# Schneider Electric Modem

## User Guide

EG_SR2MOD0x_SE_1002_UG_000_UK
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## Document history

| Revision | Modifications | Author | Date |
|----------|---------------|--------|------|
| 000 | CREATION (VERSION UK) | F. LE BRETON | 16/04/08 |
|  |  |  |  |

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 the wireless markets throughout the world, the Modem allows a simple and rapid integration of GSM / GPRS connectivity into M2M applications.

The Modem used the Wavecom Module Quad-Band version 850/900/1800/1900 MHz (Europe Bands: 900/1800 MHz and US Bands: 850/1900 MHz) and GSM/GPRS Class 10.

The Modem references are according to ranges as follows:

- **Smart Relays:** Zelio Logic of Schneider Electric
    - Modem reference: SR2 MOD02
    - Identified by marking on the Modem and the labels
- **Programmable Controllers:** Twido of Schneider Electric
    - Modem reference: SR2 MOD03
    - Identified by marking on the Modem and the labels.

# Hazard Categories and Special Symbols

The following symbols and special messages may appear in this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

A lightning bolt or ANSI man symbol in a "Danger" or "Warning" safety label on the equipment indicates an electrical hazard which, as indicated below, can or will result in personal injury if the instructions are not followed.

The exclamation point symbol in a safety message in a manual indicates potential personal injury hazards. Obey all safety messages introduced by this symbol to avoid possible injury or death.

| Symbol | Name |
|:---:|:---:|
|  | Lightning Bolt |
|  | ANSI Man |
|  | Exclamation Point |

## ⚠ DANGER

**DANGER** indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

## ⚠ WARNING

**WARNING** indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

## ⚠ CAUTION

**CAUTION** indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

## CAUTION

**CAUTION** used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

> ## ⚠ WARNING
>
> **LOSS OF CONTROL**
> - The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
> - Separate or redundant control paths must be provided for critical control functions.
> - System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delay or failures of the links.[1]
> - Each implementation of a SR2 MOD02 or SR2 MOD03 modem must be individually and thoroughly tested for proper operation before being placed into service.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control"

> ## ⚠ WARNING
>
> **HAZARD OF ELECTRIC SHOCK OR BURNS**
> - Do not open the modem.
> - Modem must be powered using a 5 to 32 VDC power supply in GSM/DCS Class 2 (5.5 to 32 VDC in GPRS Class 10) using the supplied power cable.
> - No internal user serviceable parts.
> - Modem must be returned to the factory for any repairs.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

> ## ⚠ CAUTION
>
> **EQUIPMENT DAMAGE**
> - Do not connect.a supply voltage to pins 3 and 4.
> - Do not use pins 3 and 4.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

> ## ⚠ DANGER
>
> **UNINTENDED EQUIPMENT OPERATION**
> The GSM modem must be turned off in the following situations:
> - On an aircraft. The use of cellular telephones can be hazardous to 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 refueling station.
> - In any area with a potentially explosive atmosphere which could lead to an explosion or fire.
> - In hospitals and similar places where medical equipment may be in use.
>
> **Failure to follow these instructions will result in death, serious injury, or equipment damage.**

# Copyright and Disclaimer

## PLEASE NOTE:

# 1 References

## 1.1 Products References

The various features of the Modem are shown in the table below:

| Modem |
|---|
| **Functions GSM** |
| - Quad-Bands 900/1800 and 850/1900 MHz |
| - ETSI GSM Phase 2+     Class 4 (2 W @ 850 / 900 MHz)<br>Class 1 (1 W @ 1800 / 1900 MHz) |
| - SIM Toolkit Release 99 |
| **DATA Features** |
| - GPRS Class 10 (up to 4Rx / 2Tx) |
| - Supports PBCCH, Coding schemes: CS1 à CS4 |
| - TCP/IP Library (PPPRFC, TCP Socket, UDP Socket, SMTP, POP3, FTP) |
| - Asynchronous data circuit, transparent and non-transparent, 9600 bps (standard) up to 14400 bps (depending on network) |
| - Compatible Fax Group 3 |
| - SMS point to point MT/MO and SMS CB |
| **Memory Type** |
| - Flash 32 Mbits and SRAM 4 Mbits (32/4) |
| **Interfaces** |
| - Antenna GSM: SMA-F connector |
| - Power Supply: +5.5 to +32 VDC (micro-FIT connector) |
| - RS232 + Audio via female 9-pin Sub-D connector |
| - AT Commands: GSM 07.05 and 07.07 |
| - SIM reader (SIM 3 V – 1.8 V) |
| - DIN (35 mm) Rail mounting Clip |
| **Supplied Accessories** |
| - Mounting brackets (x2) |
| - Power Supply cable - 2-wire Micro FIT |
| - GSM magnetic Antenna (SMA-M) |

## 1.2 Abbreviations

| | |
|---|---|
| **AC** | Alternating 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 |
| **dBi** | Decibel relative to an Isotropic radiator |
| **dBm** | 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 |
| **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 |
| **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 |

# 1 References

| | |
|---|---|
| **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 |

# 2 Packing

## 2.1 Contents

The Modem is supplied with:

- Modem packing case,
- The Modem,
- DIN (35 mm) Rail mounting clip,
- 2 mounting brackets,
- Instructions Sheet,
- 2-wire cable (Red/Black) with in-line fuse,
- GSM magnetic Antenna (SMA-M).
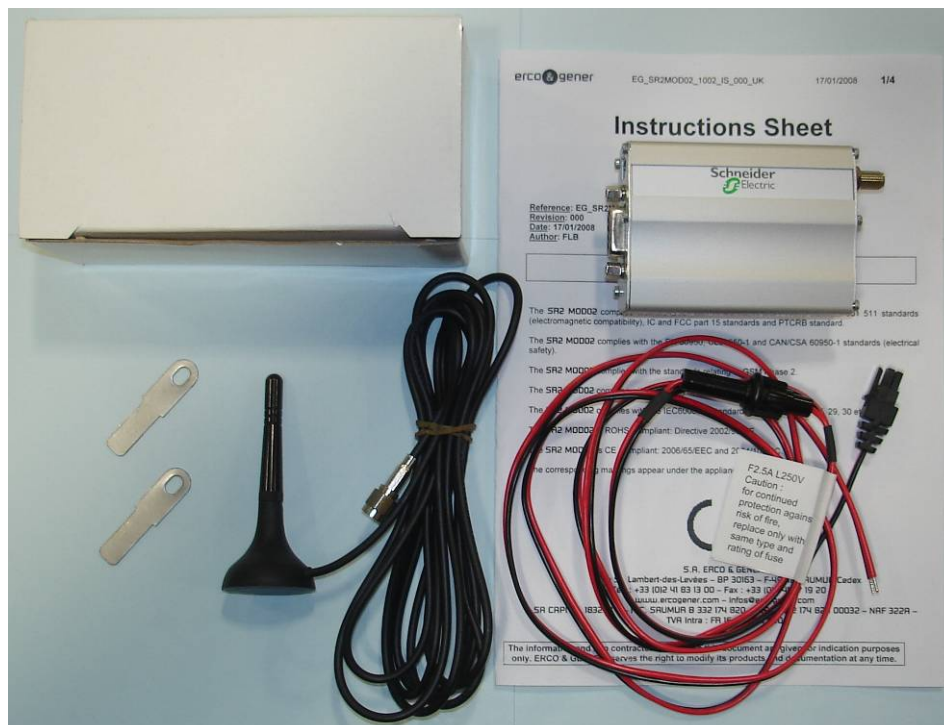
## 2.2 Packing Case

Packing case external dimensions:

- Width: 70 mm,
- Height: 70 mm,
- Length: 150 mm.

An identification label is affixed on the top of the packing case. It contains:

- The Schneider Electric logo,
- The product reference and information,
- CE mark.

Identification label dimensions:

- Height: 50 mm,
- Length: 80 mm.

## 2.3 Modem Labels

Two labels are affixed on the bottom part of the modem:

- A production label provides the following information:
  - The product reference,
  - Crossed wheelie-bin mark (DEEE standard),
  - Current, Voltage DC supply (VDC),
  - The IMEI 15-digit bar code,
  - Made by ERCO & GENER.

- Additional marking:
  - ROHS (2002/95/CE),
  - CE mark,
  - CSA,
  - UL,
  - FCC.

# 3 General Presentation

## 3.1 Physical Description

Description of the Modem:
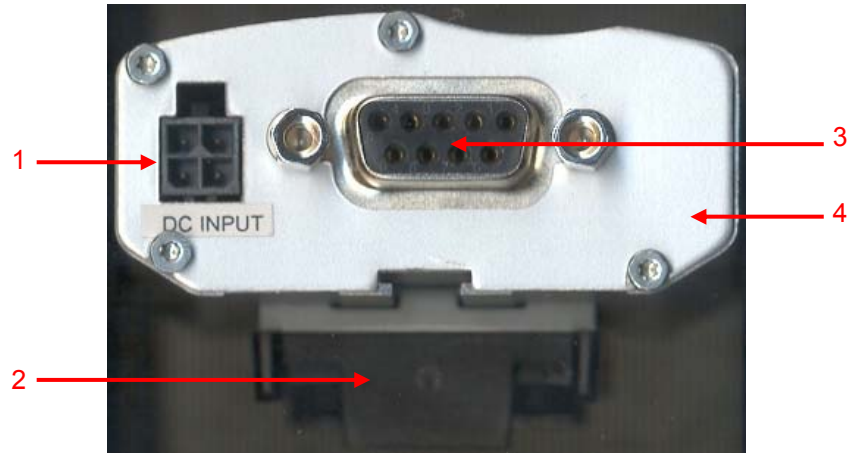


| N° | Description |
|----|-------------|
| 1 | Connector Micro-Fit 4-pins/M |
| 2 | DIN (35 mm) Rail Mounting clip |
| 3 | Connector Sub-D 9 pins/F |
| 4 | Front side |



| N° | Description |
|----|-------------|
| 1 | Rear side |
| 2 | SIM Card Cover |
| 3 | Connector SMA/F (GSM antenna) |
| 4 | GSM LED (see § 4.1.4) |
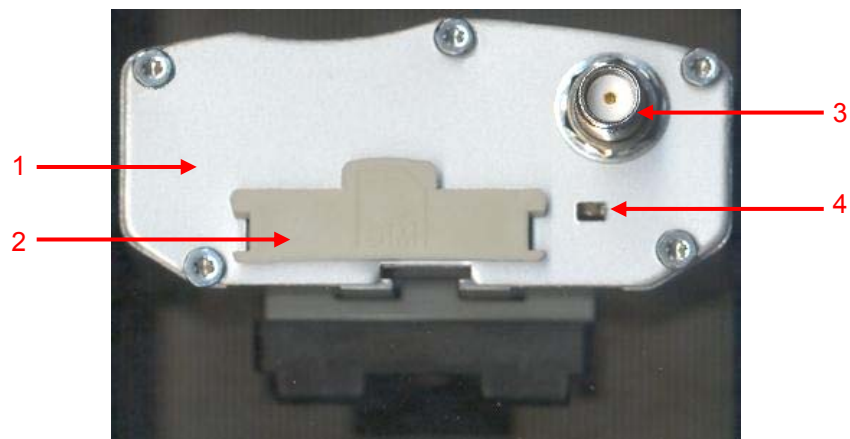
## 3.2 External connections

### 3.2.1 Connections

#### 3.2.1.1 GSM antenna connector

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

#### 3.2.1.2 4-pins Micro FIT female connector

This connector allows the connection of an external DC supply.
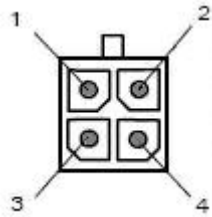
| Pin N° | Signal |
|--------|--------|
| 1 | +VDC |
| 2 | GND |
| 3 | NC |
| 4 | NC |

# ⚠ CAUTION

**EQUIPMENT DAMAGE**
- Do not connect a supply voltage to pins 3 and 4.
- Do not use pins 3 and 4.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

#### 3.2.1.3 9-pins Sub-D female connector

The 9-pins Sub-D female connector is used to connect the RS232 serial link.
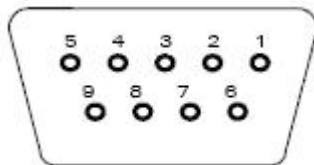
| PIN N° | Designation | Circuit (V24 – RS232C) | I/O |
|--------|-------------|------------------------|-----|
| 1 | Signal detection | 109 – DS – DCD | O |
| 2 | Data reception | 104 – RD – RXD | O |
| 3 | Data transmission | 103 – ED – TXD | I |
| 4 | Data Terminal Ready | 108/2 – TDP – DTR | I |
| 5 | Ground | 102 – TS – GND | - |
| 6 | Data Set Ready | 107 – PDP – DSR | O |
| 7 | Request To Send | 105 – DPE – RTS | I |
| 8 | Clear To Send | 106 – PAE – CTS | O |
| 9 | Ring Indicator | 125 – IA – RI | O |

### 3.2.2 Accessories

#### 3.2.2.1 2-wires micro FIT supply cable

The cable described below is supplied with the modem.
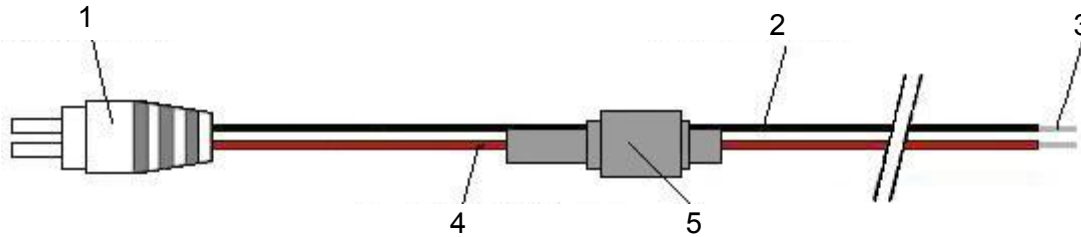


| N° | Description |
|----|-------------|
| 1 | 4-pin Micro FIT connector |
| 2 | Black wire (GND) |
| 3 | 5 mm tinned copper wire |
| 4 | Red wire (+VDC) |
| 5 | Fuse 2.5 A/250 V Fast Blow (5x20 mm) |

View from cable side
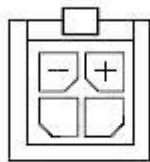


| Component | Characteristics |
|-----------|-----------------|
| Micro FIT connector | Male 4-pin |
| Cable | Length ≈ 1.5 m |
| Wire | Tinned copper 24 x 0.2 mm |
|  | Wire gauge: 0.75 mm² |

#### 3.2.2.2 GSM magnetic Antenna (SMA-M)

The GSM magnetic antenna is designed for a vertical use and must be put on a metallic support.

Its connection SMA Male allows it to be directly connected to the modem.



| Component | Characteristics |
|-----------|-----------------|
| Magnetic SMA-M Antenna | Quad Bands 850/900/1800/1900 MHz |
| Coaxial Cable | Length ≈ 2.5 m ± 10 cm |
|  | RG174 - Ø 2.54 mm |
| Antenna Dimensions | Base: Ø 30 mm Total Height: 7 cm |

# 4 Using the modem

## 4.1 Starting with the modem

### 4.1.1 Mounting/Removal

#### 4.1.1.1 Using DIN (35 mm) Rail mounting clip

The modem is supplied with a DIN (35 mm) Rail mounting clip mounted on the case.

The DIN (35 mm) Rail mounting clip allows a fast and easy mounting/removal on an OMEGA DIN (35 mm) Rail (IEC/EN 60715 / DIN (35 mm) 7.5 mm).
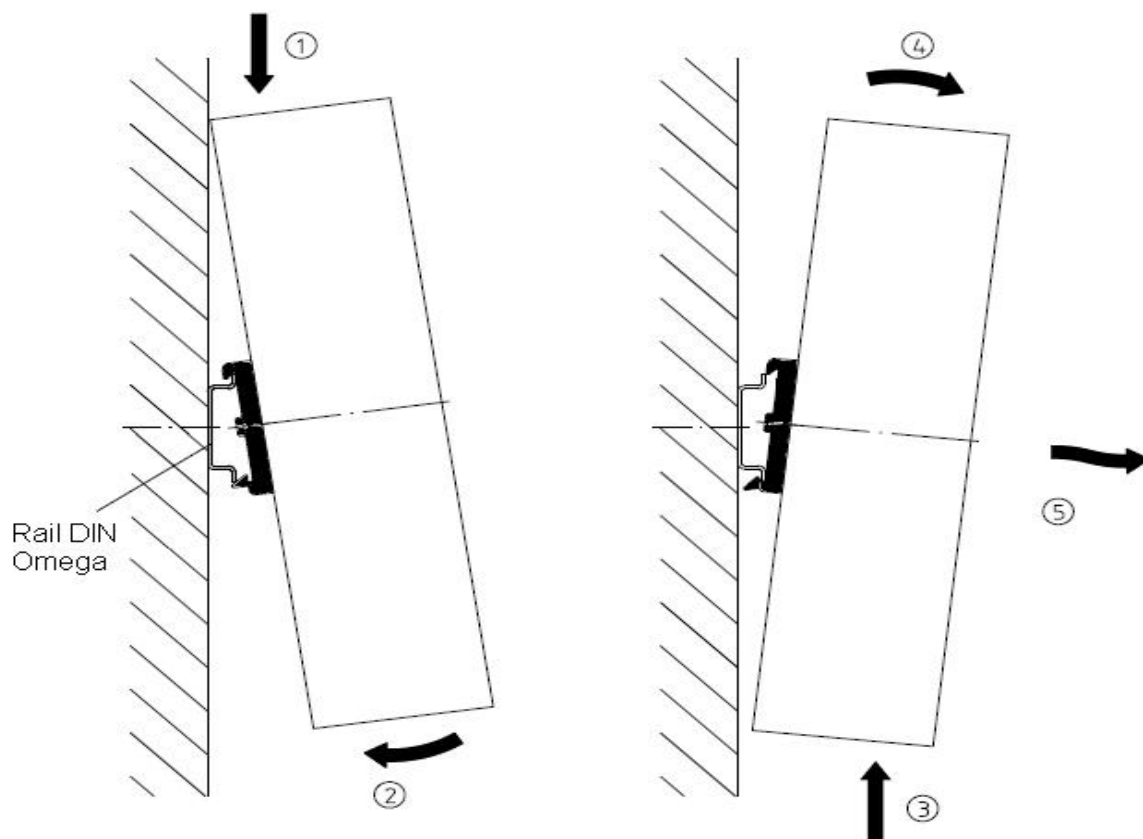


| Step | | Action |
|---|---|---|
| 1 | Mounting the modem | Press the modem on DIN (35 mm) Rail. |
| 2 | | Rotate to lock the modem on the Rail. |
| 3 | Removing the modem | Press the modem on DIN (35 mm) Rail. |
| 4 | | Rotate to unlock the modem on the Rail. |
| 5 | | Take out the modem. |

### 4.1.1.2 Mounting the modem with 2 mounting brackets

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



Fixing brackets

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



Screws must be unscrewed for removal
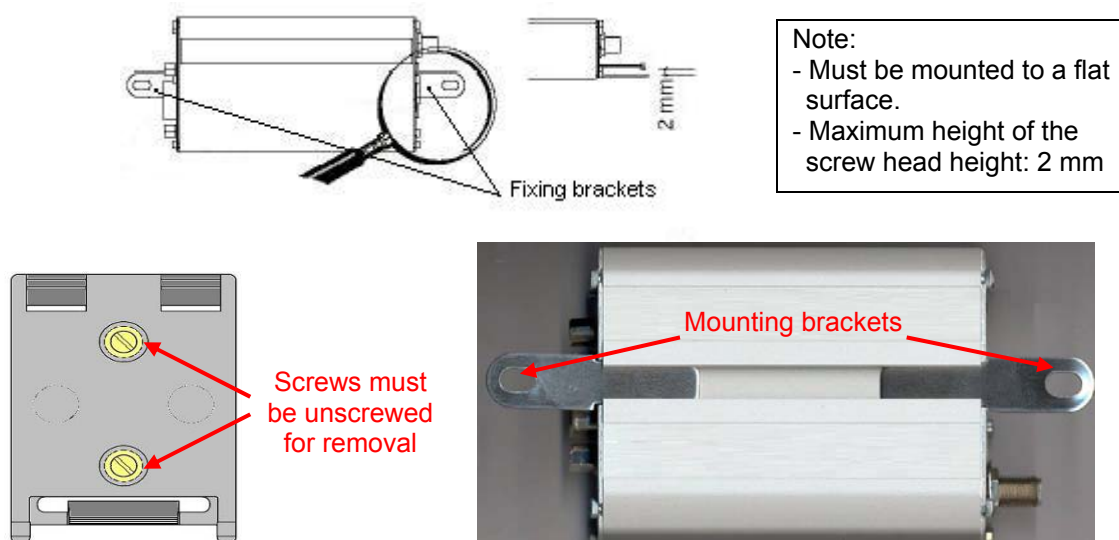
Mounting brackets

| Step | Action |
|------|--------|
| 1 | Remove the 2 DIN (35 mm) Rail mounting clip screws. |
| 2 | Slide the support of the DIN (35 mm) Rail clip. |
| 3 | Insert the 2 mounting brackets. |

### 4.1.2 Modem Installation

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

| Step | Action |
|------|--------|
| 1 | Remove the SIM card cover on the rear side |
| 2 | Carefully insert the SIM card into its holder. |
| 3 | Put the SIM card cover on the rear side. |
| 4 | Connect the GSM antenna to the SMA connector. |
| 5 | Plug the 9-pins Sub-D connector of modem to the device by using the RS232 cable. |
| 6 | Connect the supply cable to an external regulated DC source. |
| 7 | Connect the supply cable to the modem and turn on the power supply. The modem will control the network bands and the GSM LED will light up. |



Insertion Direction of the SIM Card
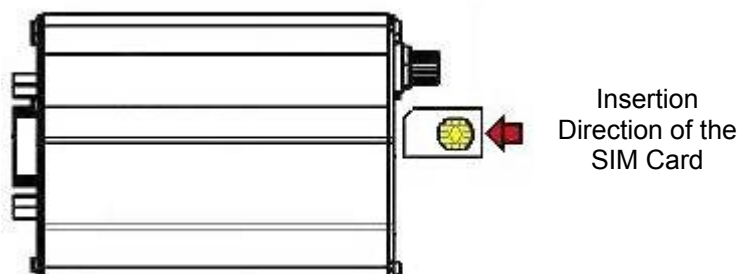
The modem is now ready for use. If you used a PC (Terminal), refer to the chapter 5 for a description of the commands for configuring and using the modem.

### 4.1.3 Network Bands Scanning

By default, the modem is configured to first automatically check the European network bands.

After insertion of SIM card Network bands scanning is activated. An embedded application automatically checks the presence of a network. In case of absence, it switches to the US network bands and continues its search. This cycle is repeated until a valid network is found.

The detected GSM network is stored in the modem.

In the case of use of new SIM card, a new network search procedure is automatically initialized.

Note: In the case of a modem configured with a SIM card for use in a specific area (European area for instance) that is then to be used in a different area (US for instance), the SIM card must be removed while modem is switched on. This is because a new network search procedure is automatically initialized after the removal (or change) of the SIM card while the device is switched on.

### 4.1.4 GSM LED
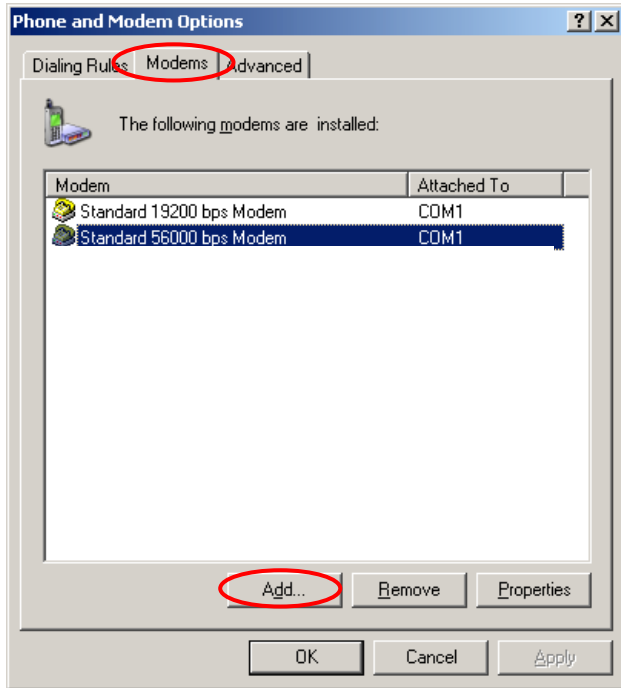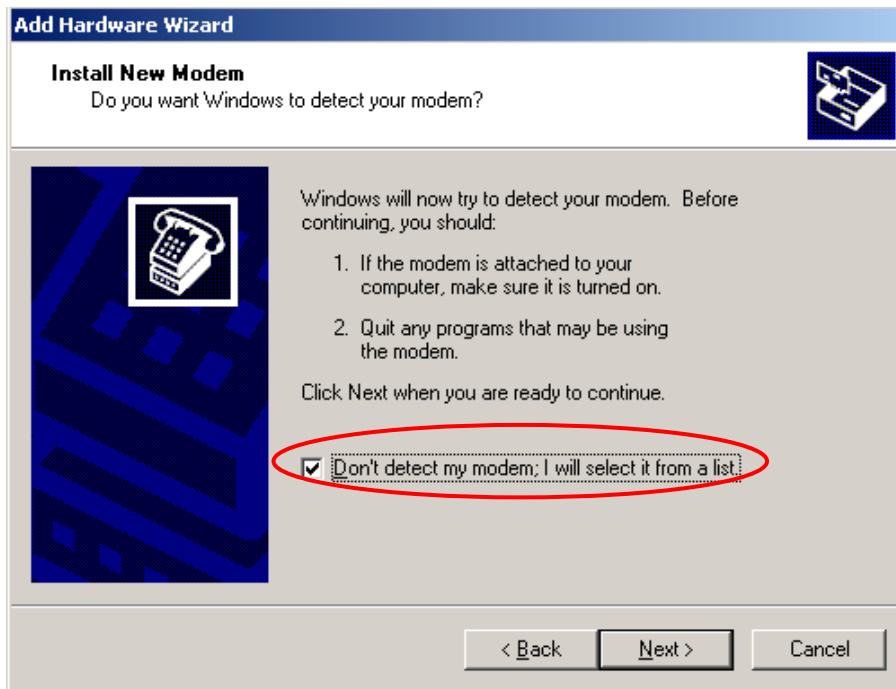
The state of the modem is indicated by the GSM LED located on the rear side of the modem (see chapter 3.1). The table below shows the meaning of the different states of the GSM LED:
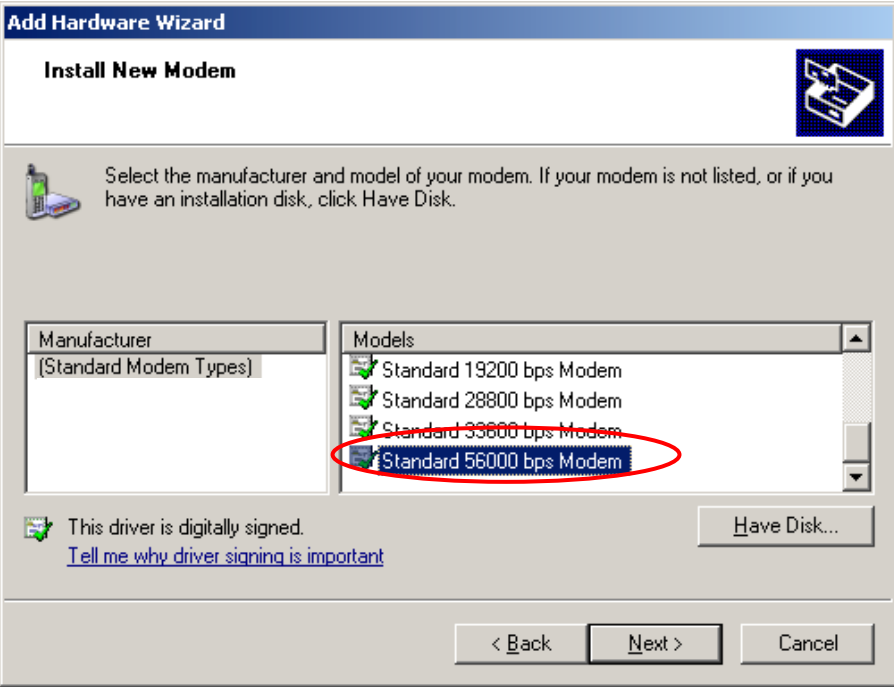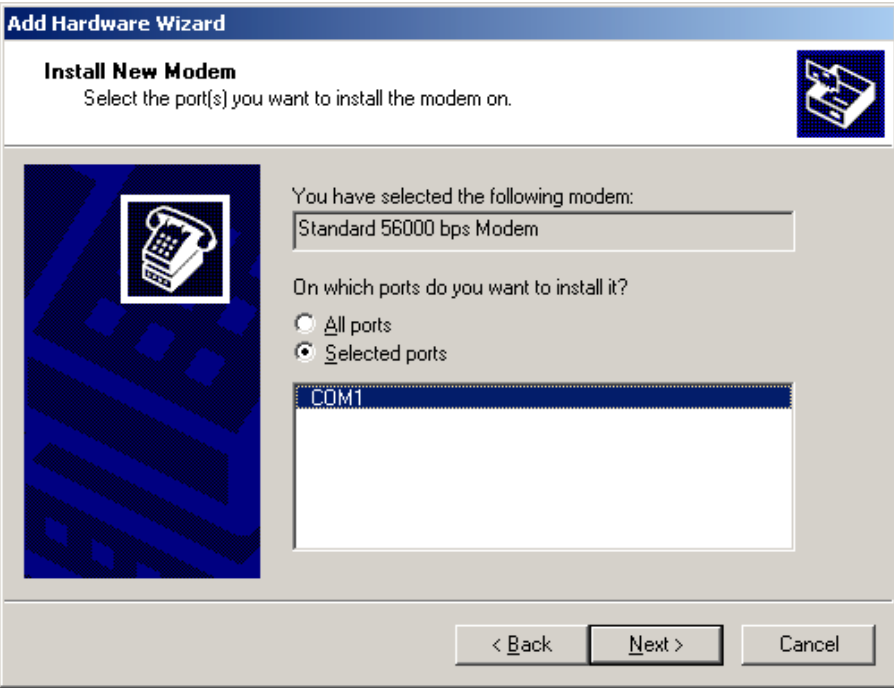
| GSM LED | LED activity | Modem state |
|---------|--------------|-------------|
| ON | LED on fixed | The modem is powered, it is ready to function but not yet recognized by the network; the PIN code has not yet been entered or the antenna is not connected. |
| | LED flashing (once every 2 seconds) | The modem is powered, the PIN code is active, the modem is recognized 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. |
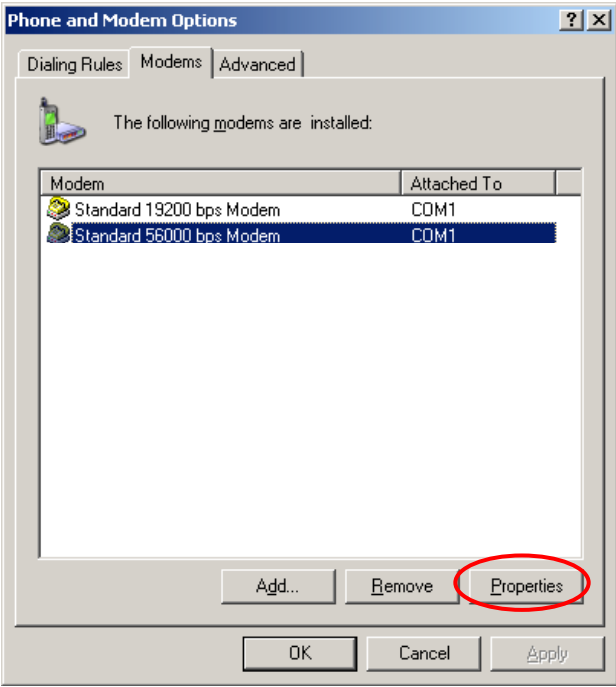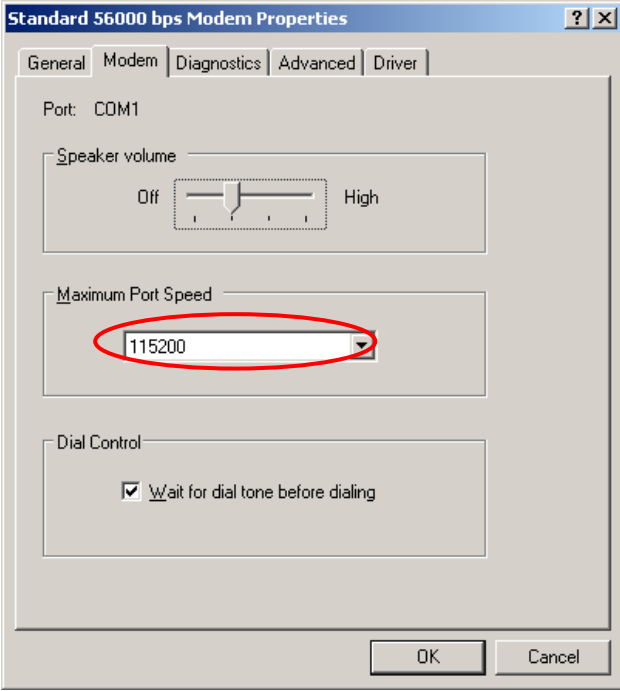
### 4.1.5 Modem configuration PC side under Windows XP
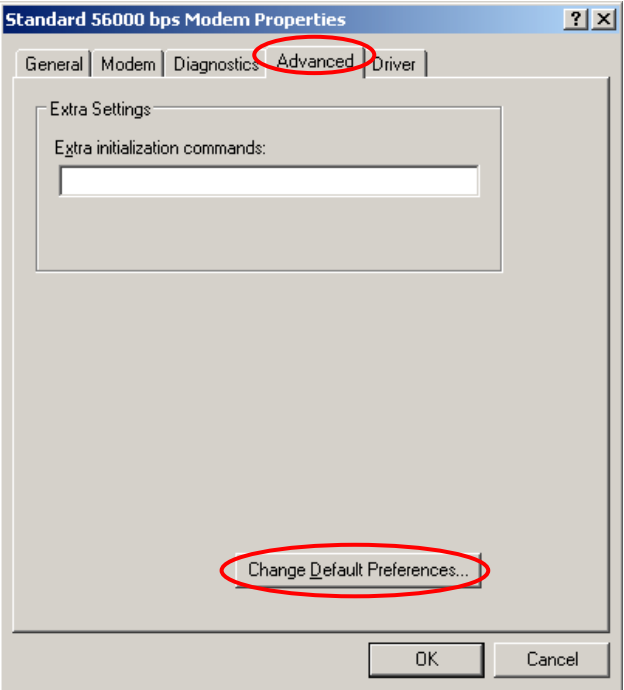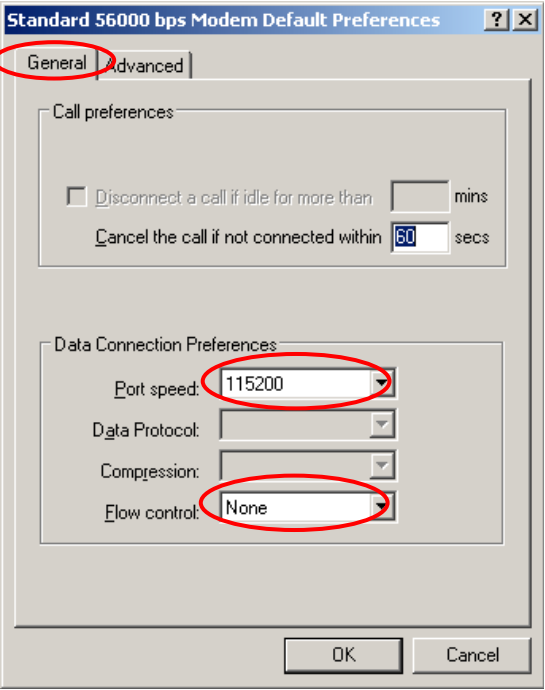
In order to use this modem PC side, it is necessary to install and configure this modem under Windows with the same communication parameters: see chapter 5.1.

To add a modem under Windows, follow instructions below:
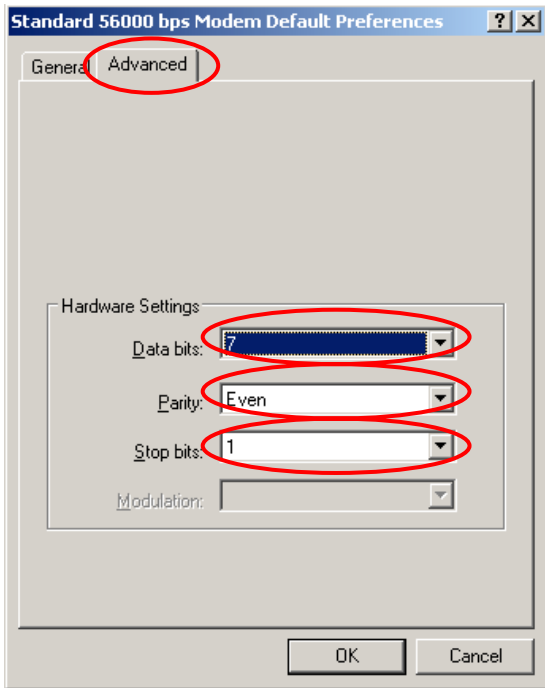
| Step | Action |
|------|--------|
| 1 | In the menu Start, Control panel, select « Phone and Modem Options » The following window appears:  Click on « Modem » then « Add ». |
| 2 | The following window appears:  Check the box « Don't detect my modem » and click on Next: |

| Step | Action |
|------|--------|
| 3 | <br>Choose a standard modem 56000 bps and click on « Next ». |
| 4 | <br>Select the communication port where the modem is connected and click on « Next ».<br>Windows installs the modem. |

| Step | Action |
|------|--------|
| 5 | After the modem is installed, it is necessary to configure the communication port link to the modem:<br><br><br><br>Click on standard modem 56000 bps then on « Properties ». |
| 6 | Click on « Modem » and select 115200 as maximal port speed.<br><br> |

| Step | Action |
|------|--------|
| 7 | Click on « Advanced » then « Change Default Preferences »:<br><br>**Standard 56000 bps Modem Properties**<br>General \| Modem \| Diagnostics \| Advanced \| Driver<br><br>Extra Settings<br>Extra initialization commands:<br><br>Change Default Preferences...<br><br>OK    Cancel |
| 8 | In the menu « General », select 115200 bps and None as Flow Control method.<br><br>**Standard 56000 bps Modem Default Preferences**<br>General \| Advanced<br><br>Call preferences<br>☐ Disconnect a call if idle for more than ___ mins<br>Cancel the call if not connected within 60 secs<br><br>Data Connection Preferences<br>Port speed: 115200<br>Data Protocol:<br>Compression:<br>Flow control: None<br><br>OK    Cancel |

| Step | Action |
|------|--------|
| 9 | Click on « Advanced » and the following window appears:<br><br>Enter the parameters according to the modem configuration (see chapter 5.1).<br><br>In the example below, the configuration is for the SR2 MOD02 Modem.<br><br> |
| 10 | Reboot the PC and the modem. After that, the modem is operational. |

# 5 Modem communication

## 5.1 Verifying modem communication

Connect the modem RS232 port to the PC COM port.

According to the type of modem, configure the DTE RS232 port as follows:

| Zelio Logic (SR2 MOD02) | Twido (SR2 MOD03) |
|---|---|
| ▪ Data rate: **115200 bauds**,<br>▪ Data size: **7 bits**,<br>▪ Parity: **Even Parity**,<br>▪ Stop bits: **1 Stop bit**,<br>▪ Flow control: **hardware flow control activated**,<br>▪ AT commands Echo: **Echo deactivated**,<br>▪ DSR Signal: **DSR 1**,<br>▪ Ring Register: **S0=0 (no automatic answer)**. | ▪ Data rate: **19200 bauds**,<br>▪ Data size: **8 bits**,<br>▪ Parity: **No Parity**,<br>▪ Stop bits: **1 Stop bit**,<br>▪ Flow control: **hardware flow control deactivated**,<br>▪ AT commands Echo: **Echo deactivated**,<br>▪ DSR Signal: **DSR OFF**,<br>▪ Ring Register: **S0=2 (answer after 2 rings)**. |

With the Windows HyperTerminal communication application, 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 connection 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 "353311xxxxxxxxx").

   ▪ *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).

## 5.2 AT commands Echo deactivated

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

- The modem's echo function is deactivated (setting by default).

- The "Local echo" of your communication application is not activated.

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.

## 5.3 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 (*rssi*) 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: <rssi>,<ber>**       where:  **<rssi>** = indicates the reception level,

**<ber>** = receive bit error rate.

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

| *rssi* value | Gain (dbm) | Interpretation | *ber* 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) | -51 dbm | Perfect | | |
| 99 | | Unknown/not detectable | 99 | Unknown/not detectable |

The GSM modem will function correctly with a minimum **<rssi>** 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.

## 5.4 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? | *+CPIN: ERROR* | The SIM card is absent or unknown |
| | *+CPIN: READY* | The PIN code is correct |
| | *+CPIN: SIM PIN* | The PIN code is bad or not yet entered |
| | *+CPIN: SIM PUK* | The PUK code is required |

## 5.5 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? | *+CREG: 0,0* | The modem is not recognized by the network. |
| | *+CREG: 0,2* | The modem is searching for a network operator. |
| | *+CREG: 0,1* | The modem is GSM attached to a local operator. |
| | *+CREG: 0,5* | The modem is GSM attached to an operator in roaming mode. |

If the modem is not registered, verify the antenna connection and the receive signal level (see chapter 5.3).

## 5.6 Main AT commands (HAYES)

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

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

(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

## 5.7 Powering down the unit

Do not cut off the supply of modem 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.

## 5.8 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.

| 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 6.2.1). |
| | Is the serial cable connected at both ends (PC and Modem)? | Verify the connection of the serial cable. |
| | Is the serial cable correctly cabled according to the table in chapter 3.2.1.3? | Cable the serial cable according to the table in chapter 3.2.1.3. |
| 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. See chapter 5.1 for the factory configuration according to the modems. |
| | 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 **ATE1Q0** followed by **AT&W** if a backup is required. |

## 5.9 "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 modem 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.
- The syntax of the AT command is 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>

---

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

---

## 5.10 "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.

| Modem returns... | Check | Action |
|---|---|---|
| "NO CARRIER" | Is the received GSM signal strong enough? | Verify the received signal quality (see chapter 5.3). |
|  | Is the modem registered on the network? | Verify network registration (see chapter 5.5). |
|  | Is the antenna correctly connected? | Check the GSM antenna installation. |
| "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 **AT+CBST=0,0,1** . |

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.

| 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 | Check with the operator. |

# 6 Functional Description

## 6.1 Architecture
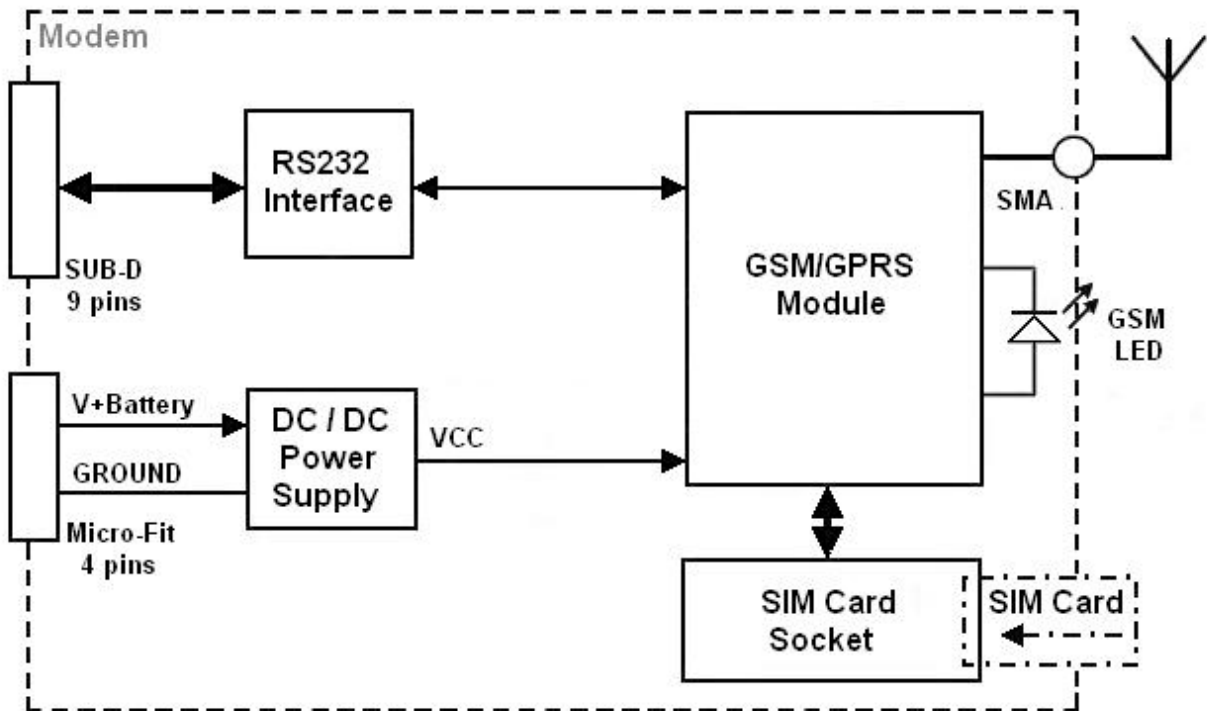


## 6.2 Power Supply

### 6.2.1 General

The modem must be powered (V+BATTERY) by an external regulated DC power supply of in Safety Extra Low Voltage (SELV) between +5.5 V and +32 V.

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

If the input voltage (V+BATTERY) falls below 5.5 V, the modem will not operate correctly.

### 6.2.2 Protections

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

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

Filter specifications:

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

## 6.3 RS232 serial link

### 6.3.1 General

The RS232 interface provides a level translation between the Wavecom GSM/GPRS Module (DCE) and the PC COM port (DTE).

The RS232 interface is protected internally (ESD protection) against external electrostatic spikes.

Filter specifications:

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)

Ring Indicator (CT125/RI)
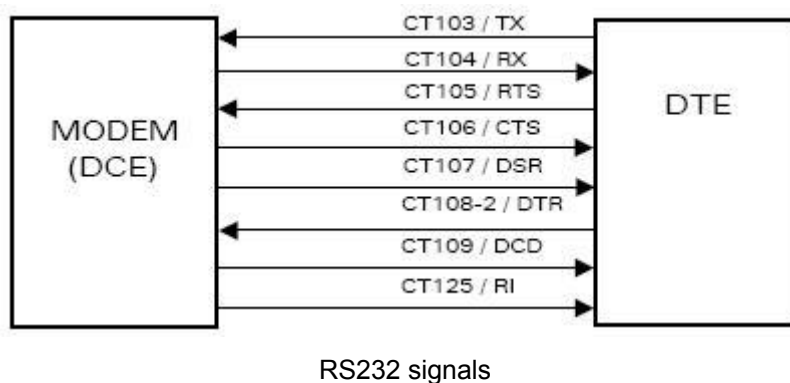


RS232 signals

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 X-Modem upgrade.

**6.3.2 Mode Autobauding**

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.

Note: See at chapter 5.1 for the default configuration of modems.

**6.3.3 Pins description**

Table: Pins description

| Signal | Pin number on Sub-D connector | I/O | RS232 standard | Description |
|---|---|---|---|---|
| CTXD/CT103 | 2 | I | TX | Transmit serial data |
| CRXD/CT104 | 3 | O | RX | Receive serial data |
| CRTS/CT105 | 7 | I | RTS | Request To Send |
| CCTS/CT106 | 8 | O | CTS | Clear To Send |
| CDSR/CT107 | 6 | O | DSR | Data Set Ready |
| CDTR/CT108-2 | 4 | I | DTR | Data Terminal Ready |
| CDCD/CT109 | 1 | O | DCD | Data Carrier Detect |
| CRI/CT125 | 9 | O | RI | Ring Indicator |
| CT102/GND | 5 | | | Ground |

# 7 Technical Characteristics

## 7.1 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 | ≈ 88 g max. (modem only) <br> < 335 g max. (modem + accessories) |
| Volume | 101.5 cm³ |
| Case | Extruded aluminum |
| Ingress Protection | IP31 |

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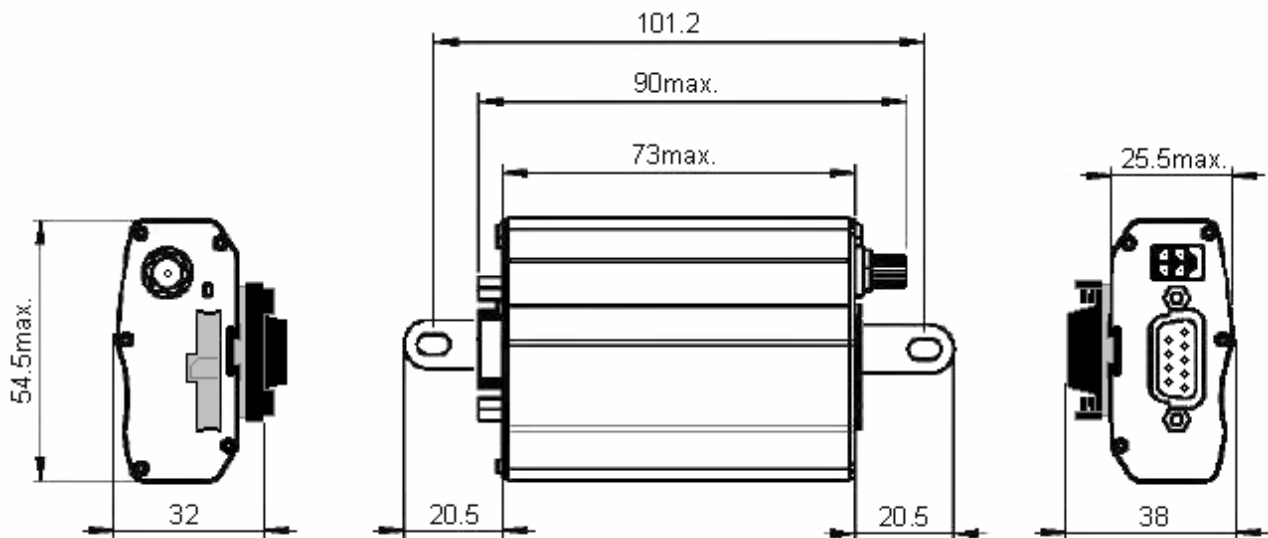
## 7.2 Electrical

### 7.2.1 Power supply

Table: Voltage range and power consumptions

| Operating voltage range | ▪ 5.5 V to 32 V DC |
|---|---|

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

The table below indicates the consequences of over and under-voltages to the modem.

Table: Effects of a power supply level below 5.5 VDC or above 32 VDC.

| If the voltage: | Then: |
|---|---|
| ▪ Falls bellow 5.5 V | ▪ GSM communication may not operate properly. |
| ▪ Goes above 32 V (transient peaks) | ▪ The modem has built in protection. |
| ▪ Goes above 32 V (continuous over-voltage) | ▪ The modem is then protected by the in-line fuse. (The modem is short-circuited by an internal varistor). |

The table below indicates the power supply consumption of the modem without the RS232 connected.

Table: Consumption (1*) without RS232 connected

| CONDITIONS T = 25°C and 3 V SIM card | | 850/900 MHz | | 1800/1900 MHz | |
|---|---|---|---|---|---|
| | | I Nom.(mA) | I Max.(mA) | I Nom.(mA) | I Max.(mA) |
| Idle mode (2*) | at 5.5V | 17.5 | 23 | 17.5 | 23 |
| | at 12V | 11.7 | 16.5 | 11.7 | 16.5 |
| | at 24V | 10 | 14 | 10 | 14 |
| | at 32V | 8.6 | 11.5 | 8.6 | 11.5 |
| Idle mode 32K (3*) | at 5.5V | 12 | 14.5 | 12 | 14.5 |
| | at 12V | 9.2 | 11.3 | 9.2 | 11.3 |
| | at 24V | 8 | 10.5 | 8 | 10.5 |
| | at 32V | 7.7 | 9.7 | 7.7 | 9.7 |
| In communication GSM 1RX/1TX | at 5.5V | 182.5 | 195.5 | 135 | 145 |
| | at 12V | 96 | 103.5 | 71.75 | 78 |
| | at 24V | 50 | 54 | 37 | 40 |
| Power (2W/1W) | at 32V | 40 | 44.5 | 31 | 34.75 |
| In communication GPRS CL10 3RX/2TX | at 5.5V | 320 | 341 | 230 | 242 |
| | at 12V | 165 | 177 | 120 | 127.5 |
| | at 24V | 87 | 93 | 64 | 68 |
| Power (2W/1W) | at 32V | 67 | 72 | 50 | 53.5 |
| During TX bursts | at 5.5V | 1178 | 1400 | 670 | 780 |
| | at 12V | 600 | 712 | 342 | 400 |
| | at 24V | 320 | 375 | 180 | 220 |
| Power (2W/1W) | at 32V | 230 | 274 | 132 | 156 |

(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.

**7.2.2 Interface SIM**

Table: SIM card characteristics

| SIM Card | 3 V or 1.8 V |
|----------|--------------|

**7.2.3 GSM/DCS**

**7.2.3.1 Frequency bands**

Table: Frequency ranges

| Parameter | GSM 850 | E-GSM 900 | DCS 1800 | PCS 1900 |
|-----------|---------|-----------|----------|----------|
| Transmission Frequency | 824 to 849 MHz | 880 to 915 MHz | 1710 to 1785 MHz | 1850 to 1910 MHz |
| Reception Frequency | 869 to 894 MHz | 925 to 960 MHz | 1805 to 1880 MHz | 1930 to 1990 MHz |

**7.2.3.2 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/GSM850 Reference Sensitivity | - 104 dBm |
| DCS1800/PCS1900 Reference Sensitivity | - 102 dBm |
| Selectivity at 200 kHz | > +9 dBc |
| Selectivity at 400 kHz | > +41 dBc |
| Linear dynamic range | 63 dB |
| Co-channel rejection | >= 9 dBc |
| Transmitter | |
| Maximum output power (E-GSM900/GSM850) at ambient temperature | 33 dBm +/- 2 dB |
| Maximum output power (DCS1800/PCS1900) at ambient temperature | 30 dBm +/- 2 dB |
| Minimum output power ( E-GSM900/GSM850) at ambient temperature | 5 dBm +/- 5 dB |
| Minimum output power ( DCS1800/PCS1900 ) at ambient temperature | 0 dBm +/- 5 dB |

**7.2.3.3 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 | Quad-bands 850/900/1800/1900 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 |
| Polarization | Linear |

| |
|---|
| Note: See chapter 3.2.2.2, for GSM antenna recommended by Schneider Electric. |

## 7.3 Environmental characteristics

For the correct operation of the modem, stay within the limits listed in the table below.

Table: Environmental characteristics

| | |
|---|---|
| Operating temperature | -20 °C to +55 °C |
| Storage temperature | -40 °C to +70 °C |
| Operating humidity without condensation | HR < 95% at +55°C |
| Atmospheric pressure | normal |

## 7.4 Standards / Conformities

The product conforms to the following requirements:

- R&TTE 1999/5/EC Directive,
- Regulations of standard ETSI EN 301 489-7, EN301 419-1 et EN 301 511,
- 2002/96/CE DEEE (crossed out wheelie bin).

The Modem conforms to the 2002/95/CE – ROHS requirements.

Conformity available on web-site www.telemecanique.com.

## 7.5 Protections

### 7.5.1 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.

### 7.5.2 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.

### 7.5.3 ESD

The modem will withstand ESD's on all accessible parts of the modem (except for the RF part) according to the IEC 61000-4-2 requirements:

       8 kV air discharge,

       4 kV contact discharge.

### 7.5.4 Miscellaneous

Filter specifications:

       Input/output EMI/RFI protection,

       Signal smoothing.

# 8 Security Recommendations

## 8.1 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 refueling 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 hazard 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.

## 8.2 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.

## 8.3 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 Schneider Electric can cancel the guarantee.

## 8.4 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 SIM Card codes. Familiarize yourself with the modem and its functions. Use the security functions to prevent unauthorized use and/or theft.