

# User Guide

## GenLoc 31e



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## Document history

Revision	Modifications	Author	Date
002	CREATION (UK version starts at revision 002)	M. REEVES	28/06/06
003	Modified 2-wires cable section page 14. Added command AT+WTONE chapter 7.7.3 page 38 and the characteristics of the buzzer function, chapter 8.2.2.2 page 44.	F. LE BRETON	06/09/06
004	Added Abbreviation GPS page 08. Added Buzzer Output page 15. Correction n° pin 6 for RX signal page 34.	F. LE BRETON	04/01/07
005	Modified schema 2-wire cable page 14. Added Hardware WatchDog function page 10-11-31-37.	F. LE BRETON	20/02/07
006	Added warning SIM during the Firmware update (OS) page 27. Modified Buzzer page 44.	F. LE BRETON	19/03/07
007	Added Copyright page 6. Modified picture PL-WD and added warning page 9-10-11. Added speed serial port page 15.	F. LE BRETON	21/05/07
008	Added abbreviations page 8-9 Added photo label option battery page 11. Added explanation application "LLC" page 18-19. Added paragraph 7.2.2 option battery page 34 to 36.	F. LE BRETON	15/10/07
009	Added further information about optional battery page 34 to 35.	F. LE BRETON	21/11/07
010	Modified Warning page 13	F. LE BRETON	24/03/09

The main modifications in this document compared to its previous version, are easily identifiable on a monitor by means of the blue text.

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## Presentation

Entirely dedicated to geo-localization and embedded data services, the GenLoc 31e modem combines both GSM/GPRS and GPS functions in the same robust unit.

The GenLoc 31e modem includes a 16-channel GPS Hypersense high sensitivity GPS receiver assuring GPS data reception in difficult environmental conditions.

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

The GSM modem is bi-band 9010/1800 MHz (with optional 850/1900 MHz), and GSM/GPRS Class 10.

The GenLoc31e has 3 operating modes:

- External mode (standard mode): Control is by an external application. The modem is used with an AT command set (see the ERCO&GENER Commands List).
- Automatic mode: Once configured, the modem is completely autonomous. It regularly records GPS positions and automatically transmits them to the client's application via a choice of services: SMS, GSM Data, FTP GPRS, GPRS TCP socket, (see the ERCO&GENER Commands List).
- Specific Development mode: The Open-AT development tool allows the development of supplementary and personalized applications. For further information concerning the tools and training, please consult our sales department.

The GenLoc 31e provides inputs/outputs allowing the creation of value-added embedded telematic solutions.

This document describes the modem and provides the following information:

- General presentation,
- Functional description,
- Available basic services,
- Installation and use (first level),
- User-level trouble shooting,
- Recommended accessories.

For further information, please refer to the following documents:

- Commands List
- Application Notes
- Release Notes
- Client support (Hot-Line)

## Warning

- TO AVOID ALL RISK OF ELECTROCUTION, DO NOT OPEN THE UNIT
- THE UNIT CONTAINS NO USER REPAIRABLE COMPONENTS
- THE UNIT MUST BE RETURNED TO THE MANUFACTURER FOR ANY REPAIRATION
- THE UNIT MUST NOT BE CONNECTED DIRECTLY TO THE MAINS SUPPLY. PLEASE USE A SUITABLE EXTERNAL POWER SUPPLY.

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# 1 References

## 1.1 Reference documents

ERCO&GENER Commands List:  
EG\_Genloc31e\_988\_CL\_xxx\_UK

Wavecom AT Commands Interface Guide:  
P\_AT\_Commands\_Interface\_Guide\_for\_Xxxx\_Appendix\_revyyy

Software update procedure:  
EG\_Genloc31e\_988\_UP\_xxx\_UK

GSM reference documents:

- GSM 07.05.
- GSM 07.07.

## 1.2 Abbreviations

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



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

## 2 Packing

### 2.1 Contents

The GenLoc 31e is supplied with:

- GenLoc 31e packing case,
- GenLoc 31e modem,
- 2 fixing brackets,
- 4-wire cable (Red/Black/Orange/Green) with in-line fuse.
- 2-wire cable (Blue/Yellow).
- Instructions Sheet.



### 2.2 Packing case

Packing case external dimensions:

- Width: 54.5 mm,
- Height: 68 mm,
- Length: 108 mm.

An identification label is attached to the top of the packing case. It contains

- The ERCO&GENER logo,
- The product reference (GenLoc 31e),
- CE mark,
- The IMEI 15-digit bar code.

Identification label dimensions:

- Height: 37 mm,
- Length: 70 mm.

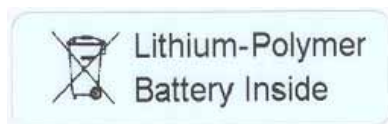
## 2.3 Modem Labels

Two labels are attached to the underside of the modem:

- A production label provides the following information:
  - CE mark,
  - Crossed wheelie-bin mark (DEEE standard),
  - DC supply (VDC),
  - Hardware WD mark,
  - Q24PLUS mark (PL),
  - The IMEI 15-digit bar code.
- Additional marking: ROHS (2002/95/CE) and "E" (E24 10R-020250).

**WARNING** : The PL mark on the case label indicates that the GenLoc 31e embedded the new generation of Wismo Q24PLUS.

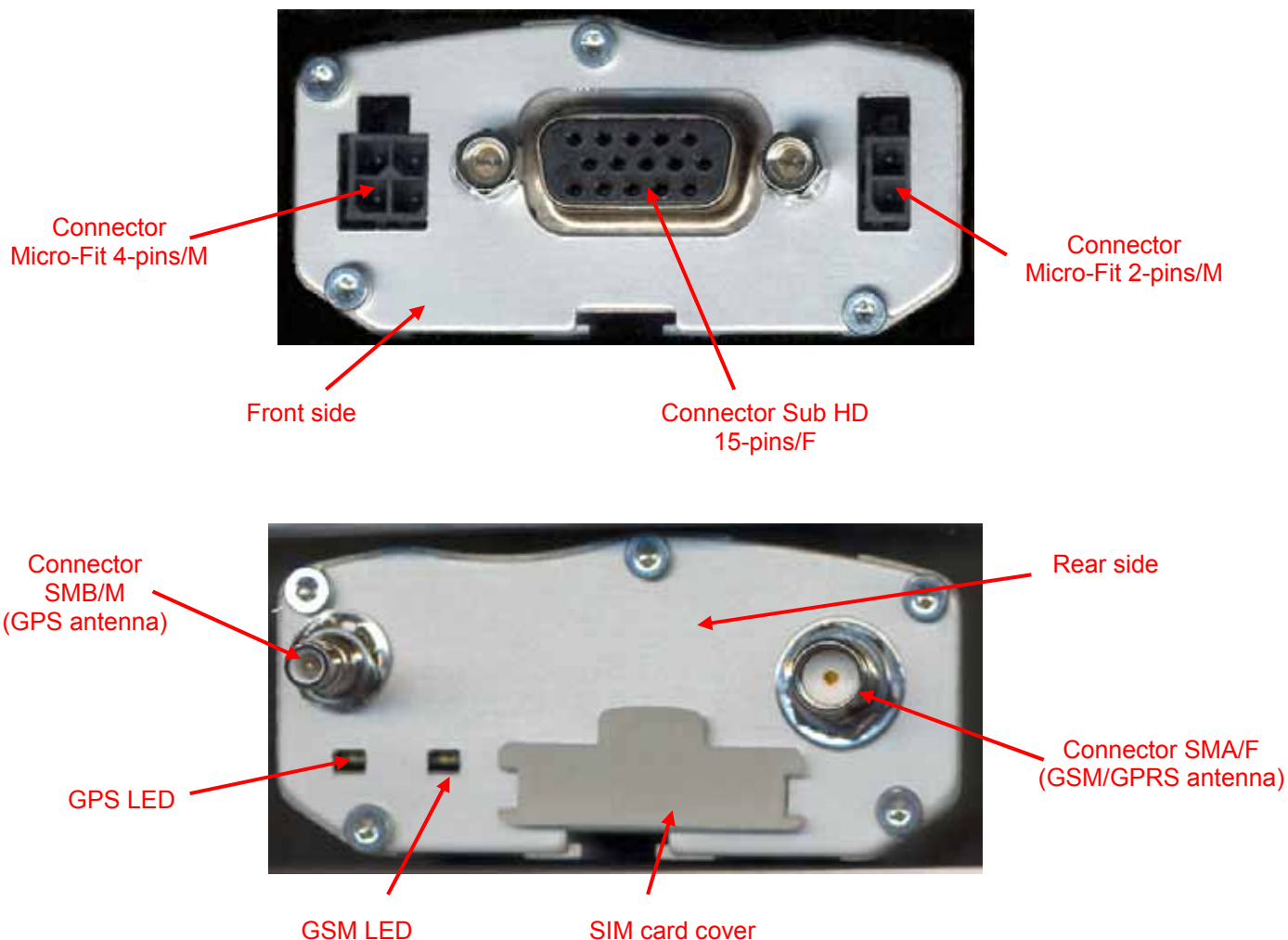
Note : The following label "**Lithium-Polymer Battery Inside**" may be present on the case if the optional internal battery has been mounted during production.



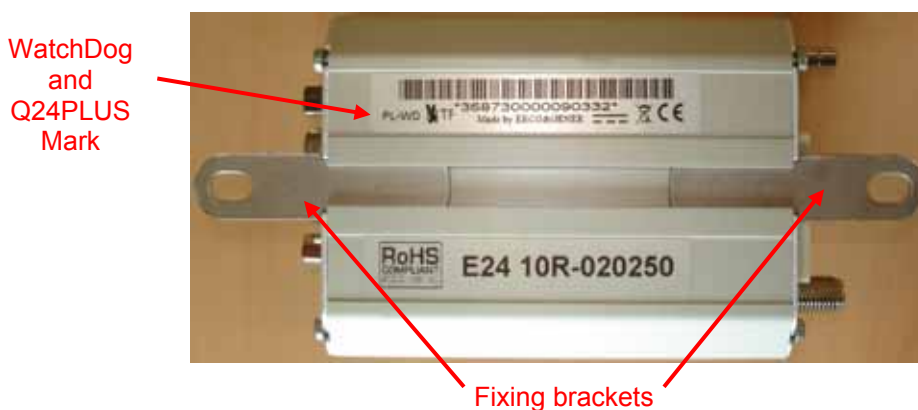
### 3 General Presentation

#### 3.1 Physical description

Description of the GenLoc 31e modem:



Two fixing brackets for attaching the modem to a support:



### 3.2 External connections

#### 3.2.1 Connections

##### 3.2.1.1 Antenna connectors

###### GSM antenna connector:

The GSM antenna connector is a 50Ω impedance female SMA type.

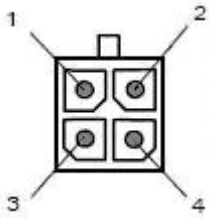
###### GPS antenna connector:

The GPS antenna connector is a 50Ω impedance male SMB type.

##### 3.2.1.2 Micro FIT connectors

###### 4-pin Micro FIT female connector:

This connector allows the connection of an external DC supply, and provides one general-purpose input and one general-purpose output.

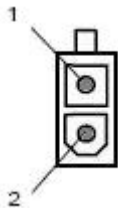


Pin N°	Signal
1	+VDC
2	GND
3	INPUT 1 (E1)
4	OUTPUT (S1)

**WARNING :** The pins 3 and 4 are used for the Input/Output functions.  
The modem can only be power supplied by the pins 1 (+VDC) and 2 (GND).

###### 2-Pin Micro FIT female connector:

This connector provides 2 general-purpose inputs.

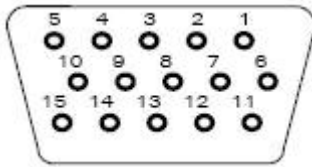


Pin N°	Signal
1	INPUT 3 (E3)
2	INPUT 2 (E2)

##### 3.2.1.3 15-pin Sub HD female connector

This connector provides:

- The serial RS232 link,
- The audio line connection (microphone and loud-speaker),
- The BOOT and RESET signals.



Pin N°	Description	Circuit (V24 – RS232C)	GPS Multiplexing	I/O
1	Signal detection / <b>Buzzer</b>	109 – DS – DCD		O
2	Data transmission	103 – ED – TXD		I
3	Boot	BOOT		I
4	Microphone +	MIC2P		I
5	Microphone -	MIC2N		I
6	Data reception	104 – RD – RXD		O
7	Data Set Ready	107 – PDP – DSR	NMEA/UBX Frames	O
8	Data Terminal Ready	108/2 – TDP – DTR	UBX Frames	I
9	Ground	102 – TS – GND		-
10	Loud Speaker +	SPK2P		O
11	Clear To Send	106 – PAE – CTS		O
12	Request To Send	105 – DPE – RTS		I
13	Ring Indicator / <b>3,8V</b>	125 – IA – RI		O
14	Reset	RESET		I
15	Loud Speaker -	SPK2N		O

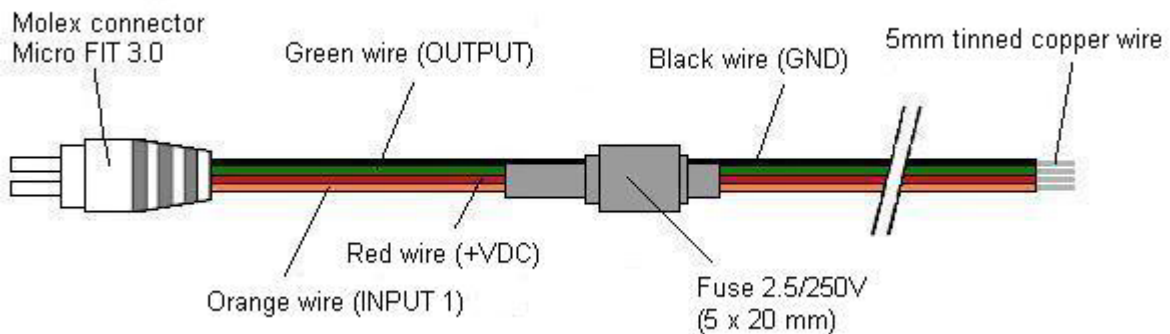
Note (by default):

- Pin 1 is the Buzzer output (connection of 109/DCD circuit optional).
- Pin 13 is a DC output (for powering typically a GenBlue 10<sup>e</sup> accessory) of 3,8V 100mA (connection of 125/RI circuit optional).

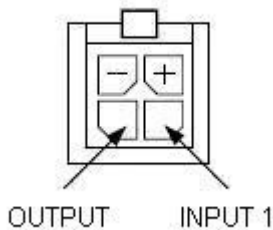
### 3.2.2 Cables

#### 3.2.2.1 4-wire micro FIT

This cable provides power to the modem and access to one general-purpose input and one general-purpose output.



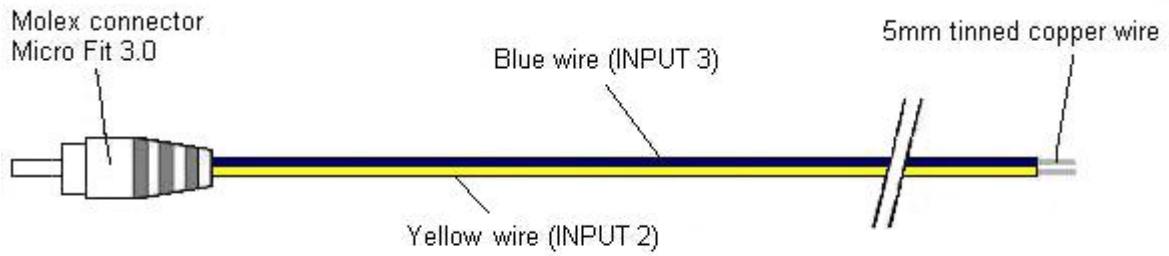
View from cable side



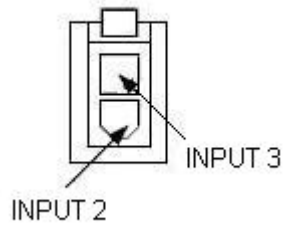
Component	Characteristics
4-pin Micro FIT connector	Type : MOLEX
Cable	Length ≈ 1.5m
Wire	Tinned copper 24 x 0.2 mm
	Surface area : 0.75 mm <sup>2</sup>

3.2.2.2 2-wire micro FIT

This cable provides access to two general-purpose inputs.



View from cable side



Component	Characteristics
2-pin Micro FIT connector	Type : MOLEX
Cable	Length ≈ 1.5m
Wire	Surface area : 0.5 mm <sup>2</sup>

## 4 Characteristics And Services

The GenLoc 31e is :

- A class 10 GSM/GPRS modem intended for asynchronous binary data transmission, fax Group3 (Class 2), SMS and voice.
- A GPS modem for position tracking.

The modem's characteristics and available services are summarised in the table below :

Characteristics	GSM	DCS
Standard	Transmission 880 MHz to 915 MHz Reception 925 MHz to 960 MHz Conforms to E-GSM Class 4 Power 2W Conforms to ETSI GSM/GPRS Phase 2	Transmission 1710 MHz to 1785 MHz Reception 1805 MHz to 1880 MHz  Class 1 Power 1W Conforms to ETSI GSM/GPRS Phase 2
GSM	Caller Identification Call forwarding Conference Call holding and pick-up USSD Forbidden call	
GPRS	Multi slot Class 10 Class 2 supported PBCCH supported CS1 to CS4 coding	
TCP/IP Stack	PPP RFC, TCP Socket, UDP Socket, SMTP, POP3, FTP	
GPS	Civil Frequency L1 (1575.42MHz) 16 channel receiver Precision : 2.5m CEP Sensitivity : -158dB Protocols : NMEA-0183, UBX Binary and RTCM input A-GPS compatible	
Interfaces	Serial Interface RS232 V24 from 300 to 115200 bauds via 15-pin/F Sub HD Complete AT command set for GSM/GPRS (07.05 and 07.07) Specific AT command set for GPS GPIO's : 3 opto-coupled inputs and 1 open-collector output	
Audio	Emergency voice call 112 FR/EFR/HR Echo cancellation Noise reduction Buzzer Output	
SMS	Text, PDU, MT, MO CB	
Data/Fax	Asynchronous Data Circuit, transparent and non-transparent 9600 (Standard) to 14400bds (depending on network) Compatible Fax Group 3	
SIM	Interface SIM 3V or 1,8V SIM Tool Kit version 99	
Power supply	5.5V to 32V DC	
Antennae	SMA-F connector the GSM antenna SMB-M for the GPS antenna Antenna management GPS active 3V	

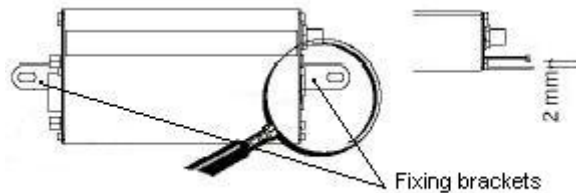


## 5 Using The Modem

### 5.1 Starting with the modem

#### 5.1.1 Mounting the modem

To mount the modem on a support, use the fixing brackets as shown in the diagram below:

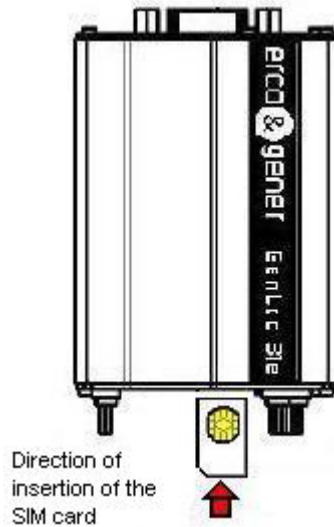


- Note :
- Must be fixed to a flat surface.
  - Maximum height of the screw head height: 2 mm

#### 5.1.2 Installation of the modem

To install the modem, it is recommended to perform the following operations with the modem turned off:

- Remove the SIM card cover on the rear side.
- Carefully insert the SIM card into its holder.



- Verify that the SIM card is positioned correctly.
- Connect the GSM antenna to the SMA connector.
- Connect the GPS antenna to the SMB connector.
- To connect to a DTE, connect the V24 link using the 15-pin Sub HD cable.
- Connect the supply cable to *an external regulated DC source (for automobile applications, refer to chapter 5.2 Recommendations for using the modem in vehicles)*.
- Connect the supply cable to the modem and turn on the power supply. The GSM LED will light up.

The modem is now ready. Refer to chapter **5.10 Main AT commands (HAYES)** for a description of the commands for configuring and using the modem.

### 5.1.3 Communication with the modem

Connect the RS232 cable between the DTE (the COM port) and the modem (DCE).

Configure the DTE RS232 port as follows :

- Data rate : **9600 bps**,
- Data size : **8 bits**,
- Parity : **None**,
- Stop bits : **1**,
- Flow control : **hardware**.

Via the DTE (a PC running a communications application such as HyperTerminal), enter the command **AT(CR)**. The modem should reply with **OK**.

In the case where no communication can be established with the modem :

- Verify the RS232 connexion between the DTE and the modem (DCE),
- Verify the configuration of the COM port on the DTE.

Some examples of AT commands which can be sent to the modem once the communication has been established and verified (these commands are explained in detail later in the document) :

- **AT+CGSN** : the modem should reply with a 15 digit number (beginning with "35873000xxxxxx").
- **AT+CPIN=xxxx** : enter the code of the SIM card xxxx (if active).
- **AT+CSQ** : verify the GSM signal reception level.
- **AT+CREG ?** : verify the registration of the modem on the network.
- **ATD<telephone number>** : start a voice call.
- **ATH** : hang-up (end of the call).
- **AT+WGPSPOS** : retrieve the current GPS position.

For further information about these AT commands and their associated parameters, refer to the "AT Commands Interface Guide" from WAVECOM and the "Commands List" from 'ERCO&GENER.

### 5.1.4 Checking the "LLC" application

To be able to access the GPS module and to read/write the GPIOs, the GenLoc 31e executes a specific loaded application called "LLC" or "LLC T".

The application "LLC T" includes all the functions of the "LLC" and also includes the functions FTP / TCP / SNTP.

The presence of one of these application may be checked via the command **ATi8** after having activated it via the command **+WOPEN=1**. (refer to the "Commands List" from ERCO&GENER.)

The table below indicates the main responses by the modem:

Command	Response	Interpretation
ATi8	<i>OK</i>	No application has been loaded and/or activated
	<i>LLC V1.14 GenLoc31e - Q24PL B OAT313 - Jun ... 13:53:01</i> <i>OK</i>	The application loaded and activated is LLC V1.14
	<i>LLC T V1.04 GenLoc31e - Q24PL B OAT314 - Jul ... 11:30:16</i> <i>OK</i>	The application loaded and activated is LLC T V1.04

#### 5.1.4 Re-initialisation of the modem

The hardware RESET signal is available on pin 14 of the 15-pin Sub HD connector. The modem is re-initialised when this RESET signal is held at a low level for at least 500µs.

**WARNING** : This RESET signal should be considered as a means of re-initialising the modem in cases of emergency only. For further details concerning the RESET of the modem, see the chapter **7.6 RESET**.

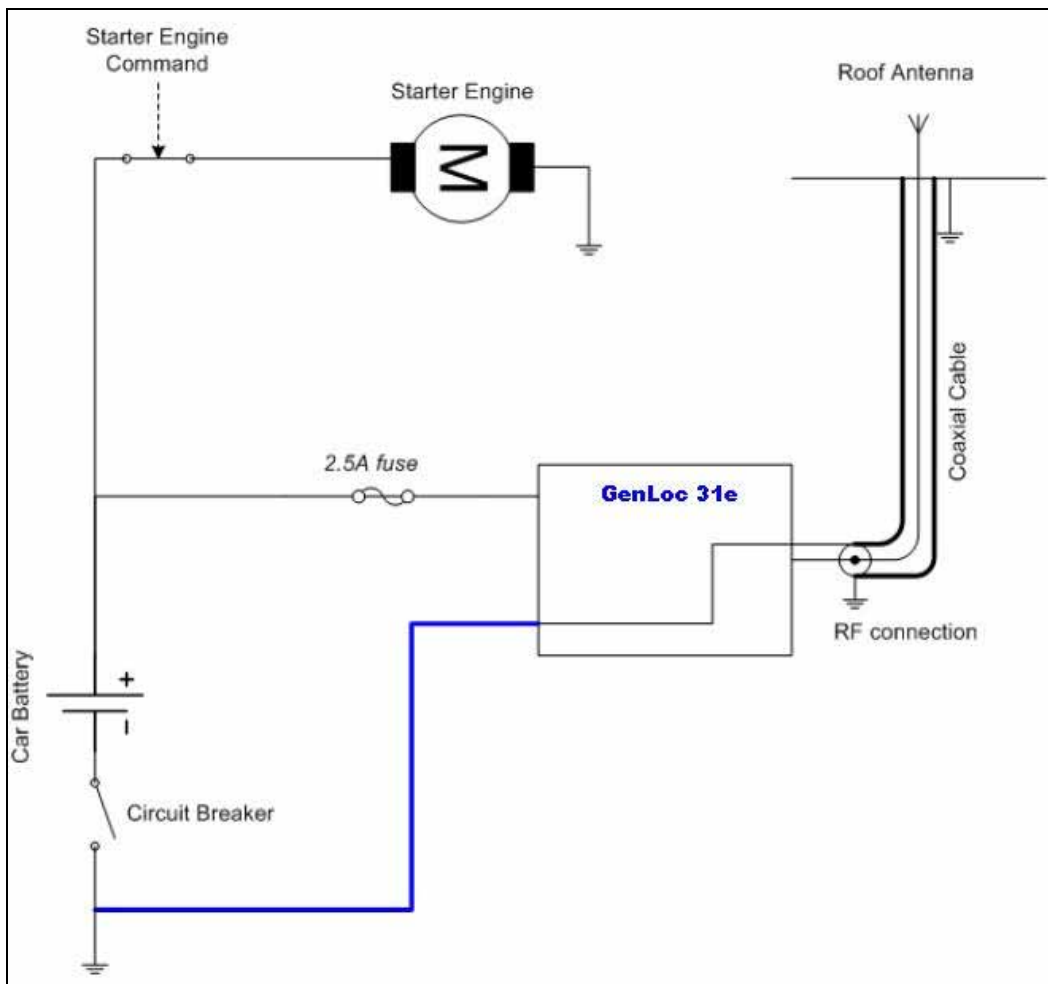
## 5.2 Recommendations for using the modem in vehicles

**WARNING** : The power supply connector on the GenLoc 31e must **NOT** be connected directly to the battery of a vehicle.

### 5.2.1 Recommended connection to the battery in a lorry

All lorries have a circuit breaker outside the cabin. The circuit breaker is necessary for security reasons. For example, if a fire breaks out in the lorry's electric box, the driver may cut the power source to avoid further danger and damage (explosion).

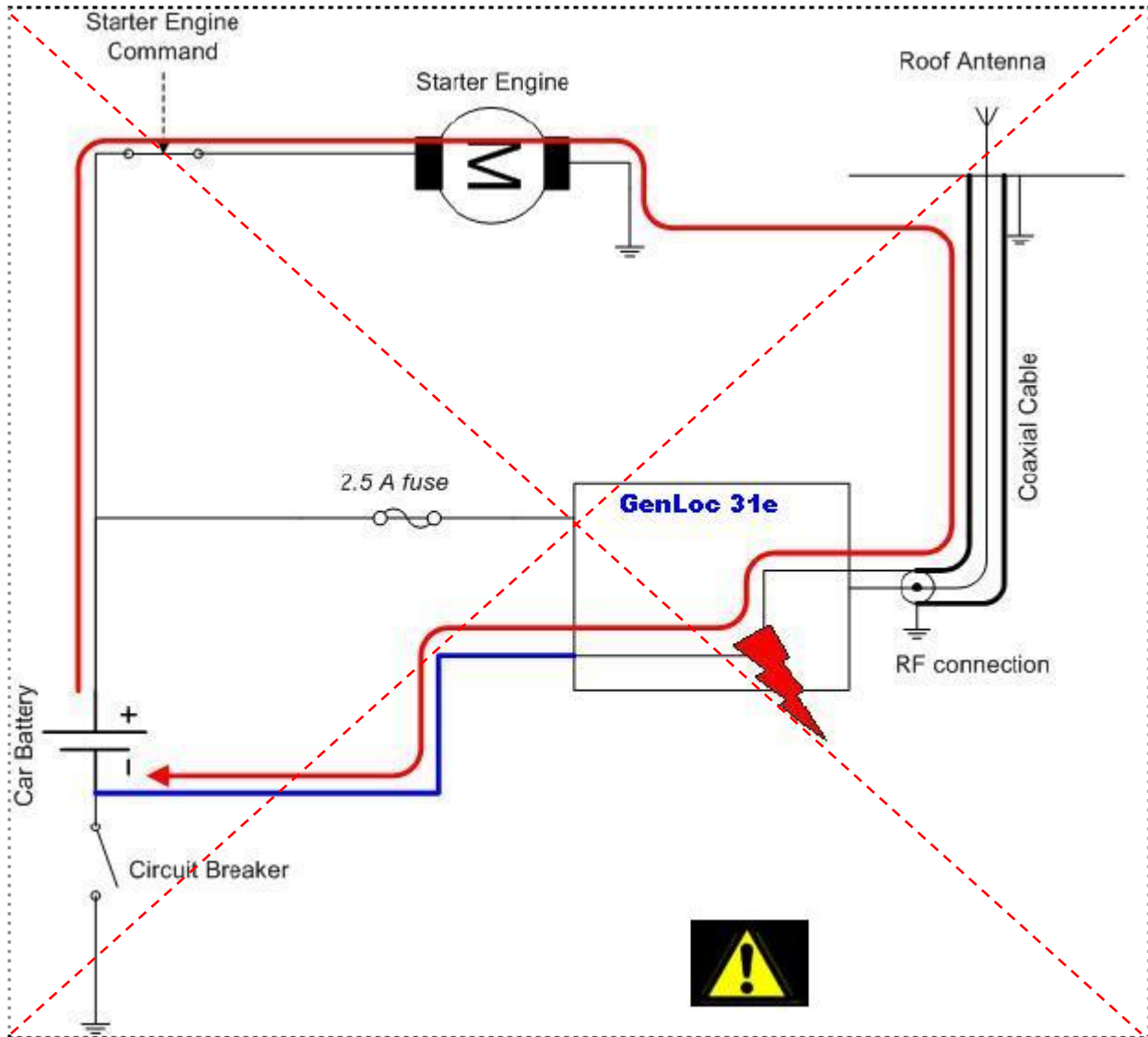
The circuit breaker is connected to the ground of the lorry, usually connected to the fuse box. As such, most lorry circuit breakers cut the ground connexion rather than the battery power side as shown in the diagram below :



The diagram above shows a **recommended** connexion, where the modem is connected after the circuit breaker to the ground of the lorry (or in the fuse box) and **NOT** directly to the earth of the battery

### 5.2.2 Technical constraints in lorries

It is highly recommended to **NOT** connect the modem supply directly the battery but instead to the circuit breaker. Otherwise the modem may be damaged when the lorry is starting and the circuit breaker is closed. In this case the ground of the lorry and the ground of the battery will be connected together via the modem as shown in the diagram below:



Example of a **forbidden** electrical connexion (risk of damage to the modem)

The diagram above shows an electrical connexion which may damage the modem because its ground is connected directly to the earth of the battery.

In this example, when the circuit breaker is closed, the current flows via the modem and the electrical circuits in the lorry (dash-board for example). When the lorry's starter motor is used it could result in the cables and or the modem being damaged or destroyed.

The internal circuits of the modem are not designed to withstand the high currents associated with starter motors.

## 5.3 Indicators

### 5.3.1 GSM LED

The state of the modem is indicated by the GSM LED located on the rear side of the modem (see chapter **3.1 Physical description**). The table below shows the meaning of the different states of the GSM LED :

GSM LED	LED activity	Modem state
ON	LED on fixed	The modem is powered, it is ready to function but not yet recognised by the network; the PIN code has not yet been entered or the antenna is not connected.
	LED flashing (once every 2 seconds)	The modem is powered, the PIN code is active, the modem is recognised by the network and is ready to make or receive a call (Idle mode).
	LED flashing (Once a second)	The modem is powered and currently in communication (Voice, Data or Fax).
OFF	LED off	The modem is not powered or is in the RESET phase.

### 5.3.2 GPS LED

The status of the GPS localisation of the modem is indicated by the GPS LED located on the rear side of the modem (see chapter **3.1 Physical description**). The table below shows the meaning of the different states of the GPS LED :

GSM LED	LED activity	Modem state
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 modem is calculating GPS position.

## 5.4 AT commands Echo deactivated

If no echo is returned when entering an AT command, it could be that :

- the "Local echo" of your communication application is not activated,
- and/or the modem's echo function has been deactivated.

The echo is configured by the command **ATE** and requires a back-up with the command **AT&W**.

To activate the modem echo, enter the command **ATE1**.

When using a communication application to send AT commands to the modem, it is recommended to :

- deactivate the "local echo" in your communication application,
- activate the modem echo (enter the command **ATE1**).

For a communication Machine to Machine with the modem, it is recommended to deactivate the modem echo (enter the command **ATE0**) to avoid the CPU receiving redundant responses.

For more information about the **ATE** command see the Wavecom "AT Commands Interface Guide".

### 5.5 Verifying GSM receive signal quality

The modem will be able to establish a call only if the received GSM signal is of a sufficient level.

The command **AT+CSQ** will return the reception level (*rssl*) of the signal sent by the closest GSM Base Transceiver Station (**BTS**), as well the receive bit error rate (*ber*).

When the SIM card is present and the PIN code has been entered, the command **AT+CSQ** will return the signal level from the BTS on the subscribed operator network.

When used without the SIM card, this command will simply indicate the closest BTS due to the fact that the modem cannot identify the current subscription. It is therefore advisable to make this test with the SIM card present.

To verify the GSM signal quality, perform the following operations :

Using a communication application, enter the command **AT+CSQ**.

The response is in the following format :

**+CSQ: <rssl>,<ber>** where : *<rssl>* = indicates the reception level,  
*<ber>* = receive bit error rate.

Verify the value *<rssl>* with the aid of the table below :

<i>&lt;rssl&gt;</i> value	Gain (dbm)	Interpretation	<i>&lt;ber&gt;</i> value	Interpretation
0	-113 dbm	Insufficient	0 to 7	See standard ETSI GSM 05.08
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 will function correctly with a minimum *<rssl>* of between 11 and 15.

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

For more information about the AT commands see the Wavecom "AT Commands Interface Guide".

### 5.6 Verifying the PIN code

The PIN code is essential in order to make a call or to accept a call from the GSM network.

The PIN code is held on the SIM card and can be modified by the user.

To verify a previously entered PIN code, use a communication application and enter the command **AT+CPIN?**

The table below shows the main responses from the modem :

Command	Response	Interpretation
AT+CPIN?	<b>+CPIN: ERROR</b>	The SIM card is absent or unknown
	<b>+CPIN: READY</b>	The PIN code is correct
	<b>+CPIN: SIM PIN</b>	The PIN code is bad or not yet entered
	<b>+CPIN: SIM PUK</b>	The PUK code is required

For more information about the AT commands see the Wavecom "AT Commands Interface Guide".

### 5.7 Verifying modem registration on the GSM network

1. Ensure that a valid SIM card is present in the SIM card reader in the modem.
2. Using a communications application, enter the following AT commands :
  - a. **AT+CPIN=xxxx** Enter the PIN code. The user has only 3 attempts to enter the PIN code. After the third attempt, only the PUK code (supplied by the operator) will allow a new PIN code to be entered.
  - b. **AT+CREG?** Verify the network registration status. The response will be of the following format : **+CREG: <mode>,<stat>** where :
    - <Mode>** = un-solicited registration message configuration,
    - <Stat>** = registration status
3. Verify the registration status with the aid of the following table :

Command	Response	Interpretation
AT+CREG?	<b>+CREG: 0,0</b>	The modem is not recognised by the network.
	<b>+CREG: 0,2</b>	The modem is searching for a network operator.
	<b>+CREG: 0,1</b>	The modem is GSM attached to a local operator.
	<b>+CREG: 0,5</b>	The modem is GSM attached to an operator in roaming mode.

If the modem is not registered, verify the antenna connexion and the receive signal level (see chapter **5.5 Verifying GSM receive signal quality**).

For more information about the AT commands see the Wavecom "AT Commands Interface Guide".



## 5.8 Reading current GPS position

The current GPS position may be obtained by entering the command **AT+WGPSPOS**. Note that after powering up the unit, the first correct GPS information will not be available until after a minimum acquisition delay of least 45 seconds.

The response is in the following format :

**+WGPSPOS:<fix>,<time>,<date>,<latitude>,<longitude>,<altitude>,<hdop>,<speed>,<heading>,<nbsat>**

**<fix>**

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

**<time>** : hhmmss.zz time of fix

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

**<date>** : jjmmaa date of fix

example : 180406 -> the 18 April 2006

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

dd (degrees) 00 to 90

mm.mmmmm (minutes) 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 (degrees) 00 to 180

mm.mmmmm (minutes) 00.00000 to 59.99999

E/W East or West

example : 00003.51202W -> longitude 0 degrees 3.51202 minutes West

**<altitude>** : mmmm.m altitude of fix in metres

**<hdop>** : mmm.mm horizontal dilution of position in metres

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

**<heading>** : dddmm.mmmm heading in degrees, minutes

ddd (degrees) 000 to 360

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

**<nbsat>** : nn number of satellites in view

The table below shows several examples of responses returned by this command :

Command	Response	Interpretation
AT+WGPSPOS	<b>+WGPSPOS:-1,,,,,,,,,0</b>	It is not possible to define a position. Verify the location of the GPS antenna or the GPS configuration GPS (see chapter <b>5.9 GPS Configuration</b> ).
	<b>+WGPSPOS:0,083138,180406,,,,,,,,,6</b>	It is not yet possible to have the position but the date and time information are available. The internal clock has been set but position information is not available.
	<b>+WGPSPOS:2,083205,180406,4716.81310N,00003.51202W,44.9,2.14,0.037,33.43,10</b>	A position has been read and all the information is available. The frame is considered complete. The GPS LED flashes.

## 5.9 GPS Configuration

### 5.9.1 Powering up the GPS module

By default the GPS is always powered up. However, the command **AT+WGPSM** allows the module to be powered on or off. This command is effective immediately and does **not** require a software RESET.

Syntax : **AT+WGPSM=0[,<x>]**

<x> = 0 : GPS module off

1 : GPS module on (default)

Examples :

Command	Response	Interpretation
AT+WGPSM=0,1	<b>OK</b>	GPS module on
AT+WGPSM=0,0	<b>OK</b>	GPS module off

For more information about this command see the ERCO&GENER "Commands List".

### 5.9.2 GPS antenna configuration

The GPS antenna may be configured with the command **AT+WGPSANT**. This command is effective immediately and does **not** require a software RESET. By default the antenna voltage is 3.3V.

The configuration and supervision syntax is as follows :

Syntax : **AT+WGPSANT=<type>[,<mode>]  
=<type>[,<supervision>]  
=<type>**

**<type>**

- 0 antenna configuration
- 1 antenna supervision
- 2 antenna status

**<mode>**

- 0 0V
- 1 3.3V(default)

**<supervision>**

- 0 supervision deactivated (default)
- 1 supervision active (returns automatically changes in the antenna status)

Examples of responses :

Command	Response	Interpretation
AT+WGPSANT=0,1	<b>OK</b>	Antenna configured to 3.3V
AT+WGPSANT=1,1	<b>OK</b>	Antenna supervision active

The response for the antenna status is as follows :

**+WGPSANT: <type>,<status>,<presence>,<voltage>**

**<type>**

- 2 antenna status

**< status >**

- 0 antenna is not powered
- 1 antenna is powered

Note : In the case of a short circuit, the hardware protection disconnects the antenna causing an open circuit. After a 10-second delay the antenna is re-powered.

**<presence>**

- 0 antenna not connected
- 1 antenna connected

**<voltage>**

Antenna voltage in mV.

Examples of responses :

Command	Response	Interpretation
AT+WGPSANT=2	<b>+WGPSANT: 2,1,1,3152 OK</b>	Antenna is connected and powered with 3,152V

For more information about this command see the ERCO&GENER "Commands List".

### 5.10 Main AT commands (HAYES)

The table below shows at a quick glance the main AT commands useful for the control of the modem.

For further information concerning the complete command set see the Wavecom "AT Commands Interface Guide" and the ERCO&GENER "Commands List".

Table : Main AT commands used with the modem.

Description	AT Command	Response	Interpretation
Enter the PIN code	AT+CPIN=xxxx  (xxxx = PIN code)	<b>OK</b>	PIN code accepted
		<b>+CME ERROR: 16</b>	PIN code incorrect (1*)
		<b>+CME ERROR: 3</b>	PIN code already entered (1*)
Verification of GSM network registration	AT+CREG?	<b>+CREG: 0,0</b>	The modem is not recognised by the network.
		<b>+CREG: 0,2</b>	The modem is searching for a network operator.
		<b>+CREG: 0,1</b>	The modem is GSM attached to a local operator.
		<b>+CREG: 0,5</b>	The modem is GSM attached to an operator in roaming mode.
Reception of an incoming call (2*)	ATA	<b>OK</b>	Reply to the call
Make a voice call	ATD<telephone number>;  (IMPORTANT: the ; at the end of the sequence specifies a voice call)	<b>OK</b>	Communication established
		<b>+CME ERROR: 11</b>	PIN code not entered
		<b>+CME ERROR: 3</b>	The credit has run out or the communication has already been established.
Make an emergency call (112)	ATD112;	<b>OK</b>	Communication established
Lost communication		<b>NO CARRIER</b>	
Hang-up	ATH	<b>OK</b>	

(1\*) The command **AT+CMEE=1** allows the display of extended error codes. This command may be saved with the command **AT&W**.

The command **AT+WIND=63** allows the display of the change of status of the SIM card (present, ready...) and to check divers modem states (modem ready after RESET...). This command may be saved with the command **AT&W**.

(2\*) The command **AT+CRC=1** will in the case of an incoming call, display more detailed ring information indicating the type of call - voice, data or fax. This command may be saved with the command **AT&W**.

Examples :

For VOICE : +CRING: VOICE

For DATA : +CRING: REL ASYNC

For FAX : +CRING: FAX

## 5.11 Powering down the unit

It is strongly unadvised to cut off the supply of GenLoc 31e whilst in communication or dialogue without having first detached from the network operator.

To avoid network congestion when powering down the modem, it is essential to first execute the command **AT+CPOF**. If this is not done, then, in certain cases the modem can remain registered on the network.

Before cutting the power in dialog mode (no communication), send the following command to the modem :

**AT+CPOF** or **AT+CFUN=0** (identical functioning). The modem will return OK and is no longer registered on the network. The radio module is put into standby and the power may then be removed.

Note : There is no particular action to be made to the GPS module before removing the power.

## 5.12 Updating the modem software

So as to be able to benefit from the latest functions of the GenLoc 31e, a procedure is used which will upgrade the software in the modem.

This consists of downloading the software into the internal Flash memory via the RS232 serial link available on the 15-pin Sub HD connector.

Please refer to the software update procedure document for a detailed description of this procedure.

**WARNING: During the Firmware (OS) update or the Open AT application loading, YOU MUST TO REMOVE THE MODEM CARD SIM in order to deactivate the Material Watch Dog and so to avoid any blocking risks of the device.**

## 6 Trouble Shooting

This section describes various problems and their solutions that may be encountered when using the modem.

Please consult the review on other problems in the FAQ's on the ERCO&GENER web site, section Support/FAQ.

### 6.1 RS232 (V24) Communication problem

If the modem does not respond to any of the AT commands via the RS232 then refer to the table below for a list of possible causes and solutions

Table : possible causes and solutions for RS232 communication problems

If the modem...	Check	Action
Returns nothing	Is the modem correctly powered?	Ensure that the modem is connected to an external regulated power source (5.5V to 32V DC). See chapter <b>8.2.1 Power supply</b> .
	Is the serial cable connected at both ends (PC and Modem)?	Verify the connexion of the serial cable.
	Is the serial cable correctly cabled according to the table in chapter <b>3.2.1.3 15-pin Sub HD female connector?</b>	Cable the serial cable according to the table in chapter <b>3.2.1.3 15-pin Sub HD female connector?</b>
Returns nothing or random characters	Is the communications terminal correctly configured on the PC?	Ensure that the terminal configuration corresponds to that of the modem. Factory configuration : Speed = 9600 bps Data bits = 8 Parity = none Stop bits = 1 Flow control = hardware
	Is there another application using the same port thus creating a conflict?	Close the conflicting application.
	Is the modem echo deactivated and without message reporting?	Enter the command <b>ATE1Q0</b> followed by <b>AT&amp;W</b> if a backup is required.

### 6.2 "ERROR" message

The modem returns the message "**ERROR**" (in response to an AT command) in the following cases :

- The COM port is not directed to the GenLoc 31e but to another modem. Enter the command **ATI**. The response should be **WAVECOM MODEM...** All other responses indicate a dialog with another modem. Verify the COM port used in the communications application.
- The syntax of the AT command is incorrect. Re-enter the command. (Refer to the Wavecom "AT Commands Interface Guide" and ERCO&GENER "Commands List".)

- The syntax of the AT command correct, but with incorrect parameters :
  - Enter the command **AT+CMEE=1** to obtain an error message with its error code instead of a simple "ERROR" message,
  - Enter again the AT command which previously caused a problem to obtain the error code. In the case of an error, the response is in the form :
    - +CME ERROR : <error code>, or
    - +CMS ERROR : <error code>.

For further information about the error codes returned by the command **AT+CMEE**, refer to the Wavecom "AT Commands Interface Guide".

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

### 6.3 "NO CARRIER" message

If the modem returns the message "NO CARRIER" after an attempted call (voice or data), check the table below for a list of possible causes and solutions.

Table : Causes and solutions when the "NO CARRIER " message is returned

Modem returns...	Check	Action
"NO CARRIER"	Is the received GSM signal strong enough?	Verify the received signal quality (see chapter <b>5.5 Verifying GSM receive signal quality</b> ).
	Is the modem registered on the network?	Verify network registration (see chapter <b>5.7 Verifying modem registration on the GSM network</b> ).
	Is the antenna correctly connected?	Check the GSM antenna installation (see chapter <b>8.2.6.3 External GSM antenna</b> for installation recommendations).
"NO CARRIER" (when attempting a VOICE call)	Has the semi-colon (;) been entered immediately after the telephone number in the AT command?	Ensure that the semi-colon (;) been entered immediately after the telephone number in the AT command, for example : ATD0123456789;
"NO CARRIER" (when attempting a DATA call)	Has the SIM card been configured for data / fax calls?	Ensure that the SIM card is allowed to make data / fax 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 <b>AT+CBST=0,0,1</b> (1*).

(1\*) For further information concerning this command see the ERCO&GENER "Commands List".

If the modem returns the message "NO CARRIER", use the command **AT+CEER** to see the extended error code. Refer to the table below for a list of extended error codes and their meanings.

Table : Interpretation of extended error codes

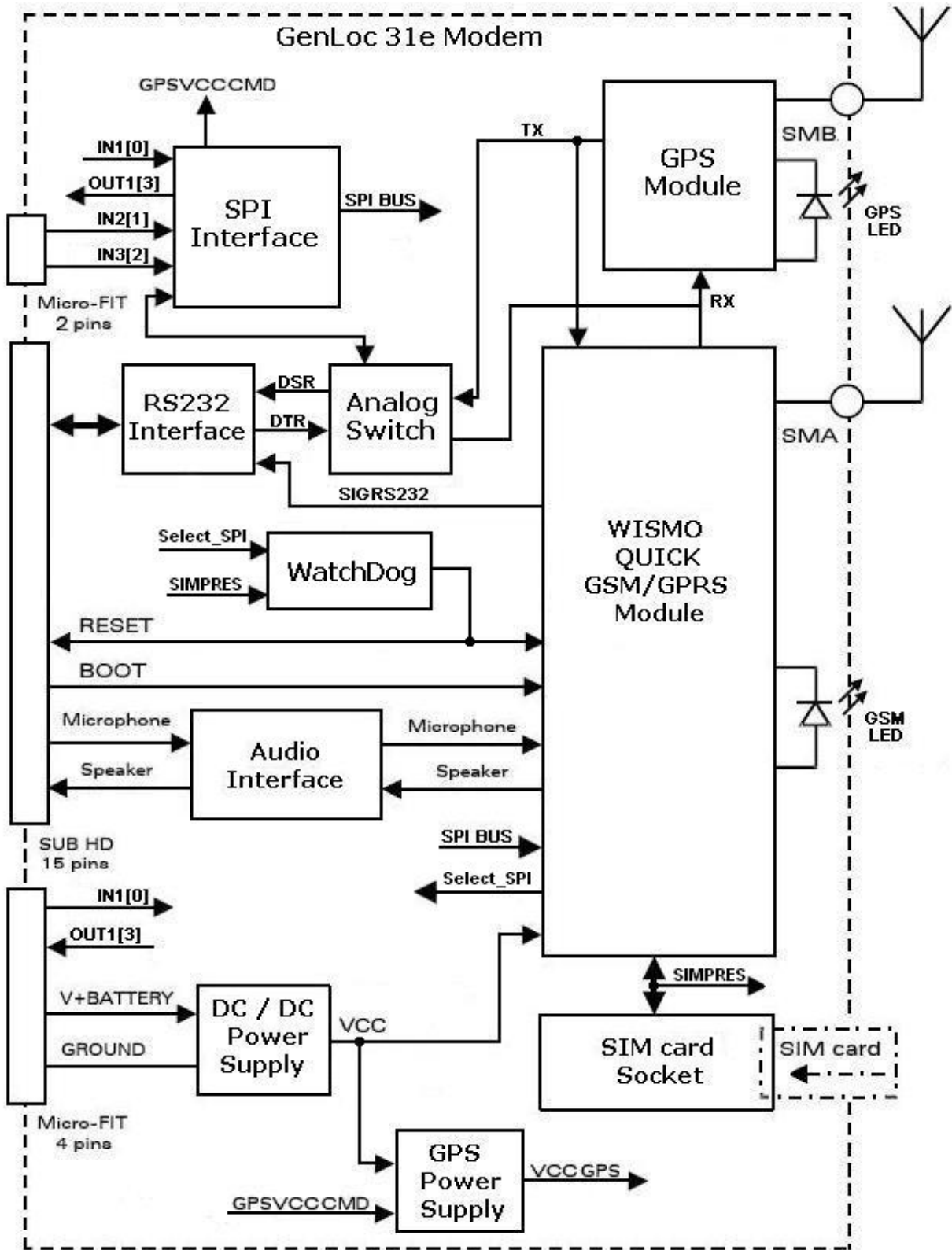
Error code	Meaning	Observations
1	Unassigned (unallocated) number	
16	Normal call clearing	
17	User busy	
18	No user responding	
19	User alerting, no answer	
21	Call rejected	
22	Number changed	
31	Normal, unspecified	
50	Requested facility not subscribed	Check your subscription (data subscription available?).
68	ACM equal to or greater than ACMmax	No more SIM card credit or card expired.
252	Call barring on outgoing calls	
253	Call barring on incoming calls	
3, 6, 8, 29, 34, 38, 41, 42, 43, 44, 47, 49, 57, 58, 63, 65, 69, 70, 79, 254	Network cause	See the Wavecom "AT Commands Interface Guide" or check with the operator.

Note : For other codes and information, see the Wavecom "AT Commands Interface Guide.



# 7 Functional Description

## 7.1 Architecture



## 7.2 Power supply

### 7.2.1 General

The modem must be powered (V+BATTERY) by an external regulated DC power source of between 5.5V and 32V.

The modem's various internal DC voltages are provided by an internal DC/DC converter.

The power for the GPS module is provided by a separate internal regulator.

The correct functioning of the modem cannot be guaranteed if the input voltage (V+BATTERY) falls below 5.5V.

### 7.2.2 Optional internal battery

#### 7.2.2.1 Presentation

The battery is fixed inside the GenLoc 31e. It is connected to an additional charging circuit assembled on the main circuit board in the GenLoc 31e.

This battery allows the continued operation of the GenLoc 31e in the absence of the external power supply (connected via the 4-pin Micro-FIT female connector).

The absence of the power supply is indicated by reading the status of a GPI input on the SPI bus.

The internal charging circuit ensures that the battery is permanently charged from the external power supply.

A completely discharged battery requires approximately 3 hours to be fully recharged.

The autonomy of the battery depends essentially on the mode of use of the GenLoc 31e (attached to a GSM/GPRS network, use of the GPIOs, GPS supply, RS232 connected...). Please refer to the power consumption table in paragraph 8.2.

**WARNING :** The optional internal battery is not cabled by default. If required it must be assembled in our factory (please consult us). The presence of the battery is indicated by a label on the outside of the case (see paragraph 2.3).

When the optional internal battery is present, the optional shock detector cannot be cabled (due to use of the same input b7 on the SPI expander for both options).

#### 7.2.2.2 Example of autonomy with the optional internal battery

Table : Example of autonomy for TCP

Charge Time	3 hours minimum
Inputs/output	Not cabled
Port COM RS232	Serial link unplugged (autonomous application loaded)
GPS	GPS permanently powered
GSM/GPRS	GSM/GPRS permanently powered (Operating on the band 900 Mhz)
Autonomy	Application sends a \$RMC frame via TCP over GPRS every 30 sec. Measured autonomy : approx. 6 hours.

Table : Example of autonomy in FTP

Charge Time	3 hours minimum
Inputs/output	Not cabled
Port COM RS232	Serial link unplugged (autonomous application loaded)
GPS	GPS permanently powered
GSM/GPRS	GSM/GPRS permanently powered (Operating on the band 900 Mhz)
Autonomy	Send to the server TCP in GPRS Autonomy measured : approx. 9 hours for 15 files transfered

7.2.2.3 Specifications

The external power supply of the GanLoc 31e remains unchanged (+5.5V to 32V DC).

Table: Characteristics of the lithium polymer battery

Nominal voltage	3.7V	
Minimal voltage (1*)	3.4V	
Capacity	660 mA/h typical	
Expected cycles times	>300 cycles> 70% of initial capacity	
Temperature range	Charge : 0°C to +45°C	Discharge : -20°C to +60°C
Protection (Rearmable fuse)	overcharge : 4.275V ±0.025V discharge voltage : 2.30V ±0.058V maximum discharge current : 2A to 4A (1.0±0.3s)	

(1\*) When the GSM / GPRS module is at the end of discharge (absence of external supply at the modem input), it sends the message +WBCI: 0 over the serial port.

In this case, only some AT commands are accessible; the SIM card and the GSM network are no longer available.

7.2.2.4 Charge voltage and supply voltage

The table below shows the power consumptions with GSM and GPS antennas and the SIM card present. The values indicated are for a completely discharged battery.

Table : Power consumption (2\*) without GPS antenna

CONDITIONS T=25°C and SIM Card 3V		I Charge Nom.(mA)	I Charge Nom.(mA)
		without RS232	with RS232
External power supply voltage	@ 5.5V	350	410
	@ 12V	170	210
	@ 24V	90	110
	@ 31.5V	75	85

(2\*) The power consumption may vary by 5% over the whole operating temperature range (-20 °C to +55 °C)

7.2.2.5 Indication of the presence/absence of the external supply

Utilisation with the ERCO & GENER application "LLC" to read the GPIOs of the integrated SPI bus expander. The "LLC" is the application allowing the management of the AT commands for GPS, and GPIOs. The "LLC" libraries are also available for the development of Open AT applications.

**AT+WIOR=<index>**

**<Index>**

0 to 2 input 0 to input 2

3 indication of the status of the external supply (\*)

(\*) In this case, the battery option is cabled and the shock detection option is not cabled.

Table: Examples of command responses with the battery option cabled

Command	Response	Interpretation
AT+WIOR	<i>AT+WIOR=(0-3)</i> <i>OK</i>	Command syntax
AT+WIOR=3	<i>+WIOR: 0</i> <i>OK</i>	External supply present
AT+WIOR=3	<i>+WIOR: 1</i> <i>OK</i>	External supply absent

For more information concerning this command refer to the "Commands List" from ERCO&GENER.

7.2.2.6 Operating guidelines and restrictions

The optional internal battery is not cabled by default. If required it must be assembled in our factory (please consult us).

When the battery option is cabled the shock detection option cannot be cabled.

A completely discharged battery requires approximately 3 hours to be fully recharged.

When the battery is connected and charged, it is not possible to perform an Off/On of the unit. Only by connecting the Reset pin (pin 14) to ground will the modem be reset.

**The battery cannot be replaced or modified by the user. The unit must not under any circumstances be opened. For any problem concerning the battery, the unit must be returned to the factory.**

Do not throw the modem or the battery on to a fire.

7.2.3 Supply protections

The modem is protected by an in-line 2.5A / 250V fuse in the power supply cable supplied with the modem..

It also has internal protection against power supply spikes of more than 32V.

Filter guarantees : Input/output EMI/RFI protection and Signal smoothing.

### 7.3 RS232 serial link

#### 7.3.1 General

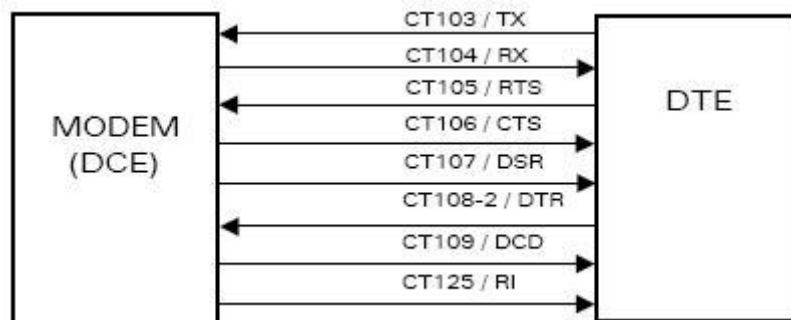
The RS232 interface provides a level translation between the WISMO (DCE) and the PC COM port (DTE). The RS232 interface is protected internally (ESD protection) against external electrostatic spikes.

Filter guarantees :

- Input/output EMI/RFI protection,
- Signal smoothing.

The following signals are available :

- TX data (CT103/TX)
- RX data (CT104/RX)
- Request To Send (CT105/RTS)
- Clear To Send (CT106/CTS)
- Data Terminal Ready (CT108-2/DTR)
- Data Set Ready (CT107/DSR)
- Data Carrier Detect (CT109/DCD) (optional) / Buzzer output (default),
- Ring Indicator (CT125/RI) (optional) / 3.8V voltage source for GenBlue 10<sup>e</sup> (default).



RS232 signals

The RS232 interface allows a certain amount of flexibility in the use of its signals. For example, the modem may operate in the 3-wire mode using only the TX, RX and GND signals. However, the CTS and RTS signals will also be required for GPRS applications and Xmodem upgrade.

### 7.3.2 Auto-baud mode

The auto-baud mode allows the modem to automatically detect the transmission speed used by the DTE. Only the following speeds will be detected : 2400, 4800, 9600, 19200, 38400, 57600 bps. Auto-baud detection cannot be guaranteed for speeds below or above these speeds.

The auto-baud mode is controlled by the AT commands. This function is explained in detail in the Wavecom “Commands Interface Guide”.

Note : By default, le GenLoc 31e is delivered with the RS232 interface configured to 9600 bps, no parity, 8 data bits, 1 stop bit.

### 7.3.3 Pins description

Table : Pins description

Signal	Pin number on Sub HD connector	I/O	RS232 standard	Description	Alternative Function
CTXD/CT103	2	I	TX	Transmit serial data	
CRXD/CT104	6	O	RX	Receive serial data	
CRTS/CT105	12	I	RTS	Request To Send	
CCTS/CT106	11	O	CTS	Clear To Send	
CDSR/CT107	7	O	DSR	Data Set Ready	
CDTR/CT108-2	8	I	DTR	Data Terminal Ready	
CDCD/CT109	1	O	DCD	Data Carrier Detect	Buzzer output (1*)
CRI/CT125	13	O	RI	Ring Indicator	3.8V DC output (1*)
CT102/GND	9			Ground	

(1\*) By default

## 7.4 General Purpose Inputs / Output

The GenLoc 31e modem provides 3 opto-coupled inputs and 1 open-collector output for controlling external equipment and applications.

These GPIO's are controlled by the AT commands :

**AT+WIOW** to write a value to a GPIO (configured as an output),

**AT+WIOR** to read a value on one of the GPIO's (configured as inputs).

The command **AT+WIOW** is used to control the output. By default the output 1 is wired as an open-collector.

Syntax : **AT+WIOW=<n>,<x>**

**<n>** = 0 : output 1 (a single output is available on the GenLoc 31e),

**<x>** = 0 : output ON

1 : output OFF

Examples :

Command	Response	Interpretation
AT+WIOW=0,1 (default)	<b>OK</b>	Output 1 OFF, open-collector transistor is open.
AT+WIOW=0,0	<b>OK</b>	Output 1 ON, open-collector transistor is closed.

This command is saved automatically to flash memory.

The command **AT+WIOR** is used to read the inputs. By default the inputs 1 to 3 are opto-coupled.

Syntax : **AT+WIOR=<n>**:

**<n>** = 0 : input 1

1 : input 2

2 : input 3

3 : optional movement detector (by default is not installed, please consult us) (1\*).

Examples :

Command	Response	Interpretation
AT+WIOR=0	<b>+WIOR: 1</b> <b>OK</b>	Input 1 is high. The input is active.
AT+WIOR=2	<b>+WIOR: 0</b> <b>OK</b>	Input 3 is low. The input is inactive.

(1\*) The movement detector is an option which must be specified when ordering the modem.

Note : See chapter 8.2.3 General purpose inputs / output for the characteristics of the GPIO's.

## 7.5 BOOT

This signal must **not** be connected. Its use is strictly reserved by the manufacturer.

## 7.6 RESET

### 7.6.1 General

A low level input on this pin allows a forced emergency hardware RESET of the modem (see the chapter **7.6.2 Reset sequence** below). In this case it acts as an input. It must be driven by an open-collector or open-drain output circuit.

- pin 14 (RESET) at 0, to reset the modem,
- pin 14 (RESET) at 1, normal operating mode.

This pin may also be used to provide a RESET to an external equipment. In this case it acts as an output. If an external RESET is not required it may be left unconnected.

Table : Pin description

Signal	Pin number on Sub HD Connector	I/O	Type	Description
RESET	14	I/O	SCHMITT	Reset Modem

**WARNING** : This signal must only be used in a case of emergency. A software RESET is always preferable to a hardware RESET. It is strongly unadvised to execute a RESET whilst in communication or dialogue without having first detached from the network operator.

Note : For more information about the software RESET, see the Wavecom “AT Commands Interface Guide”. See chapter **5.11 Powering down the unit** to detach from the network and power down.

### 7.6.2 Reset sequence

To active the emergency RESET sequence, the RESET signal may be pulled to a low level for at least 500µs.

After the modem has been RESET, if a SIM card is present in the reader there will be a delay whilst it is initialised before being accessible. Also, the GPS acquisition time must be taken into consideration.



## 7.7 WatchDog

The Hardware WatchDog function allows the surveillance of the modem software activity : the Software management of the WatchDog must be implanted in the embedded application (Open AT).

If the software activity is interrupted, the component WatchDog starts a material Reset.

The WatchDog function is active only if the SIM card is present. That's why during a Firmware Update, it's imperative to remove the SIM card.

Note: On the box label, the presence of the WD mark allows to identify Modems GenLoc 31e integrating this hardware feature.

## 7.8 Audio

The audio interface is a standard interface for connecting a telephone handset.

Echo cancellation and noise reduction features are also available to improve the audio quality in hands-free applications.

ERCO&GENER recommend the use of the following cable : DATA/AUDIO Sub D 9pts Fem / Sub HD 15pts Male / RJ9 (order code 4404000205) and a telephone handset (order code 3153400000).

Table : Pin identification

Pin name	SUBD 9 F pin number	SUBD 15 M-HD pin number
DCD/Buzzer	1	1
RXD	2	6
TXD	3	2
DTR	4	8
GND	5	9
DSR	6	7
RTS	7	12
CTS	8	11
RI/3.8V	9	13
	RJ9 pin number	
Micro +	1	4
Speaker +	2	10
Speaker -	3	15
Micro -	4	5

### 7.8.1 Microphone

Differential microphone inputs are used to help reduce common-mode and TDMA noise. They are ESD protected.

An electret type microphone (0.5 mA / 2 Volts) may be connected directly to these inputs allowing the connexion of a telephone handset.

The microphone impedance is approximately 2 kΩ.

The gain of the microphone input may be internally adjusted in 3dB steps to between +30dB to +51dB by using the command **AT+VGT** (see the Wavecom “AT Commands Interface Guide”).

Table : Pins description

Signal name	Pin number Sub HD Connector	I/O	Type	Description
CMIC2P	4	I	Analogue	Microphone +ve
CMIC2N	5	I	Analogue	Microphone -ve

### 7.8.2 Loud-speaker

Differential outputs are used to help reduce common-mode and TDMA noise.

The internal push-pull amplifier will drive load of between 32 and 105 Ohms and 1nF (see details in the table Speaker gain vs Max output voltage in the Wavecom "AT Commands Interface Guide").

The loud-speaker may be connected directly to the output pins.

The amplifier gain may be adjusted from between -22dB to +6dB in 2dB steps using the command **AT+VGR** (see the Wavecom “AT Commands Interface Guide”).

Table : Pins description

Signal name	Pin number Sub HD Connector	I/O	Type	Description
CSPK2P	10	O	Analogue	Loud-speaker +ve
CSPK2N	15	O	Analogue	Loud-speaker -ve

### 7.8.3 Buzzer Output

As standard, the GenLoc31e offers a buzzer output on pin 1 of the 15-pin Sub-D connector. This output provides a frequency intended to drive a **Transducer**.

Table : Pin description

Signal	Pin number Sub HD Connector	I/O	Type	Description
Buzzer	1	O	Analogue	Buzzer output

**AT+WTONE** : This command allows a tone to be played on the speaker or the buzzer.

The frequency, gain and duration of the tone may be specified:

Syntax: **AT+ WTONE =<mode>,<dest>,<freq>,<gain>,<duration>**

**<mode>**

- 0 : stop the tone
- 1 : generate a tone

**<dest>** : Select the output

- 1 : Speaker (Loud-speaker)
- 2 : Buzzer

**<freq>** : Frequency of the tone

- for the Speaker, the range is 300Hz to 3400Hz
- for the Buzzer, the range is de 1Hz to 50000Hz

**<gain>** : Gain of the tone (default value 9 corresponding to -15dB)

the range is from 0dB to 15dB

<b>&lt;gain&gt;</b>	Speaker (dB)	Buzzer (dB)	<b>&lt;gain&gt;</b>	Speaker (dB)	Buzzer (dB)
0	0	-0.25	8	-12	-12
1	-0.5	-0.5	9	-15	-15
2	-1	-1	10	-18	-18
3	-1.5	-1.5	11	-24	-24
4	-2	-2	12	-30	-30
5	-3	-3	13	-36	-40
6	-6	-6	14	-42	-infini
7	-9	-9	15	-infini	-infini

**< duration >** : duration of the tone (in 100ms steps)

The range is from 0 to 50. When the value is 0 the duration is infinite. The tone can be stopped with the command **AT+WTONE=0**.

Examples :

Command	Response	Interpretation
AT+WTONE=1,1,440,0,30	<b>OK</b>	A tone is output to the speaker output for 3 seconds.
AT+WTONE=1,2,4000,5,0	<b>OK</b>	A tone is output to the buzzer output. To stop the tone, send the command <b>AT+WTONE=0</b>
AT+WTONE=0	<b>OK</b>	Stop the tone.

By default, the buzzer output is cabled in the modem. For more information refer to the Wavecom “AT Commands Interface Guide”.

Note : Refer to the table in chapter 8.2.2. for the characteristics of the audio interface.

## 7.9 SPI Interface

The SPI (Serial Peripheral Interface ) bus is a 4-wire serial communications bus. The SPI bus is basically a simple synchronous serial interface for connecting low speed external devices using a minimal number of wires. In the GenLoc 31e the DataIn and DataOut signals are connected together providing a single bi-directional data line and thus reducing the number of required wires to three. A synchronous clock generated by the GenLoc 31e shifts serial data into and out of the devices. Devices on the bus are selected with an chip-select signal.

The bus consists of :

- SCL : Clock signal (configured at 1MHz)
- SCD : Data In/Out : bi-directional data
- SPI\_EN : Chip-select / Enable signal

Note : Optional (please consult us) - the SPI bus may be made available at the expense of the audio signals on the 15-pin Sub HD female RS232 connector.

## 7.10 Direct GPS interface

It is possible to access the GPS module directly via the RS232 (V24). An internal switch may be configured to connect the GPS module directly to the RS232 link such that the GSM\_DSR signal becomes the GPS\_TxD signal (transmission GPS NMEA frames) and the GSM\_DTR signal becomes the GPS\_RxD signal (reception UBX frames).

Syntax : **AT+WIOW=7,<x>** or **AT+WIOW=8,<x>**

**<x>** = 0 : GSM\_DSR and GSM\_DTR mode

1 : GPS\_TxD and GPS\_RxD mode

Examples :

Command	Response	Interpretation
AT+WIOW=7,0 (default)	<b>OK</b>	GSM_DSR and GSM_DTR mode (standard DSR and DTR signals)
AT+WIOW=7,1	<b>OK</b>	GPS_TxD and GPS_RxD mode (direct GPS interface mode)

This command is saved automatically to flash memory.

Note : In the direct GPS interface mode, the default data rate is 9600 bps.

## 7.11 GPS Module

The GenLoc 31e is a 16-channel high-sensitivity GPS receiver capable of receiving GPS positions with different filter criteria (see ERCO&GENER "Commands List").

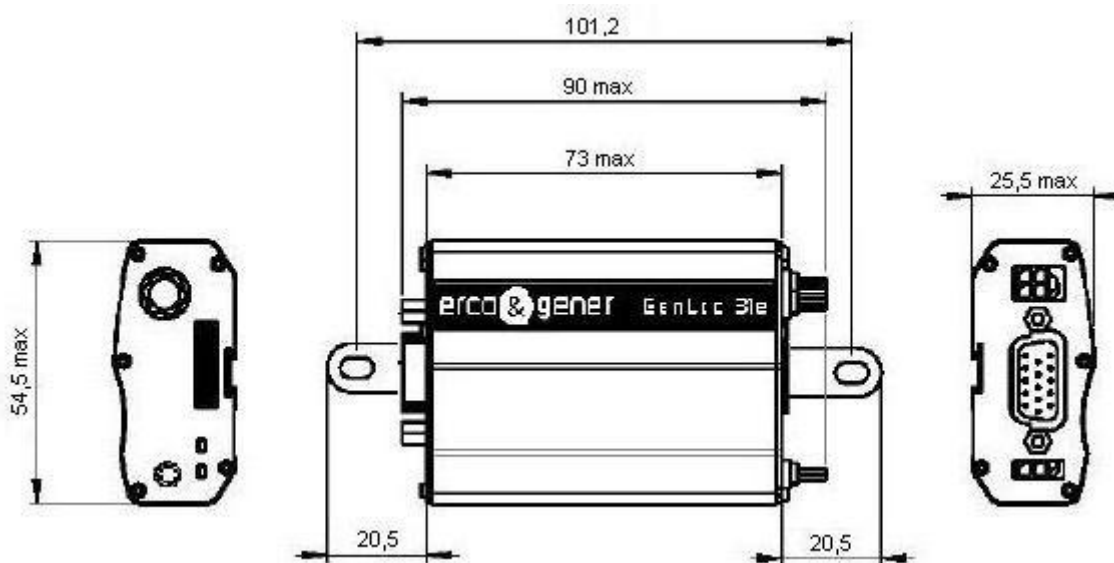
## 8 Technical Characteristics

### 8.1 Mechanical

Table : Mechanical characteristics

Dimensions	73 x 54.5 x 25.5 mm (excluding connectors)
Overall Dimensions	90 x 54.5 x 25.5 mm
Weight	≈ 95 grams (modem only) < 198 grams (modem + fixing brackets + cables)
Volume	101.5 cm <sup>3</sup>
Case	Extruded aluminium
Ingress Protection	IP31

The illustration below indicates the dimensions (in mm) of the modem showing the clearances necessary for installation.



## 8.2 Electrical

### 8.2.1 Power supply

Table : Voltage range and power consumptions

Operating voltage range	5.5V to 32V DC (GSM or DCS or GPRS)
Average power consumptions	GSM 900 MHz : 96mA @ 12V in communication – GPS OFF (*) GSM 1800 MHz : 72mA @ 12V in communication – GPS OFF (*) Idle mode : 10mA @ 12V - GPS OFF (*) GPS : 25mA @ 12V (with antenna 20mA @ 3.3V)

GPS OFF(\*) : AT+WGPSM=0,0 : the supplies for the GPS antenna and internal GPS module are off.

Note : The modem is permanently powered once the power supply is connected.

Table : Effects of a power supply defect

If the voltage :	Then :
falls bellow 5.5V	GSM and GPS communications cannot be guaranteed.
goes above 32V (transient peaks)	The modem guarantees its own protection.
goes above 32V (continuous over-voltage)	The modem is short-circuited by an internal varistor. The modem is then protected by the in-line fuse.

Table : Consumption (1\*) with GPS OFF (AT+WGPSM=0,0) and without RS232 connected

CONDITIONS T=25°C 3V SIM card		E-GSM/GPRS 900MHz		E-GSM/GPRS 1800MHz	
		I Nom.(mA)	I Max.(mA)	I Nom.(mA)	I Max.(mA)
Idle mode (2*)	@ 5,5V	17,5	23	17,5	23
	@ 12V	11,7	16,5	11,7	16,5
	@ 32V	8,6	11,5	8,6	11,5
Idle mode 32K (3*)	@ 5,5V	12	14,5	12	14,5
	@ 12V	9,2	11,3	9,2	11,3
	@ 32V	7,7	9,7	7,7	9,7
In communication GSM 1RX/1TX Power (2W/1W)	@ 5,5V	182,5	195,5	135	145
	@ 12V	96	103,5	71,75	78
	@ 32V	40	44,5	31	34,75
In communication GPRS CL10 3RX/2TX Power (2W/1W)	@ 5,5V	320	341	230	242
	@ 12V	165	177	120	127,5
	@ 32V	67	72	50	53,5
During TX bursts Power (2W/1W)	@ 5,5V	1178	1400	670	780
	@ 12V	600	712	342	400
	@ 32V	230	274	132	156

Table : Consumption (1\*) with GPS ON (AT+WGPSM=0,1) antenna 20 mA @3.3V and without RS232 connected

CONDITIONS T=25°C et carte SIM 3V		E-GSM/GPRS 900MHz		E-GSM/GPRS 1800MHz	
		I Nom.(mA)	I Max.(mA)	I Nom.(mA)	I Max.(mA)
Idle mode (2*)	@ 5,5V	68,5	88	68,5	88
	@ 12V	37,7	42,5	37,7	42,5
	@ 32V	19,6	24	19,6	24
Idle mode 32K (3*)	@ 5,5V	63	82,5	63	82,5
	@ 12V	35,2	40,3	35,2	40,3
	@ 32V	18,7	22,2	18,7	22,2
In communication GSM 1RX/1TX Power (2W/1W)	@ 5,5V	233,5	260,5	186	210
	@ 12V	122	136,5	97,75	111
	@ 32V	50	57	41	47,25
In communication GPRS CL10 3RX/2TX Power (2W/1W)	@ 5,5V	371	392	281	293
	@ 12V	191	210	146	160,5
	@ 32V	77	84,5	60	66
During TX bursts Power (2W/1W)	@ 5,5V	1229	1451	721	845
	@ 12V	626	745	368	433
	@ 32V	240	286,5	142	168,5

(1\*) The power consumption may vary by 5% over the whole operating temperature range (-20 °C to +55 °C)  
 (2\*) Idle mode : modem is registered on the network but not in communication.  
 (3\*) Idle mode 32K : low power mode controlled by an external application, via the DTR CTS signals.

### 8.2.2 Audio interface

Table : Characteristics of the audio interface on the 15-pin Sub HD connector

Audio parameters	Min.	Typ.	Max.	Units	Comments
Microphone input current @ 2V / 2 KΩ		0.5		mA	
Absolute microphone input voltage (max.)			100	mV pp	AC voltage
Loud-speaker output current (load 150 Ω // 1nF)		16		mA	
Absolute loud-speaker impedance	32	50		Ω	
Impedance of the loud-speaker amplifier in differential mode			1	Ω	+/- 10%

Table : Characteristics of the internal microphone input filter

Frequency range	Gain
0 - 150 Hz	< -22 dB
150 - 180 Hz	< -11 dB
180 - 200 Hz	< -3 dB
200 - 3700 Hz	0 dB
> 4000 Hz	< -60 dB

Table : Recommended microphone characteristics

Parameters	Value
Type	Electret 2 V / 0.5 mA
Impedance	Z = 2 kΩ
Sensitivity	-40 dB to -50 dB
SNR	> 50 dB
Frequency response	Compatible with the GSM specifications

Table : Recommended loud-speaker characteristics

Parameter	Value
Type	10mW, electromagnetic
Impedance	Z = 32 to 50 Ω
Sensitivity	110 dB SPL min. (0 dB = 20 μPa)
Frequency response	Compatible with the GSM specifications

**8.2.2.2 Buzzer**

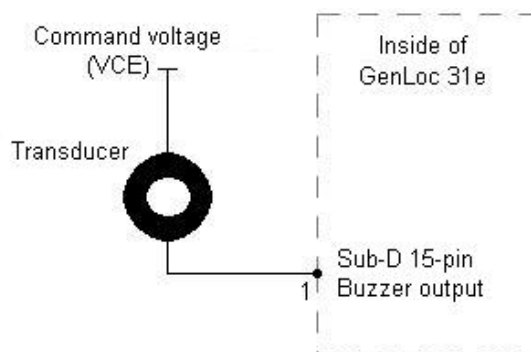
Table :Example of a transducer tested with the GenLoc 31e :

Audio parameters	Max.	Units
Loud Speaker output current (max.)	80	mA
Command voltage VCE	32	V

Table :Example of a transducer tested with the GenLoc 31e :

Buzzer characteristics	Values
Type	Transducer KINGSTATE KX-1612
Power consumption	6-18V peak/40mA max.
Resonant frequency	2400Hz ±200HZ
Coil impedance	115.0 Ω ±17.2 Ω
Acoustic level	Min.85dBA (Typical 92) @10cm

The internal output circuit of the Wismo is an open-drain.





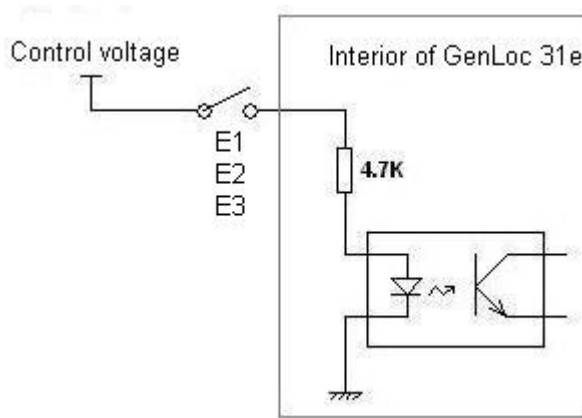
**8.2.3 General purpose inputs / output**

The GenLoc 31e modem provides 3 opto-coupled inputs (E1 to E3) and 1 open-collector output (S1) for controlling external equipment and applications.

**8.2.3.1 Inputs**

Table : Characteristics of the opto-coupled inputs

Parameter	Minimum value	Maximum value
Control voltage	5.5 V DC	32 V DC

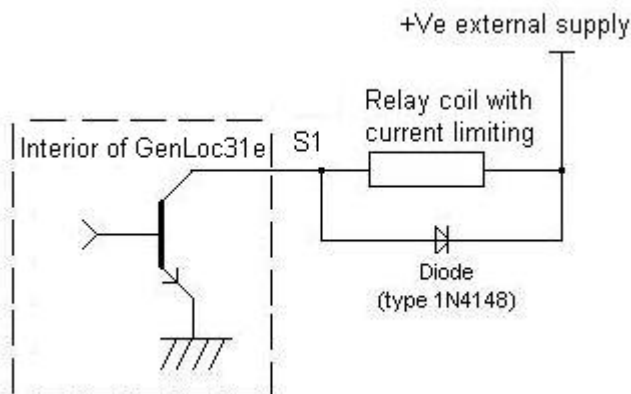


Typical input circuit of the three inputs

**8.2.3.2 Output**

Table : Characteristics of the open-collector output

Parameter	Maximum value
Collector voltage	60 V DC
Collector current	1 A DC



Typical output circuit of the output

8.2.4 SIM interface

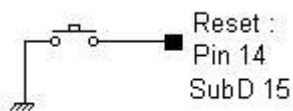
Table : SIM card characteristics

SIM card	3 V or 1.8 V
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8.2.5 RESET signal

Table : RESET signal electrical characteristics

Parameter	Minimum value	Maximum value	Unit
Input impedance (R)	4.7		kΩ
Input capacitance (C)		10	nF



Typical RESET connection

Table : RESET signal operating conditions

Parameter	Minimum value	Maximum value	Condition
*VT-	1.1 V	1.2 V	
*VT+	1.7 V	1.9 V	
VOL	0 V	0.4 V	IoL = -50 μA
VOH	2.0 V	2.8 V	IoH = 50 μA

\* VT-, VT- Hysteresis thresholds

8.2.6 GSM / DCS

8.2.6.1 Frequency bands

Table : Frequency ranges

Parameter	E-GSM 900	DCS 1800
Transmission frequency	880 to 915 MHz	1710 to 1785 MHz
Reception frequency	925 to 960 MHz	1805 to 1880 MHz

8.2.6.2 RF Performances

The RF performances are compliant with the ETSI GSM 05.05 recommendation.

The RF performances for receiver and transmitter are given in the table below.

Table : Receiver and Transmitter RF performances

Receiver	
E-GSM900 Reference Sensitivity	- 104 dBm
GSM/DCS1800 Reference Sensitivity	- 102 dBm
Selectivity @ 200 kHz	> +9 dBc
Selectivity @ 400 kHz	> +41 dBc
Linear dynamic range	63 dB
Co-channel rejection	>= 9 dBc
Transmitter	
Maximum output power (E-GSM 900) at ambient temperature	33 dBm +/- 2 dB
Maximum output power (E-/DCS 1800 at ambient temperature	30 dBm +/- 2 dB
Minimum output power (E-GSM 900) at ambient temperature	5 dBm +/- 5 dB
Minimum output power (E-DCS 1800) at ambient temperature	0 dBm +/- 5 dB

8.2.6.3 External GSM antenna

The external GSM antenna is connected to the modem via the SMA/M connector. It must have the characteristics listed in the table below.

Table : External GSM antenna characteristics

Antenna frequency range	Dual-band GSM 900 / DCS 1800 MHz
Impedance	50 Ohms nominal
DC Impedance	0 Ohm
Gain (antenna + cable)	0 dBi (in a minimum direction)
VSWR (Rx max TX max)	1.5:1
Polarisation	Linear

Note : See chapter **10 Recommended Accessories** for GSM antenna recommended by ERCO&GENER.

8.2.7 GPS

8.2.7.1 GPS operation

The performance of the GPS receiver is given in the table below.

Table : GPS performance specification

Parameter	Specification			
Receiver Type	L1 frequency, C/A Code, 16 channels, 8192 search bins			
Maximum Update Rate	4 Hz			
Accuracy	Position	2.5m CEP / 5m SEP		
	Position DGPS / SBAS	2m CEP / 3m SEP		
Acquisition	Starting	Fast Acquisition Mode	Normal Mode	High Sensitivity Mode
	Cold	34 s	36 s	41 s
	Hot	3.5 s		
Signal Reacquisition	< 1 s			
Sensitivity	Fast Acquisition Mode	Acquisition and Reacquisition	Tracking	
	-142 dBm	-148 dBm	-158 dBm	
Operational Limits	COCOM restrictions			

8.2.7.2 External GPS antenna

The external GPS antenna is connected to the modem via the SMB/F connector. It must have the characteristics listed in the table below.

Table : External GPS antenna characteristics

Reception frequency	1575.42 MHz +/-1.023 MHz
Impedance	50 Ohms nominal
Antenna gain	15 dB typical / 45 dB max
Typical radial gain	5 dBi (in a minimum direction)
VSWR (Rx max)	1.5:1
Polarisation	RHCP
Power supply voltage	3.3V
Power supply current (max)	30mA

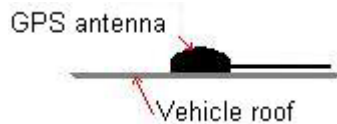
Note : See chapter **10 Recommended Accessories** for GPS antenna recommended by ERCO&GENER.

### 8.2.7.3 Installation of the external GPS antenna

The position of the antenna mounting is crucial for an optimal performance of the GPS receiver. The antenna must have full view of the sky ensuring a direct line-of-sight with as many visible satellites as possible.

Some recommendations :

- Place patch antennae parallel to the geographic horizon with the dome upper-most.
- It is preferable to place the antenna on the outside of the vehicle.
- Do not place the antenna on athermic windscreens. Some modern vehicles are fitted with a special windscreen that cuts down the amount of UV (Ultra Violet) rays that will be transferred through the windscreen which help cut down on glare. These windscreens are called Athermic, or UV Coated and will dampen/reduce GPS signals coming through the windscreen.
- Do not place the antenna under metallic surfaces.



Typical GPS antenna installation

### 8.3 Environmental characteristics

To ensure the correct operation of the modem, the limits listed in the table below should be respected.

Table : Environmental characteristics

Operating temperature	-20 °C to +55 °C
Storage temperature	-30 °C to +85 °C
Operating humidity without condensation	HR < 70% @ +55°C
Atmospheric pressure	normal

## 8.4 Standards / Conformities

The product conforms to the following requirements :

- R&TTE 1999/5/EC Directive,
- Regulations of standard ETSI EN 301 489-7 (02),
- 95/54/EC Automotive Directive: E24 10R-02050 ("E" mark).
- 2002/96/CE DEEE (crossed out wheelie bin).

It also conforms to the following standards :

Standard	Reference
Safety Standard	EN 60950 (ed. 2000 3 <sup>rd</sup> Edition)
EMC - Conducted disturbance measurement	EN 55022 : 1994
EMC - Electrostatic discharges immunity	EN 61000-4-2 : 1995
EMC - Radiated radio frequency disturbances immunity	EN 61000-4-3 : 1996
EMC - Fast transient burst immunity	EN 61000-4-4 : 1995
EMC - Conducted radio frequency disturbances immunity	EN 61000-4-6 : 1996
Road vehicles (Automotive)	ISO 7637-1 Ed.1990

The following mark is visible on the underside of the unit :



The GenLoc 31e modem conforms to the 2002/95/CE – ROHS requirements.

## 8.5 Protections

### 8.5.1 Power supply

The modem is protected by an in-line fuse in the power supply cable supplied with the modem.

The fuse type is : FSD 2.5 A / 250 V FAST.

### 8.5.2 Over-voltage

The modem is protected against voltages over +32 VDC.

When the supply voltage exceeds +32 VDC, the power supply is cut in order to protect the internal electronic components against the over-voltage.

### 8.5.3 ESD

The modem will withstand ESD's on all accessible parts of the modem (except for the RF part) according to the IEC 1000-4-2 requirements:

- 8 kV air discharge,
- 4 kV contact discharge.

### 8.5.4 Miscellaneous

Filter guarantees :

- Input/output EMI/RFI protection,
- Signal smoothing.



## 9 Security Recommendations

### 9.1 General

It is important to follow the specific regulations for the use of radio operator equipment, in particular the possible risks of radio frequency interference (RFI). Please follow carefully the security advice given below.

Turn off your GSM modem :

- On an aircraft. The use of cellular telephones can endanger the operations of the plane, disturb the cellular network and is illegal. The non-observance of this instruction can lead to the suspension of cellular telephone services as well as a fine.
- At a refuelling station.
- In any area with a potentially explosive atmosphere which could lead to an explosion or a fire.
- In hospitals and similar places where medical equipment may be in use.

Restrictions of use of radio operator equipment in :

- Fuel depots.
- Chemical factories.
- Locations where demolition is under way.
- 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 apparatus and pacemakers. Consult the manufacturers of medical equipment to determine if it is adequately protected.

The use of your GSM modem close to other electronic equipment may also cause interference if the equipment is insufficiently protected. Observe all the manufacturer's warnings and recommendations for the equipment.

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

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

## 9.2 Security in a vehicle

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

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

An incorrect installation of a GSM modem in a vehicle could cause incorrect operation of the electronics of the vehicle. To avoid such problems, ensure that the installation is carried out by a qualified person. At the time of the installation, verify the electronic protection system of the vehicle.

The use of an apparatus to activate 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 look after and preserve this product for many years.

- Do not expose the modem to the extreme environments such as a high temperature or a high humidity content.
- Do not use or store the modem in dusty or dirty places.
- Do not open or disassemble the modem. ALL WARRANTIES ARE VOID IF THE PRODUCT IS OPENED, ALTERED, AND/OR DAMAGED.
- Do not expose the modem to liquids. It is not impermeable.
- Avoid dropping, striking, or shaking the modem violently.
- Do not place the modem near computer disks, credit or voyage cards or other magnetic media. The information contained on the discs or the cards can be affected by the modem.
- The use of third party equipment or accessories, not made or authorized by ERCO&GENER can cancel the guarantee.

## 9.4 Your responsibility

This modem is under your responsibility. Treat it with care. It is not a toy. Install it in a secure place out of the reach of children.

Make a careful note of your PIN and PUK codes. Familiarize yourself with the modem and its functions. Use the security functions to prevent unauthorized use and/or theft.

## 10 Recommended Accessories

The accessories recommended by ERCO&GENER for use with the modem GenLoc 31e are shown on our Internet site in the section Products/Accessories. For more information, contact our sales department.

## 11 Client support

ERCO&GENER ensures customer support of all sold modems. As such you will have access to:

- The latest version of this document,
- The product's brief commercial description,
- The latest Wavecom OS User Guides,
- Conformity certificates,
- Application notes.

Note: The optional support for Open AT development is also available (please consult us).

## DECLARATION OF CONFORMITY

Manufacturer : ERCO & GENER

Address : Rue des Petites Granges  
Z.I. de Saint Lambert des Levées  
B.P. 30163  
49412 SAUMUR CEDEX – France

Website : <http://www.ercogener.com>

declares that the product :

Name : GenLoc 31e                      Type : Modem

Complies with :                      - R&TTE 1999/5/EC Directive,  
   - Regulations of standard ETSI EN 301 489-7 (02),  
   - ROHS Compliant : Directive 2002/95/CE,  
   - 95/54/EC Automotive Directive : E24 10R-020250 ("E" Mark).

Safety :                      EN 60950 :                      2000 3<sup>rd</sup> Edition

EMC :                      EN 55022 : 1994                      Conducted disturbance measurement  
   EN 61000-4-2 : 1995                      Electrostatic discharges immunity  
   EN 61000-4-3 : 1996                      Radiated radiofrequency disturbances immunity  
   EN 61000-4-4 : 1995                      Fast transient burst immunity  
   EN 61000-4-6 : 1996                      Conducted radiofrequency disturbances immunity

ISO 7637-1 Ed. 1990 Road Vehicles



The corresponding markings appear under the appliance.

Saumur, Avril 10<sup>th</sup> 2006

Charles CHAUSSONNIER  
Managing Director

A handwritten signature in blue ink, appearing to be 'Charles Chaussonnier'.