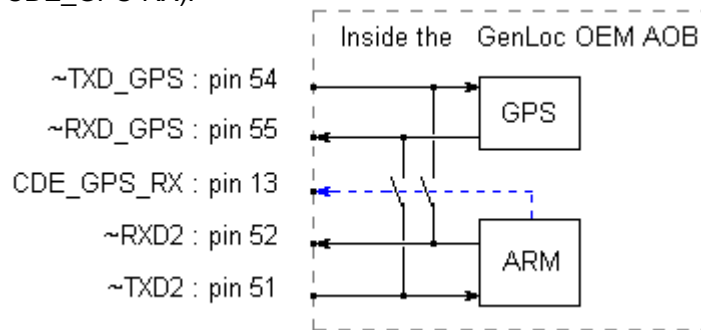


The serial interface was designed to allow a certain flexibility in the use of the signals. Indeed, the Socket Modem can work in 3-wire mode (using only the TX, RX, GND signals), but the use of the TX, RX, GND, CTS, RTS signals is obligatory for a GPRS application and for the updating in X-Modem, which is not the case for the signals DTR, DSR, DCD and RI that may not be used. It is necessary to use the RTS/CTS signals for the material flow control in order to avoid data corruption during the transmission.

3.14 Auxiliary serial link (~RXD2 and ~TXD2)

An auxiliary serial interface (UART2) is available on the GenLoc OEM AOB.

When an embedded application controls the GPS module, the serial link of the GPS is redirected towards the ARM. The redirection is indicated by the status of the pin 13 (see paragraph 3.4 CDE_GPS-RX).



When this function is selected, the pins 51, 52, 54 and 55 must not be connected.

Inputs/outputs description

Signal	Pin number	I/O	Type I/O	Description	Level
CT103 / TXD2	51	I	To ARM7	Transmit serial data	3.3V
CT104 / RXD2	52	O	From ARM7	Receive serial data	3.3V

Electrical characteristics of the inputs/outputs

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{OL}	Output Low-level Voltage	I _{O max}			0.4	V
V _{OH}	Output High-level Voltage	I _{O max}	2.9		3.4	V
I _O	Output Current				8	mA
V _{IL}	Input Low level voltage		-0.3		0.8	V
V _{IH}	Input High level voltage		2.0		3.5	V
V _{HYS}	Hysteresis Voltage		0.4		0.7	V
I _{LEAK}	Input Leakage Current	(Typ: TA = 25°C, Max: TA = 85°C)		40	300	nA
R _{PULLUP}	Pull-up Resistor			10		KΩ
C _{IN}	Input Capacitance				14	pF



The total current on the outputs

- | | | |
|-------------------|---------------|--------------|
| 13 - CDE_GPS-RX | 18 - GPIO_2 | 50 - GPIO_6 |
| 14 - ON / OFF GPS | 19 - GPIO_1 | 52 - ~RXD2 |
| 15 - GPIO_5 | 20 - GPIO_0 | 56 - SPI_CLK |
| 16 - GPIO_4 | 21 - SPI_AUX | 57 - SPI_IO |
| 17 - GPIO_3 | 49 - +VCC_3V3 | 58 - WDI |

Must be below 62 mA

3.15 External Interrupt (~INTR)

The input ~INTR is very sensitive and is activated upon a change of status from up to down. If this signal is not used, it must be left upwards.

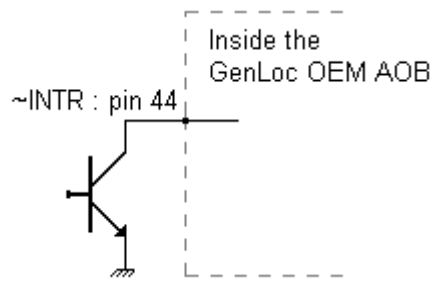
For its use, this input must be switched via an open collector.

Input description

Signal	Pin number	I/O	Type I/O	Description	Level
~INTR	44	I	From ARM7	External Interrupt	3.3V

Electrical characteristics of the input

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{IL}	Input Low level voltage		-0.3		0.8	V
V _{IH}	Input High level voltage		2.0		3.5	V
V _{HYS}	Hysteresis Voltage		0.4		0.7	V
I _{LEAK}	Input Leakage Current	(Typ: TA = 25°C, Max: TA = 85°C)		40	300	nA
R _{PULLUP}	Pull-up Resistor		80	103	145	KΩ
C _{IN}	Input Capacitance				14	pF



Recommended scheme



If this signal is not used, it must be left upwards.

3.16 Real Time Clock supply (VCC_RTC)

The input VCC_RTC is used to supply power to the Real Time Clock managed by the commands **AT\$RTCTIME**. (If the GenLoc OEM AOB contains the standard library see the document "EG_EGM_CL_xxx_yy" of Erco & Gener).

When it is activated, the Real Time Clock is provided by the GSM/GPRS module but a power supply (via VCC_RTC) is necessary for the backup of the date and the time when the modem is turned off.

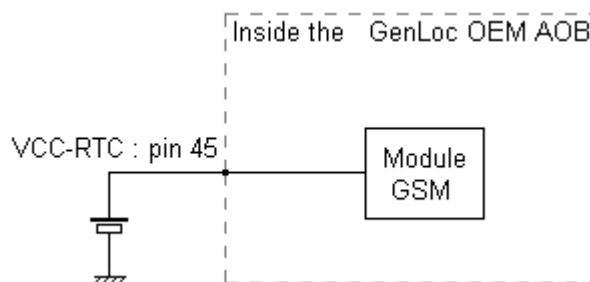
This input can also manage a the charge of a battery "**LITHIUM only**".

Input description

Signal	Pin number	I/O	Type I/O	Description	Level
VCC_RTC	45	I	Supply	RTC Back-up supply	2.7V < VCC_RTC < 4.5V



If the Real Time Clock is not used, this input must be left upwards.



Recommended scheme

3.16.1 Using a battery

Electrical characteristics of the input

VCC_RTC	Description	Conditions	Min.	Typ.	Max.	Units
V _{BAT}	Voltage for Real Time Clock		2.7	3.0	4.5	V
I _C		(VCC_RTC = 3.2V, +VBAT =0V and no load GPIO or serial port)		3.0	6.0	µA

3.16.2 Using a lithium battery

This function is managed by the commands **AT\$ \$BBCHG**, if the GenLoc OEM AOB contains the standard library, see the document "EG_EGM_CL_xxx_yy" of Erco & Gener).

Different battery tensions are available.

Electrical characteristics of the output

VCC_RTC	Description	Conditions	Min.	Typ.	Max.	Units
V _{BAT}	Battery tension			3.1		V
				3.2		V
				3.0		V
				3.8		V
I _{CH}	Charging current		350	500	900	µA



USE EXCLUSIVELY A LITHIUM BATTERY

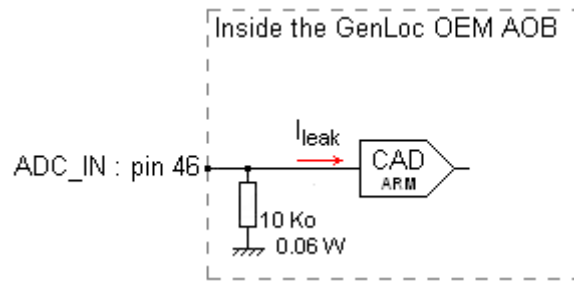
3.17 ADC_IN

Input description

Signal	Pin number	I/O	Type I/O	Description	Level
ADC_IN	46	I	To ARM	Analog converter	3.3V

Electrical characteristics of the input

ADC_IN	Description	Conditions	Min.	Typ.	Max.	Units
V _{ADVREF}	Reference tension		3.2	3.3	3.4	V
V _{IN}	Analog input		0		V _{ADVREF}	V
I _{LEAK}	Leak current			1		µA
C _{IN}	Input Capacitance			12	14	pF



If the analog input is not used, it must be connected to the GND (0V).

3.18 VCC output (VCC_3V3)

This output can be used to supply some external functions. This VCC power supply is available when the GenLoc OEM AOB is powered on and must be used as a DC supply.

Output description

Signal	Pin number	I/O	Type I/O	Description	Level
VCC_3V3	49	O	Supply	Digital supply	3.3 V

Electrical characteristics of the output

Parameter	Condition	Min	Nom	Max	Unit
Output voltage	$I = 20\text{mA}$	3.2	3.3	3.4	V
Output current				62	mA



The total current on the outputs

13 - CDE_GPS-RX	18 - GPIO_2	50 - GPIO_6
14 - ON / OFF GPS	19 - GPIO_1	52 - ~RXD2
15 - GPIO_5	20 - GPIO_0	56 - SPI_CLK
16 - GPIO_4	21 - SPI_AUX	57 - SPI_IO
17 - GPIO_3	49 - +VCC_3V3	58 - WDI

Must be below 62 mA

3.19 ~ON/OFF GSM

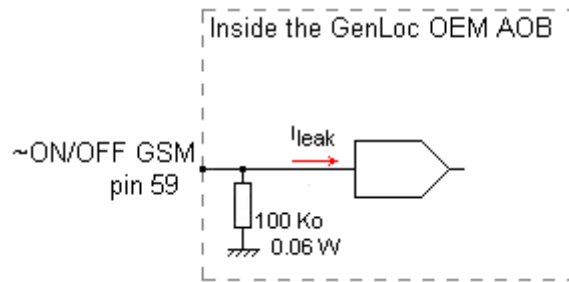
This pin is used to switch the power supply of the GSM part. It can be directly driven by the exterior. At powering on, this pin is positioned by a pull-down at the GND ground.

Input description

Signal	Pin number	I/O	Type I/O	Description	Level
~ON/OFF GSM	59	I		GSM/GPS Power management	5V

Electrical characteristics of the input

~ON/OFF GSM	Description	Conditions	Min.	Typ.	Max.	Units
V _{IL}	Input Low level voltage		-0.3		0.7	V
V _{IH}	Input High level voltage		2		5.5	V
I _{LEAK}	Input Leakage Current		-1	0	1	μA



If this input is not used, it must be left upwards.

3.20 Auxiliary ADC (AUXV0)

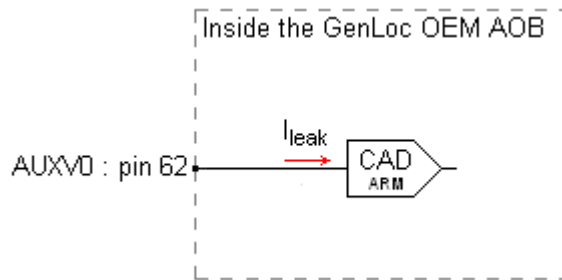
The GSM/GPRS module provides an Analog/Digital converter (ADC). This converter has a 10 bits resolution, with a range of 0 to 1.75 V max.

Input description

Signal	Pin number	I/O	Type I/O	Description	Level
AUXV0	62	I	To ARM	Analog converter	3.3V

Electrical characteristics of the input

AUXV0	Description	Conditions	Min.	Typ.	Max.	Units
V_{ADVREF}	Reference tension		3.2	3.3	3.4	V
V_{IN}	Analog input		0		V_{ADVREF}	V
I_{LEAK}	Leak current			1		μA
C_{IN}	Input Capacitance			12	14	pF



If this analog input is not used, it must be connected to the GND (0V).

3.21 GPS Pins

3.21.1 GPS serial interface série (~TXD and ~RXD)

The serial link is adapted to the protocol V24 of logical level 3.3V.

The available signals on the serial link are:

TX data (CT103/TXD): Data transmission,

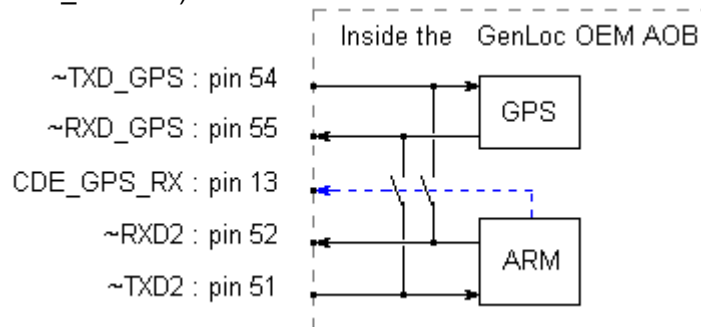
RX data (CT104/RXD): Data reception.

These signals are directly sent towards the UART of the GPS module.

By default, the parameters of the link are:

- Speed : 9 600 bauds
- Nb bit : 8 bits
- Parity : none
- Nb stop : 1 stop

When an embedded application controls the GPS module, the serial link of the GPS is redirected towards the ARM. The redirection is indicated by the status of the pin 13 (see paragraph 3.4 CDE_GPS-RX).



When this function is selected, the pins 51, 52, 54 and 55 must not be connected.

Inputs/outputs description

Signal	Pin number	I/O	Type I/O	Description	Level
~RXD_GPS	55	O	From GPS	Receive serial data	3.3V
~TXD_GPS	54	I	To GPS	Transmit serial data	3.3V

Electrical characteristics of the input

~TXD_GPS	Description	Conditions	Min.	Typ.	Max.	Units
V _{IL}	Input Low level voltage				0.22	V
V _{IH}	Input High level voltage		0.91		3.7	V

Electrical characteristics of the output

~RXD_GPS	Description	Conditions	Min.	Typ.	Max.	Units
V _{OL}	Output Low-level Voltage	I _{out} = 4 mA			0.4	V
V _{OH}	Output High-level Voltage	I _{out} = -4 mA	2.8		3.4	V

3.21.2 Indication of the GPS activity status (TIMEPULSE)

The TIMEPULSE signal can directly drive a LED according to the indication of the GPS activity status.

One pulse per second is sent when the GPS signal received is given for "FIX" (stabilized). This pulse is synchronized upon ascending front with a pulse length of 100 ms.

The GPS activity status is also indicated by the status of the GPS LED (see paragraph 6.3.2 led).

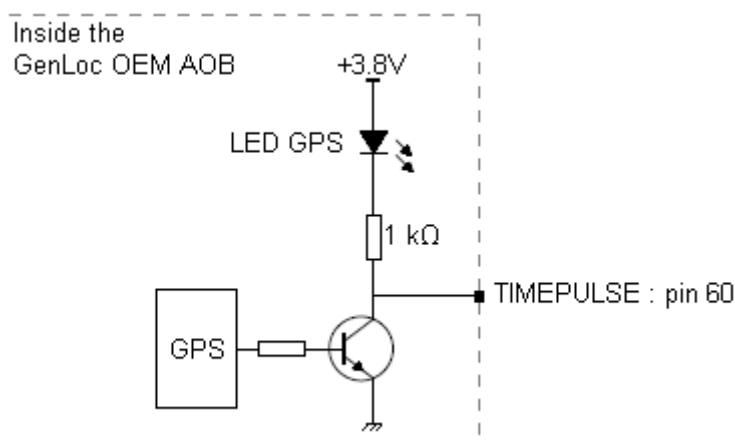
Input description

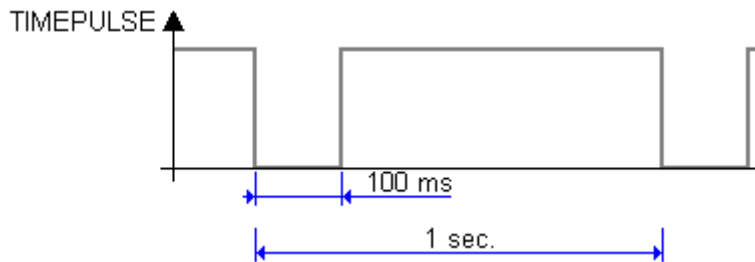
Signal	Pin number	I/O	Type I/O	Description	Level
TIMEPULSE	60	O	From GPS	Activity Status indication	3.8

Electrical characteristics of the output

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V _{CBO}	collector-base voltage	open emitter			75	V
V _{CEO}	collector-emitter voltage	open base			40	V
I _C	collector current (DC)				600	mA
I _{CM}	peak collector current				800	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C			250	mW
I _{CBO}	collector cut-off current	IE = 0; VCB = 60 V			10	µA
		IE = 0; VCB = 60 V; T _j = 125 °C			10	µA
V _{CEsat}	collector-emitter saturation voltage	IC = 150 mA; IB = 15 mA; (*)			300	mV
		IC = 500 mA; IB = 50 mA; (*)			1	V

(*) Pulse test: tp ≤ 300 µs; δ ≤ 0.02.





4 Radio Design

4.1 Antennas characteristics

4.1.1 GSM/DCS Characteristics

4.1.1.1 Frequency band

The GSM/GPRS antenna must answer to the exigencies 850/900/1800/1900MHz. The frequency used depends on the application and the installation country. A Quad-bands antenna 850/900/1800/1900 MHz will work with all these frequency bands.

The frequency band 850/1900 is mainly used on the North and South American continent, while the frequency band 900/1800 is used throughout the rest of the world. To know the frequency band corresponding to a country consult the website www.gsmworld.com

4.1.1.2 RF Functioning

The RF functioning complies with the ETSI GSM Standard recommendation.

The RF performances for the receiver and the transmitter are described below.

Table: Parameters of the RF receiver and transmitter

Receiver	
Sensitivity in 850/900	- 106 dBm, GPRS Coding Scheme 1 (CS1)
Sensitivity in 1800/1900	- 106 dBm, GPRS Coding Scheme 1 (CS1)
Transmitter	
Maximum power (Power Class1 - 850/900) at room temperature	33 dBm ± 2 dB @ antenna connection
Maximum power (Power Class4 - 1800/1900) at room temperature	30 dBm ± 2 dB @ antenna connection

4.1.1.3 GSM external antenna

The external GSM antenna must comply with the characteristics described in the table below.

Table: Characteristics of the external GSM antenna

Frequency band	850/900/1800/1900 MHz
Impedance	50 Ohms nominal
DC impedance	0 Ohm
Gain	0 dBi in a mini direction
VSWR (Rx max TX max)	1.5:1
Polarization	Linear

4.1.2 GPS characteristics

4.1.2.1 GPS functioning

The GPS performances are given in the table below.

Table: GPS parameters

Parameters	Specifications
Kind of reception	Frequency L1 C/A Code – 50 channels
Time To First Fix ¹	Cold Start (Autonomous) 29 s
	Warm Start (Autonomous) 29 s
	Hot Start (Autonomous) < 1s
	Aided Starts ² < 1 s
Sensibility ³	Tracking & Navigation -160 dBm
	Reacquisition -160 dBm
	Cold Start (Autonomous) -145 dBm
Horizontal Position Accuracy ⁴	Autonomous < 2.5 m
	SBAS < 2.0 m
Max Navigation Update Rate	4 Hz
Velocity Accuracy ⁵	0.1 m/s
Heading Accuracy ⁵	0.5 degrees
Dynamics	≤ 4 g
Operational Limits Velocity	515 m/s

¹ All satellites at -130 dB

² Dependent on aiding data connection speed and latency

³ Demonstrated with a good active antenna

⁴ CEP, 50%, 24 hours static, -130dBm

⁵ 50% @ 30m/s

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
NFtot	Receiver Chain Noise Figure			2.5		dB
Prfin	RF Input Power			-5	+5	dBm
Vccrf	VCC_RF voltage		3.1		3.3	
Iccrf	VCC_RF output current				50	mA

4.1.2.2 GPS external antenna

The external antenna must comply with the characteristics described in the table below.

Table: Characteristics of the GPS external antenna

Rx frequency	1575.42 MHz +/-1.023 MHz
Impedance	50 Ohms nominal
Antenna gain	15 dB typ / 45 dB max
Typical extended gain	5 dBi in a mini direction .
VSWR (Rx max)	1.5:1
Polarization	RHCP
Supply tension	3.3V
Supply voltage (max)	30mA

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
	Rx frequency		1574.397	1575.42	1576.443	MHz
	Impedance			50		Ω
	Antenna gain			15	45	dB
	Typical extended gain			5		dBi
	VSWR				1.5:1	
	Polarization	RHCP				
	Supply tension		3.1		3.3	V
	Supply voltage				50	mA

4.2 Recommendations

The integration and the choice of the antenna are major points in the final application.

A particular care must be paid for:

- The conception of the antenna part on the application (direct on PCB),
- The antenna connector (type + losses),
- The choice of the antenna.

These elements could affect the GSM / GPRS / GPS functioning like the sensitivity and the transmission power.

The antenna must be as far as possible from the digital circuits (including the interface signals) in order to protect the final application.

On terminals including the antenna, an insufficient protection could radically affect the sensitivity. Moreover, the power transmitted by the antenna could affect the application.



It is strongly recommended to work with an antenna manufacturer or to develop an adapted antenna or to validate an adapted solution already existing for the application. The antenna adaptation (mechanical and electrical) is one of the key problems in the conception of a GSM terminal.

- According to the general recommendations, all components working with high frequencies (microprocessors, memories, DC/DC converter), and the RF active parts will not have to be too close. In such a case, a correct power supply and decoupling sectors will have to be made and validated.
- Avoid to place components around the RF connections and next to the RF line (between the module and the antenna).
- The RF lines and the cables will have to be as short as possible.
- The coaxial cable will not have to be placed next to devices working with low frequencies.
- Some signals like VBATT and the charger line may require some EMI/RFI decoupling: condenser in parallel of 33 pF next to the module, or a serial ferrite bead (or both to improve the results). In the case of using a ferrite bead, the recommendations given for the power supply must be carefully respected (high capacity and low impedance).

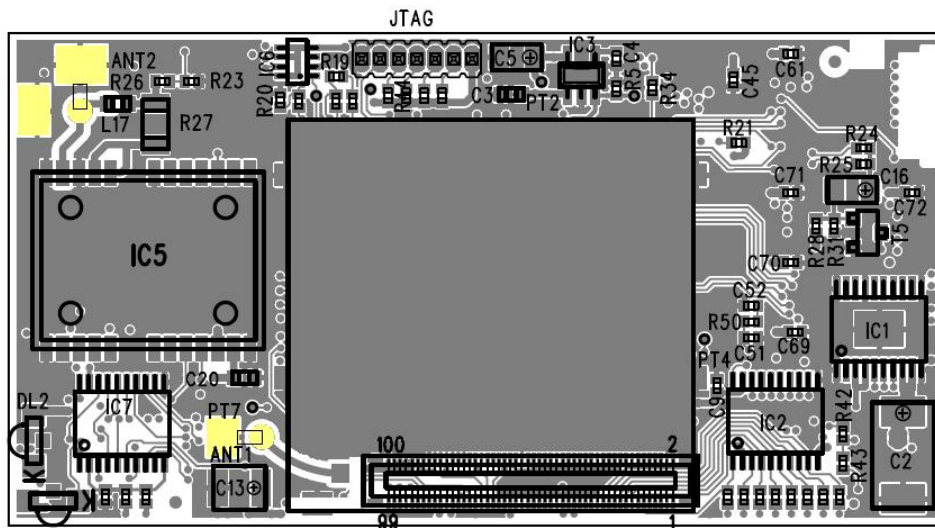
4.3 Connections

The antennas must be soldered to the GenLoc OEM AOB via a 50 Ω coaxial cable. The coaxial cable must be connected to the antenna round pads and to the ground rectangular pads (see scheme below).

It is recommended to use a coaxial cable like RG178 coaxial or equivalent with the following assembling directives:

1. The cable and the GSM/DCS antenna connector must be chosen to reduce as little as possible some losses in the frequency bands used for GSM 850/E-GSM 900MHz and DCS 1800/PCS 1900MHz.

2. The cable and the GPS antenna connector must be chosen to reduce as little as possible some losses in the frequency bands used for GPS 1575.42 MHz +/-1.023 MHz.
3. To obtain a good ground plane, the cable ground must be connected to the ground pad, as indicated in the schemes below.



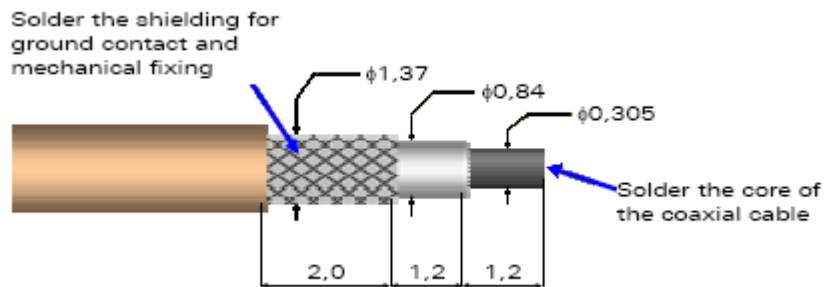
Pads of the antennas cables.

Recommendations for manual soldering

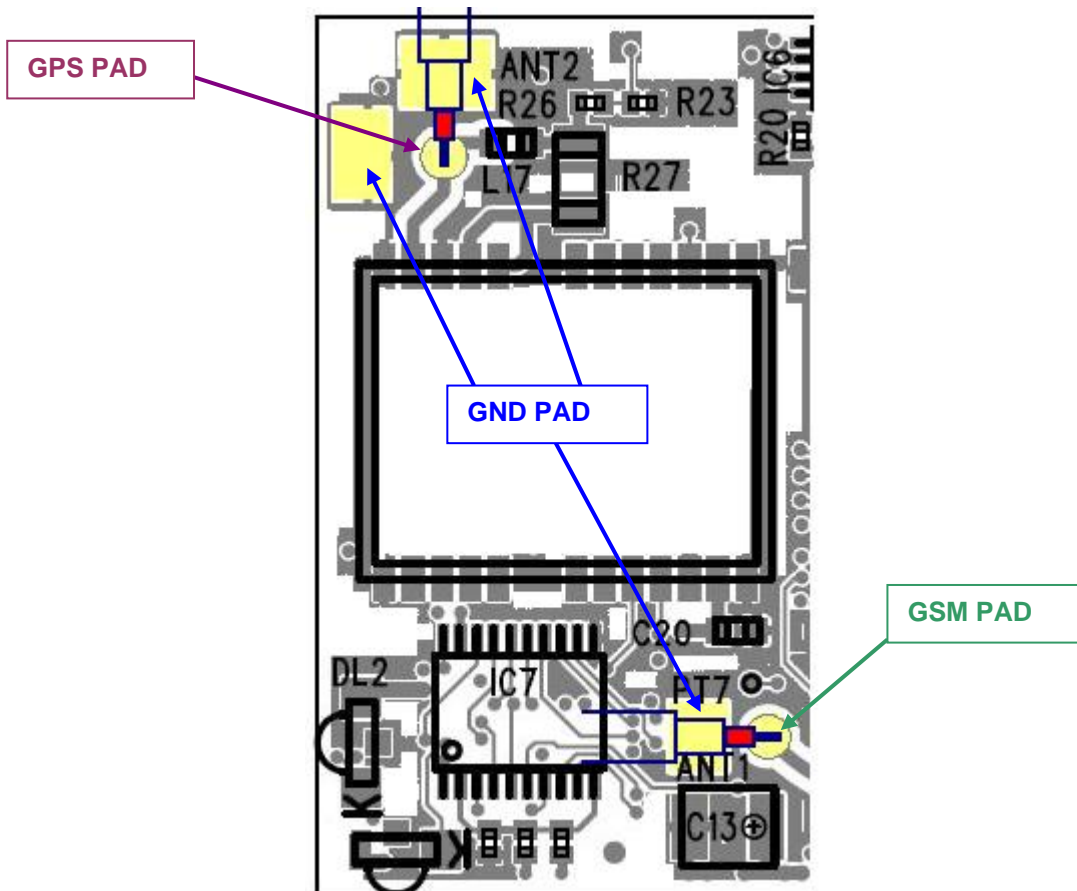
- Soldering iron: WSD80 (Weller) or equivalent
- ROHS soldering tin: Kester 245 Cored 58 (Sn96.5Ag3Cu0.5)

Assembling process

- Tin diameter = 0.5 mm
- Binocular: Mantis (Vision engineering) or equivalent
- Soldering iron: length 2.4 mm x width 0.8 mm (LT BLF type)
- T max = 385 °C for 3 to 5 sec



Example of measures for the coaxial cable RG178 / stripped



Example of preparation of antenna cables (drawing not on scale)

Note: a maximal loss of 0.5 dB can be taken into account between the module and an external connector.

5 Technical specifications

5.1 Environmental characteristics

To ensure a correct functioning, the limits listed in the table below must be respected.

Table: Environmental characteristics

Operating temperature	-30 °C to +60 °C
Storage temperature	-40 °C to +85 °C
Atmospheric pressure	normal

5.2 Mechanical specifications

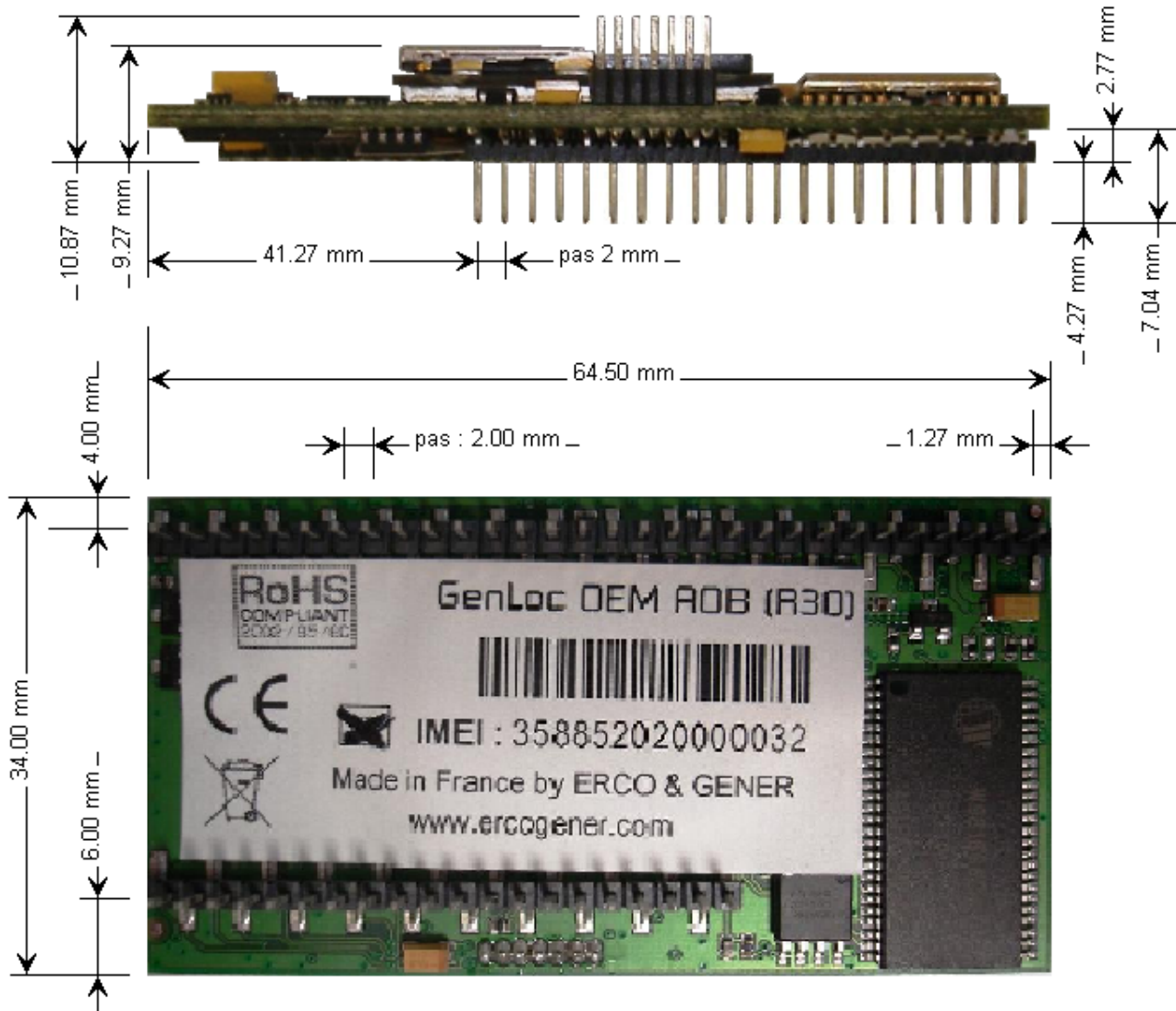
5.2.1 Mechanical characteristics

Table: Mechanical characteristics

Complete dimensions	64.5 x 34 x 15 mm (with the SIM card)
Weight	≈ 25 grams (Socket Modem only)

5.2.2 Mechanical diagram

The illustration below shows the dimensions of the modem including the clearances necessary for the integration of the module.



5.3 Electrical characteristics

5.3.1 Power supply



Once the power supply is connected and the pin ON/OFF GSM is ON, the modem is permanently consuming.

The following table describes the consequences of over-voltage or insufficient voltage on the modem.

Table: Effects of a power supply defect

	Then:
▪ Drop of tension below 4.8V	▪ The functioning, the GSM and GPS communication are not guaranteed.
▪ Tension over 5.5V (Overvoltage peak and continue)	▪ The protection against tensions over 5.5V and inverted tensions must absolutely be insured out of the module .

The table below describes the different consumptions depending on the frequency band selected with an output 50 Ω RF of the GSM module.

Table: Consumption of the ARM

ARM Operation @ 5V			
Board	Mode	Nom/Av (mA)	Max./Pic (mA)
Only		35	

Table: Consumption of the GSM module

GSM Operation @ 5V			
Band	Mode	Nom/Av (mA)	Max./Peak (mA)
1900	1 RX/1TX, Full Power	204	1180
1800		215	1280
900		248	1600
850		250	1600
All	Idle ¹	2.4	154

GPRS Operation @ 5V			
Band	Mode	Nom/Av (mA)	Max./ Peak (mA)
1900	2 RX/2TX, Full Power	340	1180
1800		354	1280
900		422	1600
850		420	1600
All	Idle ¹	2.4	140

Table: Consumption of the GPS module with passive antenna

GPS Operation @ 5V			
Band	Mode	Nom/Av (mA)	Max./Peak (mA)
Acquisition	Max performance	102	150
Tracking		43	
Acquisition	Eco Mode	67	
Track		40	

(*)The power supply consumptions may vary of 5% depending on the temperature range (-20 °C to +60 °C).

(¹) Idle mode = modem registered on the network but not in communication.

6 Using the module

6.1 Guide for the conception of your application

6.1.1 Hardware recommendations

Some CEM tests of the final application must be made in order to detect possible problems.

During the conception of your application board, a particular care must be taken for the following points:

- Possibility of interference emission by the application (RF) in the GSM frequency band.
- DES protections of the SIM part in the case of a external swerving, (see paragraph 3.11.2 External SIM card interface).
- Length of the SIM interface line (better < 25.4 cm).
- EMI protections of the audio Inputs/Outputs (filters against emissions of 900 MHz), (see paragraph 3.8 Audio Interface).
- Microphone input correctly adjusted (Microphone + Loudspeaker).
- DES protections of the serial link...
- Common ground plane recommended for the analogical / digital / RF grounds.
- Metal or plastic casing with conductor paint recommended (with external antenna).
- Do not place the processor or circuits like oscillator next to the GSM module and the antenna cables, in order to avoid emissions which could disturb your application.
- Do not place the audio interface close to the antennas to reduce the risks of TDMA noise.



The GenLoc OEM AOB does not include protection against overvoltage. The protections of the power supply will have to be chosen by the rule book.

6.1.2 Antennas

The choice of the elements that form the antenna (type, performance, cable length and the thermal resistance, etc.) and its integration into the application are major criteria.

These elements could affect the performances of the GSM characteristics like the sensitivity and the transmission power.

For applications including the antennas, a correct protection is necessary; otherwise the sensitivity of the terminal could be affected.

The antenna must be as isolated as possible from the digital circuits and the modem interface; otherwise the transmission power via the antenna could affect the application.

6.1.3 Minimum Hardware interface to start

A minimum of signals of the serial link are necessary to work correctly with the GenLoc OEM AOB for your application (see paragraph 3.13 Serial link (UART1) for the installation of the serial link).

Minimums signals required to make the GenLoc OEM AOB work with the UART1

Pin number	Signal	Description
63,41	GND	GROUND
61	+5V	Power Supply
38	CT106 / CTS1	Clear To Send
35	CT103 / TXD1	Transmit
34	CT104 / RXD1	Receive
33	CT105 / RTS1	Request To Send
59	ON/OFF GSM	Status ON connected to 0V or upwards Status OFF connected to +5V

*

Connected at + 5 V_{DC}

6.2 Using the GenLoc OEM AOB with a Terminal emulator software

The following paragraph explains how to configure the PC for the data exchange.

6.2.1 Installation of a Terminal emulator software

You will find below an example realized with Windows HyperTerminal (the terminal emulator software).

Installation:

1. START> ALL PROGRAMS>ACCESSORIES>COMMUNICATIONS>HYPERTERMINAL,
Launch HyperTerminal.
2. Enter the name you want, click on an icon, click on "OK"
3. " Connect using": select "COM1" (or another COM port available).
4. Enter the following "Port parameters":
 - 115200 bps,
 - 8 data bits,
 - Parity none,
 - 1 stop bit,
 - Material flow control.

And click on "OK".

Once HyperTerminal is open and configured, it can be used to send AT commands to the GenLoc OEM AOB.

6.2.2 Example of AT commands

Example of AT commands which can be sent when the communication with the Socket Modem is validated, when the GenLoc OEM AOB contains the standard library. (Detailed commands in the following paragraphs):

- **AT+CGSN** : the response of the modem must be a number with 15 digits
(starting with "35885202xxxxxx") when the serial link is correct.
- **AT+CPIN="xxxx"** : enter the code of the SIM card xxxx (if activated).
- **AT+CSQ** : check the reception level of the GSM signal received.
- **AT+CREG ?** : check the registering of the modem on the network.
- **ATD< telephone number >** : launch a voice call.
- **ATH** : hang-up (end of call).
- **AT+GPSPOS** : read a position given by the GPS.

For more information about these AT commands and their associated parameters, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

6.3 Leds

6.3.1 GSM led

6.3.1.1 Without library

The GenLoc OEM AOB does not contain any library. The led is off.

6.3.1.2 With EGM standard library

The led remains off.

6.3.1.3 The application ERCO & GENER EaseLoc-01

This application is currently under development. Contact us.

6.3.1.4 The owner application

The GenLoc OEM AOB contains your application. The status of the led depends on your parameters.

6.3.2 GPS led

The positioning status of the modem is indicated by the GPS LED status.

The table below explains the signification of the different possible status of the GPS LED.

GPS LED status	LED activity	Modem status
Off	LED off	The modem is not calculating GPS position; the GPS is not active or the antenna is not connected.
On	LED flashing	The GPS is synchronized with different satellites. It found its position.

6.4 Checking the quality of the GSM reception signal

The modem will be able to make a call only if the received GSM signal is powerful enough.

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER) and in this case, the command **AT+CSQ** allows to know the reception level (*rsst*) of the signal sent by the closest GSM Base Transceiver Station (BTS), as well as the receive bit error rate (*ber*).

When the SIM card is inserted and the PIN code entered, the command **AT+CSQ** allows to measure the signal coming from the BTS terminal of the subscription operator network.

This command can also be used without SIM card, it indicates in this case the nearest BTS which can be ORANGE, SFR or BOUYGUES for France (Without SIM card, the current subscription is not recognized). It is therefore advisable to do the measure when the SIM card is present.

To check the quality of the GSM signal, do the following operations:

Use a communication software like Hyperterminal, enter the command **AT+CSQ**.

The response is in the following format:

+CSQ : <rssI>, <ber> with:

<rssI> = indicates the reception level,

<ber> = receive bit error rate.

Check the answered value **<rssI>** with the help of the table below.

Value of the <rssI>	Gain in dbm	Interpretation	Value of the <ber>	Interpretation
0	-113 dbm	Insufficient	0 to 7	See ETSI GSM 05.08 standards
1 to 10	-111 to -95 dbm	Insufficient		
11 to 30	-93 to -53 dbm	Sufficient		
31 (max)	-51dbm	Perfect		
99		Unknown/ not detectable	99	Unknown / not detectable

The GSM modem works normally with a minimum **<rssI>** between 11 and 15.

Below 10, the signal level is insufficient; the modem cannot work depending on the geographical situation or the vehicle mobility. Above 15, the signal is sufficient.

For more information about AT commands, see the document "EG_EGM_CL_XXX_YY" of ERCO & GENER.

6.5 Checking the PIN code

The PIN code is necessary to make a call or to accept a response coming from the GSM network. This code is held in the SIM card and can be modified by the user.

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER) ; in this case, to check if the PIN code has previously been entered, use a communication software like Hyperterminal, and enter the command **AT+CPIN?**

The table below shows the main responses given by the modem:

Command	Response	Interpretation
AT+CPIN?	+CPIN : ERROR	The SIM card is absent or not recognized
	+CPIN : READY	The PIN code is correct
	+CPIN : SIM PIN	The PIN code is wrong or not entered yet
	+CPIN : SIM PUK	The PUK code is required

For more information about AT commands, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

6.6 Checking the modem registration on the GSM network

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER), in this case:

1. Ensure that a valid SIM card has been inserted in the SIM card reader of the modem.
2. Using a communication software like Hyperterminal, enter the following AT commands:

a. **AT+CPIN="xxxx"** to enter the PIN code. The user has only 3 attempts to enter the PIN code.

After the third attempt, only a second code (PUK code) supplied by the operator, will allow you to chose a new PIN code.

b. **AT+CREG?** to check the registration status on the network. The response will be of the following format: **+CREG : <mode>, <stat>** with:

<Mode> = configuration of the registration message not solicited,

<Stat> = registration status.

3. Check the registration status according to the value given in the table hereunder.

Command	Response	Interpretation
AT+CREG?	+CREG : 0,0	The modem is not recognized by the network.
	+CREG : 0,2 or 0,3	The modem is searching for a network operator.
	+CREG : 0,1	The modem is attached in GSM to the local operator.
	+CREG : 0,5	The modem is attached in GSM to the roaming operator.

If the modem is not registered: check either the connection between the modem and the antenna or the reception level of the signal (cf. paragraph 6.4).

For more information about AT commands, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

6.7 Reading a current position given by GPS

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER); in this case, the reading of a GPS position can be done with the command **AT+GPSPOS**. This command allows to get the information received of the current position. After powering on the modem, a minimum acquisition time is necessary (around 30 seconds).

The response is in the following format and the table shows examples of responses:

+GPSPOS:<fix>,<time>,<date>,<latitude>,<longitude>,<altitude>,<hdop>,<speed>,<cap>,<nbsat>

<fix>

- 0 invalid fix
- 1 2D fix
- 2 3D fix
- 1 impossible to define a position

<time> : hhmmss.zz

example: 083205.00 -> 8 hours 32 minutes 05 seconds and 00 hundredth of a second in UTC

<date> : ddmmyy

example: 180406 -> the 18 April 2006

<latitude> : ddmm.mmmmm(N/S)

dd (degree) 00 to 90

mm.mmmmm (minute) 00,00000 to 59,99999

N/S North or South

example: 4716.81310N -> latitude 47 degrees 16,81310 minutes North

<longitude> : dddmm.mmmmm(E/W)

ddd (degree) 00 to 180

mm.mmmmm (minute) 00,00000 to 59,99999

E/W East or West

example: 00003.51202W -> longitude 0 degree 0 3,51202 minutes West

<altitude> : mmmm.m in meters

<hdop> : mmm.mm horizontal dilution position in meters

<speed> : ssss.s ground speed in km/s

<cap> : dddmm.mmmm

ddd (degree) 000 to 360

mm.mmmm (minute) 00,0000 to 59,9999

<nbre sat> : nn number of satellites seen

The following table shows examples of responses returned by this command.

Command	Response	Interpretation
AT+GPSPOS	+GPSPOS:-1,,,,,,,,,0	It is not possible to define a position. Check the positioning of the GPS antenna or the GPS configuration (see paragraph 4.1.2.2 GPS external antenna , 6.8 configuration).
	+GPSPOS:0,083138,180406,,,,,,,,6	It is not yet possible to have a position but the date and time information are available. A complete frame should be obtained soon or the antenna position is not optimum
	+GPSPOS:2,083205,180406,4716.81310N,0003.51202W,44.9,2.14,0.037,33.43,10	A position is read and all the information is available. The frame is considered as complete. The GPS LED is flashing.

6.8 GPS configuration

6.8.1 Powering on the GPS module

The modem contains the EGM standard library; in this case, by default, the GPS module is on, the command AT+GPSPWR allows an on/off of the module.

AT+GPSPWR=[<x>]

<x> = 0 : GPS off

1 : GPS on (by default)

Examples:

Command	Response	Interpretation
AT+GPSPWR=1 (by default)	OK	GPS on
AT+GPSPWR=0	OK	GPS off

For more information about this AT command, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

6.9 Management of logical inputs/outputs

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER), in this case, these functions are controlled by AT commands. Each input/output corresponds to a number which will have to be entered in the command.

Table: Number of the inputs/outputs

Name of the input/output	<n> Number of the input/output
GPIO_0	7
GPIO_1	8
GPIO_2	9
GPIO_3	36
GPIO_4	37
GPIO_5	10
GPIO_6	30

6.9.1 Choosing the direction

AT+GPIODIR This command is used to drive the direction of the inputs/outputs. By default, the inputs/outputs are positioned in input. The control can be made as follows:

AT+GPIODIR=<n>,<x> with:

<n> = number of the input/output (see table above)

<x> = 0 : Output

1 : Input

Without value <x> the command returns the direction of the input/output.

Table: Example of command of direction

Command	Response	Interpretation
AT+GPIODIR=7,0	OK	The direction of the pin GPIO_0 becomes an output.
AT+GPIODIR=36,1	OK	The direction of the pin GPIO_3 becomes an input.
AT+GPIODIR=10	+GPIODIR: 10=1 OK	The direction of the pin GPIO_5 is in input
AT+GPIODIR=8	+GPIODIR: 8=0 OK	The direction of the pin GPIO_1 is in output

6.9.2 Management of the inputs

AT+GPIOGET This command is used to read the input status. The control can be made as follows:

AT+GPIOGET=<n> with:

<n> = number of the input (see table above)

Table: Example for reading an input

Command	Response	Interpretation
AT+GPIOGET=36	+GPIOGET: 36=1 OK	Input GPIO_3 read at 1, the input GPIO_3 is controlled
AT+ GPIOGET=10	+GPIOGET: 10=0 OK	Input GPIO_5 read at 0, the input GPIO_5 is not controlled

6.9.3 Management of the outputs

AT+GPIOSET This command is used to drive the output status. The control can be made as follows:

AT+GPIOSET=<n>,<x> with:

<n> = number of the output (see table above)

<x> = 0 : Output on OFF

1 : Output on ON

Without value <x> the command returns the output status.

Table: Example of command of direction

Command	Response	Interpretation
AT+GPIOSET=7,0	OK	Output GPIO_0 goes to OFF. The output GPIO_0 is on the 0V.
AT+GPIOSET=8,1	OK	Output GPIO_1 goes to ON. The output GPIO_1 is on the +3.3V.
AT+GPIOSET=7	+GPIOSET: 7=0 OK	The output GPIO_0 is on the 0V.
AT+GPIOSET=8	+GPIOSET: 8=1 OK	The output GPIO_1 is on the 3.3V.

6.10 Management of the analog inputs

These functions are currently under development. Contact us.

6.11 Main AT commands (HAYES)

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER), in this case, the table below describes the main AT commands necessary for the control of the modem.

Other AT commands are available, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

Table: Main AT commands used with the modem.

Description	AT Command	Response	Interpretation
Entering the PIN code	AT+CPIN="xxxx" (xxxx = PIN code)	OK	PIN code accepted
		+CME ERROR: 16	PIN code incorrect (1*)
		+CME ERROR: 3	PIN code already entered (1*)
Verification of the registration on network	AT+CREG?	+CREG : 0,1	The modem is attached in GSM to the local operator.
		+CREG : 0,5	The modem is attached in GSM to the roaming operator.
		+CREG : 0,2 ou 0,3	The modem is searching for a network operator.
		+CREG : 0,0	The modem is not recognized by the network.
Reception of an incoming call (2*)	ATA	OK	Answers to the call
Launch an outgoing voice call	ATD< telephone number>; (the ; at the end of the chain is important, it allows to make a voice call)	OK	Communication established
		+CME ERROR: 11	PIN code not entered
		+CME ERROR: 3	The credit is out or a communication is already established.
Launch an emergency call (112)	ATD112;	OK	Communication established
Communication lost		NO CARRIER	
Hang up	ATH	OK	

(1*) with **+CMEE=1**. The command **AT+CMEE=1** allows to display the extended error codes; it is possible to save it with the command **AT&W**.

with **%CSTAT=1**. The command **AT+%CSTAT=1** allows to display the status change of the SIM card (card present, card ready ...) and to know some status of the modem (modem ready after a RESET ...), it is possible to save it with the command **AT&W**.

(2*) with **+CRC=1**. The command **AT+CRC=1** allows during an incoming call to obtain an extended message indicating the type of channel called. This message corresponds to the type of number called: vocal or data, it is possible to save it with the command **AT&W**.

Examples:

If the VOICE number is called, the modem will return: **+CRING : VOICE**

If the DATA number is called, the modem will return: **+CRING : REL ASYNC**

6.12 Turning the device off

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER); in this case, it is strongly unadvised to cut the power of the GenLoc OEM AOB during the communication or during the dialogue without having previously detached it from the network operator.

Indeed, for reasons of non-congestion of the network, it is necessary during the normal turning off of the modem to execute the command **AT+COPS=2**.

Without this command, the modem may, in some cases, be still registered on the network.

In dialogue mode (out of communication), before cutting the power supply, the following sequence has to be sent to the modem: **AT+COPS=2**.

The modem returns OK, the modem is not registered on the network anymore, the radio module is put in sleep mode, the power supply can be cut.

Note: There is no particular action to do on the GPS part before turning it off.

6.13 Modem updating procedure

In order to benefit from the latest functions of the GenLoc OEM AOB, an updating procedure is usable to upgrade the firmware inside the modem.

This procedure consists in downloading the software into the internal Flash memory of the modem via the RS232 link available on the Sub-D 9-pin connector of the Starter Kit GenLoc OEM AOB.

Contact us for the software updating.

7 Trouble shooting

This section of the document describes the problems that may be encountered when using the modem.

7.1 Problem of communication between the modem and the RS232 link (V24)

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER); in this case, if the modem does not respond to the AT commands via the RS232 link, see the table below to find the possible reasons and the solutions.

Table: Solutions when there is no dialogue between the modem and the RS232 link

If the modem...	Check:	Action
Returns nothing	Is the modem correctly powered?	Ensure that the regulated external power supply is connected to the modem and supplies a 5V _{DC} tension (see paragraph 3.2 and paragraph 3.19 ~ON/OFF GSM).
	Is the serial cable connected at both ends (PC and Modem)?	Check the connection of the serial cable.
	Is the serial cable correctly cabled according to paragraph 3.13 Serial link (UART1)?	Connect the serial cable respecting the pins denomination (paragraph 3.13 Serial link (UART1)).
Returns nothing or insignificant characters	Is the communication terminal correctly configured on the PC?	Ensure that the communication terminal configuration complies with the one of the modem. Factory configuration of the modem: Speed = 115200 bps Data Bits = 8 Parity = none Stop Bits = 1 Flow control = material
	Is there another application used which creates a conflict during the access to the communication port?	Close the conflicting application.
	Is the modem without echo and without reporting?	Send the command ATE1Q0 followed by AT&W if a backup is necessary.

7.2 "ERROR" message

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER), the modem returns the message "**ERROR**" (in response to an AT command) in the following cases:

- The GSM module is not powered. See paragraph 3.19 ~ON/OFF GSM
- The COM port is not directed towards the modem GenLoc OEM AOB but towards another modem. Enter **AT11**, the response must be **Enabler_III...** Any other response indicates a dialogue with another modem. Check the affectation of the COM port in Hyperterminal.
- The syntax of the AT command is incorrect: check it (see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER),
- The syntax of the AT command is correct, but transmitted with wrong parameters:
 - Enter the command **AT+CMEE=1** to obtain an error message with its error code instead of the simple message "ERROR",
 - Enter again the AT command which previously caused the reception of the message "ERROR" in order to obtain the error code.

In case of an error code obtained, the modem response can be under the following form:

Either +CME ERROR : < error code > ,

Or +CMS ERROR : < error code > .

For more information about the error codes returned after having sent the command **AT+CMEE**, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

Note: It is strongly recommended to allow systematically the modem to return the error codes (enter the command **AT+CMEE=1**).

7.3 "NO CARRIER" message

The modem contains the EGM standard library (see the documents "EG_EGM_CL_xxx_yy" of ERCO & GENER); in this case, if the modem responds "NO CARRIER" after an attempted call (voice or data), see the table below to find the possible reasons and the solutions.

Table: Solutions when the message "NO CARRIER» is returned

If the modem ...	Check :	Action
"NO CARRIER"	Is the level of reception of the GSM signal strong enough?	See the paragraph 6.4 Checking the quality of the GSM reception signal, to check the quality of the received signal.
	Is the modem registered on the network?	See the paragraph 6.6 Checking the modem registration on the GSM network, to check its registration.
	Is the antenna correctly connected?	See the paragraph 4.1.1.3 GSM external antenna for the recommendations about the soldering of the GSM antenna.
"NO CARRIER" (when attempting a VOICE communication)	Has the semi-colon (;) been entered immediately after the telephone number in the AT command?	Ensure that the semi-colon (;) has been entered immediately after the telephone number in the AT command. For example: ATD0123456789;
"NO CARRIER" (when attempting a DATA communication)	Has the SIM card been configured for data calls?	Ensure that the SIM card is allowed to make data calls (check with your SIM card supplier)
	Is the selected modulation type supported by the called number?	Ensure that the selected modulation type is supported by the called number.
	Is the selected modulation type supported by the network?	Ensure that the selected modulation type is supported by the network. If not, select a compatible modulation type with the command AT+CBST=0,0,1 (1*)

(1*) For more information about this AT command, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

If the modem returns a message "NO CARRIER", you can get the extended error code with the command **AT+CEER**.

For more information about the error codes returned after having sent the command **AT+CEER**, see the document "EG_EGM_CL_xxx_yy" of ERCO & GENER.

8 Standards/Conformities

The product complies with the essential requirements:

- ROHS Compliant : Directive 2002/95/CE,
- 2002/96/CE DEEE (crossed out wheelie bin).

Certification of the GSM module

- GSM 3GPP TS 51.010-1
- FCC Parts 15, 22 & 24
- GCF version 3.27.0
- CE Mark Version 3.12.0
- PTCRB oui
- Industry Canada oui
- RoHS Compliant oui

Certification of the GPS module

- The modules are based on AEC-Q100 qualified GPS chips



This subassembly was designed in accordance with the applicable standards. The CE marking applies to end products only. Consequently, the tests of conformity have to be done on the complete product that integrates this subassembly.

9 Security Recommendations

9.1 General security

It is important to respect the specific regulations concerning the use of radio equipments, in particular with the possible risks of interference due to radio frequency (RF). Please respect carefully the security advices below.

Turn off your GSM Modem:

- In an aircraft. The use of cellular phones can endanger the operations of the plane; disturbing the cellular network is illegal. The non-observance of this instruction can lead to the suspension or the exclusion of the cellular telephone services, or even to a trial or both,
- At a refuelling station,
- In any area with a potentially explosive atmosphere that could cause an explosion or a fire,
- In hospitals and other places where medical equipment may be used.

Restrictions of use of radio equipments in:

- Fuel warehouses,
- Chemical factories,
- Places where destruction operations are in the running,
- Other places where signs indicate that the use of cellular telephones is prohibited or dangerous.
- Other places where you should normally turn off the engine of your vehicle.

There can be a danger associated with the use of your GSM modem close to insufficiently protected medical devices such as acoustic devices and pacemakers.

Consult the manufacturers of medical equipment to know if it is adequately protected.

Using your GSM modem close to other electronic equipment may also cause interferences if the equipment is insufficiently protected.

Pay attention to the warnings and the recommendations of the manufacturers.

The modem is designed to be used with "fixed" and "mobile" applications:

- "Fixed" application: the GSM modem is physically linked to a site and it is not possible to move it easily to another site.
- "Mobile" application: the GSM modem is designed to be used in various places (other than fixed) and is intended to be used in portable applications.

9.2 Security in a vehicle

Do not use your modem whilst driving, unless equipped with a correctly installed ear-piece/hands-free kit.

Respect the national regulations concerning the use of cellular telephones in vehicles. Road safety is always a priority.

An incorrect installation of the GSM modem in a vehicle could cause an incorrect functioning of the electronics in the vehicle. To avoid such problems, ensure that the installation was made by a qualified person. During the installation, a verification of the electronic protection system of the vehicle must be made.

The use of a warning equipment which activates the headlights or the horn of a vehicle on a public highway is not authorized.

9.3 Care and maintenance

The suggestions below will help you to preserve this product for many years.

Do not expose the modem to the extreme environments, to high temperature or high humidity.

Do not use or store the modem in dusty or dirty places, it could be damaged.

Do not try to disassemble the modem, at the risk of cancelation of the guarantee.

Do not expose the modem to water, rain or spilled beverage, it is not impermeable.

Avoid dropping, striking, or shaking the modem violently. The lack of care can damage it.

Do not place the modem next to computer disks, credit or travel cards or other magnetic supports. The information contained on disks or cards can be affected by the modem.

The use of other equipments or accessories not made or authorized by ERCO & GENER can cancel the guarantee of the modem.

9.4 Your responsibility

This modem is under your responsibility. Treat it with care, it is not a toy. Keep it always in a secure place and out of the reach of children.

Try to remember your PIN and PUK codes. Familiarize yourself with the modem and use the security functions to lock it in case of non authorized use or theft.

10 Recommended Accessories

The accessories recommended by ERCO & GENER for the GenLoc OEM AOB, are shown on our website in the section Products/Accessories. For more information, contact our sales department.

11 Client support

ERCO & GENER ensures the client support for all its modems sold. You will then have access to:

- The latest version of this document
- The datasheet of the product
- The latest versions of the OS user guides
- Certificates
- Application notes

Note: The support for the EGM developments is proposed as an option (contact us).



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L'esprit Modem