



**CINTERION**  
a Gemalto company

# Hardware Interface Description

## BGS2T

Version: 01.301c  
DocId: BGS2T\_HD\_v01.301c



Document Name:

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Version:

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Date:

**2012-09-20**

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Status

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## 0 Document History

Preceding document: "BGS2T Hardware Interface Description" Version 01.301b

New document: "BGS2T Hardware Interface Description" Version **01.301c**

| Chapter | What is new   |
|---------|---|
| 3.6.1   | Revised parameter description for pin 6 in <a href="#">Table 12</a> . |
| 3.8     | New section <a href="#">Hardware Watchdog</a> .                       |
| 5.1     | Revised mechanical dimensions and added <a href="#">Figure 12</a> .   |
| 5.3     | Added transportation cardbox size.                                    |

Preceding document: "BGS2T Hardware Interface Description" Version 01.301a

New document: "BGS2T Hardware Interface Description" Version 01.301b

| Chapter | What is new                                 |
|---------|---|
| 5.2, 7  | Revised part number for Wago mounting foot. |

Preceding document: "BGS2T Hardware Interface Description" Version 01.301

New document: "BGS2T Hardware Interface Description" Version 01.301a

| Chapter | What is new   |
|---------|---|
| 1.4     | Updated <a href="#">Figure 1</a> showing product label information.   |
| 3.5.1   | Revised <a href="#">Table 10</a> and <a href="#">Figure 5</a> listing signal names and showing pin assignments for 6-pole Western jack. |

New document: "BGS2T Hardware Interface Description" Version 01.301

| Chapter | What is new             |
|---------|-------------------------|
| ---     | Initial document setup. |

# 1 Introduction

This document<sup>1</sup> describes the hardware of the Cinterion BGS2T. The BGS2T comes in two variants depending on the type of serial interface:

- BGS2T RS232 implements a V.24 / V.28 RS-232 interface with a D-sub 9-pole female socket and a 6-pole Western jack as plug-in power supply connector.
- BGS2T RS485 implements a 6-pin header for the RS-485 interface including power supply and ignition line.

Wherever necessary and appropriate this document distinguishes between these two variants.

The scope of this document includes interface specifications, electrical issues and mechanical characteristics of BGS2T. It specifies standards pertaining to wireless applications and outlines requirements that must be adhered to for successful product design. The BGS2T is a compact GSM modem for the transfer of data in GSM networks. Industrial standard interfaces and an integrated SIM card reader allow using BGS2T easily as a quad band GSM/GPRS terminal.

## 1.1 Related Documents

- [1] BGS2T AT Command Set
- [2] BGS2T Release Notes

Prior to using the GSM/GPRS terminal read the latest product information provided in the Release Notes.

You can use the following link to visit the Cinterion Website:  
<http://www.cinterion.com>

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<sup>1</sup>. The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Cinterion wireless product.

## 1.2 Terms and Abbreviations

**Table 1:** Terms and abbreviations

| Abbreviation | Description                               |
|--------------|---|
| ARP          | Antenna Reference Point                   |
| ATC          | AT Command                                |
| BTS          | Base Transceiver Station                  |
| CB           | Cell Broadcast                            |
| CODEC        | Coder-Decoder                             |
| DCE          | Data Circuit terminating Equipment        |
| DSR          | Data Set Ready                            |
| DTR          | Data Terminal Ready                       |
| EFR          | Enhanced Full Rate                        |
| EGSM         | Enhanced GSM                              |
| EMC          | Electromagnetic Compatibility             |
| ESD          | Electrostatic Discharge                   |
| ETS          | European Telecommunication Standard       |
| FDMA         | Frequency Division Multiple Access        |
| G.C.F.       | GSM Conformity Forum                      |
| GSM          | Global Standard for Mobile Communication  |
| HW           | Hardware                                  |
| IC           | Integrated Circuit                        |
| IF           | Intermediate Frequency                    |
| IMEI         | International Mobile Equipment Identifier |
| I/O          | Input/ Output                             |
| IGT          | Ignition                                  |
| ISO          | International Standards Organization      |
| ITU          | International Telecommunications Union    |
| kbps         | kbits per second                          |
| LVD          | Low voltage Directive                     |
| Mbps         | Mbits per second                          |
| MMI          | Machine Machine Interface                 |
| MO           | Mobile Originated                         |
| MS           | Mobile Station                            |
| MT           | Mobile Terminated                         |
| NC           | Not Connected                             |
| NTC          | Negative Temperature Coefficient          |

**Table 1:** Terms and abbreviations

| Abbreviation | Description                                     |
|--------------|---|
| PA           | Power Amplifier                                 |
| PCB          | Printed Circuit Board                           |
| PCM          | Pulse Code Modulation                           |
| PCS          | Personal Communication System                   |
| PD           | Power Down                                      |
| PDU          | Protocol Data Unit                              |
| R&TTE        | Radio and Telecommunication Terminal Equipment  |
| RF           | Radio frequency                                 |
| RI           | Ring Indication                                 |
| RX           | Receive direction                               |
| SIM          | Subscriber Identification Module                |
| SMS          | Short Message Service                           |
| SW           | Software  |
| TDD          | Time Division Duplex                            |
| TDMA         | Time Division Multiple Access                   |
| TX           | Transmit direction                              |
| UART         | Universal Asynchronous Receiver and Transmitter |

## 1.3 Regulatory and Type Approval Information

### 1.3.1 Directives and Standards

BGS2T has been designed to comply with the directives and standards listed below.

**Table 2:** Directives

|             |  |
|-------------|--|
| 99/05/EC    | Directive of the European Parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (in short referred to as R&TTE Directive 1999/5/EC).<br>The product is labeled with the CE conformity mark  |
| 2002/95/EC  | Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)<br>  |
| 2002/96/EC  | Directive of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE)  |
| 2003/108/EC | Directive of the European Parliament and of the Council of 8 December 2003 amending directive 2002/96/ec on waste electrical and electronic equipment (WEEE)   |

**Table 3:** Standards of North American type approval

|                      |  |
|----------------------|--|
| CFR Title 47         | "Code of Federal Regulations, Part 15 B, Part 22 and Part 24 (Telecommunications, PCS)"; US Equipment Authorization FCC                                  |
| NAPRD.03 V5.6        | "Overview of PCS Type certification review board<br>Mobile Equipment Type Certification and IMEI control"<br>PCS Type Certification Review board (PTCRB) |
| RSS133 (Issue 2)     | Canadian Standard  |
| IEEE Std. C95.1-1999 | IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz                               |

**Table 4:** Standards of European type approval

|                          |   |
|--------------------------|---|
| 3GPP TS 51.010-1         | "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification"   |
| ETSI EN 301 511 V9.0.2   | Candidate Harmonized European Standard (Telecommunications series)<br>Global System for Mobile communications (GSM); Harmonized standard for mobile stations in the GSM 900 and DCS 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC)<br>(GSM 13.11 version 7.0.1 Release 1998) |
| GCF-CC V3.40.0           | Global Certification Forum - Certification Criteria   |
| ETSI EN 301 489-1 V1.8.1 | Candidate Harmonized European Standard (Telecommunications series)<br>Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements  |

**Table 4:** Standards of European type approval

|                          |  |
|--------------------------|--|
| ETSI EN 301 489-7 V1.3.1 | Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS) |
| EN 62311-2008            | Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)   |
| EN 60950-1 (2006)        | Safety of information technology equipment   |

**Table 5:** Requirements of quality

|              |                       |
|--------------|-----------------------|
| IEC 60068    | Environmental testing |
| DIN EN 60529 | IP codes              |

**Table 6:** Standards of the Ministry of Information Industry of the People's Republic of China

|                 |   |
|-----------------|---|
| SJ/T 11363-2006 | "Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products" (2006-06).  |
| SJ/T 11364-2006 | <p>"Marking for Control of Pollution Caused by Electronic Information Products" (2006-06).</p> <p>According to the "Chinese Administration on the Control of Pollution caused by Electronic Information Products" (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Hardware Interface Description.</p> <p>Please see <a href="#">Table 1.3.2</a> for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.</p>  |

**Table 7:** Toxic or hazardous substances or elements with defined concentration limits

| 部件名称<br>Name of the part                  | 有毒有害物质或元素 Hazardous substances |           |           |                 |               |                 |
|---|--------------------------------|-----------|-----------|-----------------|---------------|-----------------|
|   | 铅<br>(Pb)                      | 汞<br>(Hg) | 镉<br>(Cd) | 六价铬<br>(Cr(VI)) | 多溴联苯<br>(PBB) | 多溴二苯醚<br>(PBDE) |
| 金属部件<br>(Metal Parts)                     | ○                              | ○         | ○         | ○               | ○             | ○               |
| 电路模块<br>(Circuit Modules)                 | X                              | ○         | ○         | ○               | ○             | ○               |
| 电缆及电缆组件<br>(Cables and Cable Assemblies)  | ○                              | ○         | ○         | ○               | ○             | ○               |
| 塑料和聚合物部件<br>(Plastic and Polymeric parts) | ○                              | ○         | ○         | ○               | ○             | ○               |

O:  
表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。  
Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:  
表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。  
Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

### 1.3.2 Safety Precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating BGS2T. Manufacturers of the cellular terminal are advised to convey the following safety information to users and operating personnel and incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Cinterion Wireless Modules GmbH assumes no liability for customer's failure to comply with these precautions.

|   |  |
|---|--|
|    | <p>When in hospitals or other health care facilities, observe the restrictions on the use of mobiles. Switch off the cellular terminal or mobile if to be instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy.</p> <p>The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on. This personal subgroup always should check the distance to the mobile.</p> |
|   | <p>Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.</p> <p>Check the local and actual laws about these themes.</p>  |
|  | <p>Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.</p>   |
|  | <p>Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.</p>   |
|  | <p>Road safety comes first! Do not use a hand-held cellular terminal or mobile while driving a vehicle unless it is securely mounted in a holder for speakerphone operation. Before making a call with a hand-held terminal or mobile park the vehicle. Speakerphones must be installed by qualified personnel. Faulty installation or operation can constitute a safety hazard.</p> <p>Check the actual and local laws about these themes.</p>  |

|   |   |
|---|---|
|  | <p><b>IMPORTANT!</b></p> <p>Cellular terminals or mobiles operate using radio signals and cellular networks. In that case connections cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls.</p> <p>Remember, in order to make calls or receive calls the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength.</p> <p>Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call.</p> <p>Some networks require a valid SIM card to be properly inserted in the cellular terminal or mobile.</p> |
|  | If a power supply unit is used to supply the device it must meet the demands placed on SELV circuits in accordance with EN60950. The maximum permissible connection length between the device and the supply source should not exceed 3m.   |
|  | According to the guidelines for human exposure to radio frequency energy, an antenna connected to the FME jack of the device should be placed at least 20cm away from human bodies.   |

## 1.4 Product Label

The label fixed to the bottom of the BGS2T terminal comprises the following information.

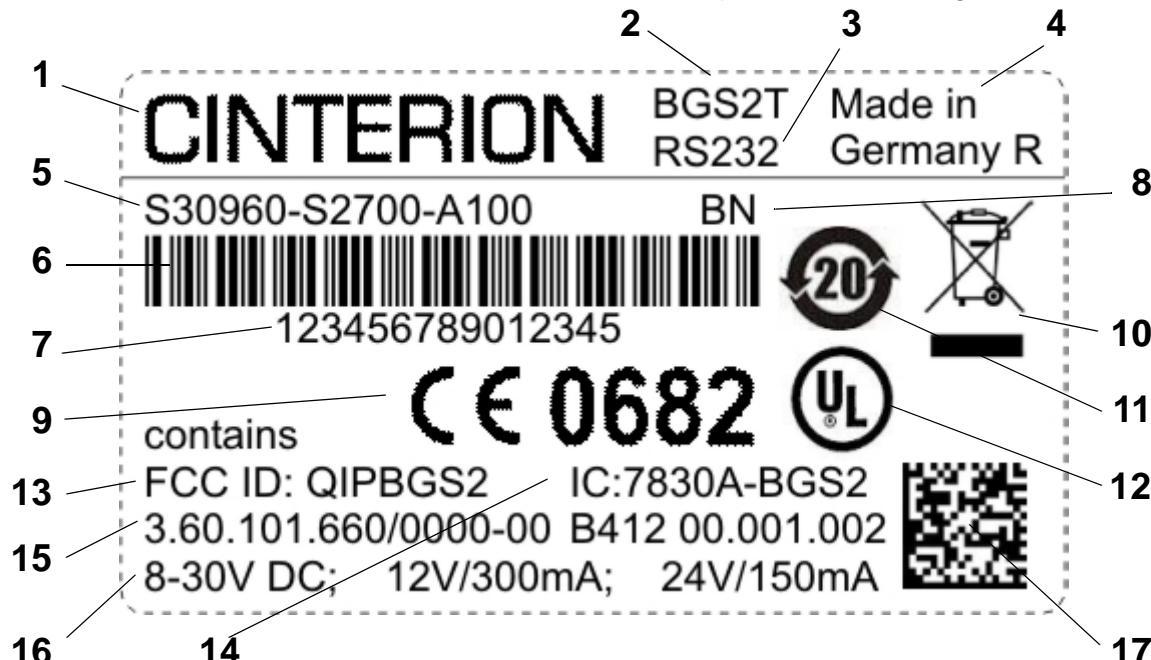


Figure 1: BGS2T label

Table 8: BGS2T label information

| No. | Information  |
|-----|--|
| 1   | Cinterion logo   |
| 2   | Product name   |
| 3   | Product variant  |
| 4   | Marking "Made in Germany"  |
| 5   | Product ordering number  |
| 6   | Barcode (Code128)  |
| 7   | Product IMEI   |
| 8   | Date code  |
| 9   | CE logo with fixed number 0682 (may be replaced for samples with "Not for sale") |
| 10  | WEEE symbol (see <a href="#">Table 2</a> ).                                      |
| 11  | Chinese RoHS symbol (see <a href="#">Table 6</a> ).                              |
| 12  | UL logo  |
| 13  | FCC ID   |
| 14  | IC ID  |
| 15  | Manufacturer code  |
| 16  | Power supply unit ratings  |
| 17  | Manufacturer code  |

## 2 Product Concept

### 2.1 Key Features at a Glance

| Feature                                    | Implementation   |
|--|--|
| General                                    |  |
| Incorporates BGS2 module                   | The BGS2 module handles all signal and data processing within the BGS2T. Internal software runs the application interface and the complete GSM/GPRS protocol stack.  |
| Frequency bands                            | Quad band: GSM 850/900/1800/1900MHz  |
| GSM class                                  | Small MS   |
| Output power (according to Release 99, V5) | <p>Class 4 (+33dBm ±2dB) for EGSM850<br/>     Class 4 (+33dBm ±2dB) for EGSM900<br/>     Class 1 (+30dBm ±2dB) for GSM1800<br/>     Class 1 (+30dBm ±2dB) for GSM1900</p> <p>The values stated above are maximum limits. According to Release 99, the maximum output power in a multislots configuration may be lower. The nominal reduction of maximum output power varies with the number of uplink timeslots used and amounts to 3.0dB for 2Tx.</p> |
| Power supply                               | Single supply voltage 8V to 30V  |
| Operating temperature (BGS2 module)        | Normal operation: -30°C to +85°C<br>Extended operation: -40°C to -30°C and +85°C to +90°C  |
| Physical                                   | Dimensions: 80.10mm x 56.21mm x 22.10mm<br>(excluding antenna and serial interface connectors)<br>Weight: 65g (approx.)  |
| RoHS, WEEE                                 | All hardware components are fully compliant with the EU RoHS and WEEE Directives   |
| GSM / GPRS features                        |  |
| Data transfer                              | <p>GPRS:</p> <ul style="list-style-type: none"> <li>• Multislot Class 10</li> <li>• Full PBCH support</li> <li>• Mobile Station Class B</li> <li>• Coding Scheme 1 – 4</li> </ul> <p>CSD:</p> <ul style="list-style-type: none"> <li>• V.110, RLP, non-transparent</li> <li>• 2.4, 4.8, 9.6, 14.4kbps</li> <li>• USSD</li> </ul> <p>PPP-stack for GPRS data transfer</p>   |
| SMS  | <ul style="list-style-type: none"> <li>• Point-to-point MT and MO</li> <li>• Cell broadcast</li> <li>• Text and PDU mode</li> </ul>  |
| Fax  | Group 3; Class 2 and Class 1   |
| Software                                   |  |
| AT commands                                | Hayes 3GPP TS 27.007, TS 27.005, Cinterion AT commands   |
| SIM Application Toolkit                    | SAT Release 99   |

| Feature             | Implementation   |
|---------------------|--|
| TCP/IP stack        | Protocols: TCP server/client, UDP, HTTP, FTP, SMTP, POP3<br>Access by AT commands  |
| Firmware update     | Upgradeable via serial interface   |
| Interfaces          |  |
| Serial interface    | BGS2T RS232: <ul style="list-style-type: none"><li>• RS-232 interface for AT commands and data</li><li>• Supports RTS/CTS hardware handshake</li><li>• Supports software XON/XOFF flow control</li><li>• Multiplex ability according to GSM 07.10 Multiplexer protocol</li><li>• Baud rates from 1200bps to 230400bps</li></ul> BGS2T RS485: <ul style="list-style-type: none"><li>• RS-485 interface for AT commands and data</li><li>• Baud rates from 1200bps to 115200bps</li></ul> Both variants: <ul style="list-style-type: none"><li>• Autobauding supported</li></ul> |
| SIM card reader     | Supported SIM cards: 3V, 1.8V  |
| Antenna             | Antenna connected via female SMA connector   |
| Power on/off, Reset |  |
| Power on            | BGS2T RS232: <ul style="list-style-type: none"><li>• DTR line at RS-232 interface or IGT_IN line at power connector</li></ul> BGS2T RS485: <ul style="list-style-type: none"><li>• IGT_IN line at RS-485 interface</li></ul>   |
| Power off           | Normal switch-off by AT^SMSO or external On/Off push button<br>Automatic switch-off in case of critical temperature and voltage conditions   |
| Reset               | Orderly shutdown and reset by AT command<br>Emergency restart via RST_IN line at power connector (BGS2T RS232 only)  |
| Special features    |  |
| Real time clock     | Timer functions via AT commands  |
| Phonebook           | SIM card and terminal  |

## 3 Interface Description

### 3.1 Overview

BGS2T provides the following interfaces for power supply, antenna, SIM card and data transfer:

- 6-pole Western connector (female) for power supply, ignition, power down signal (BGS2T RS232 only)
- SMA antenna connector (female)
- SIM card reader
- 9-pole (female) D-sub connector for BGS2T RS232 or 6-pin (female) connector for BGS2T RS485

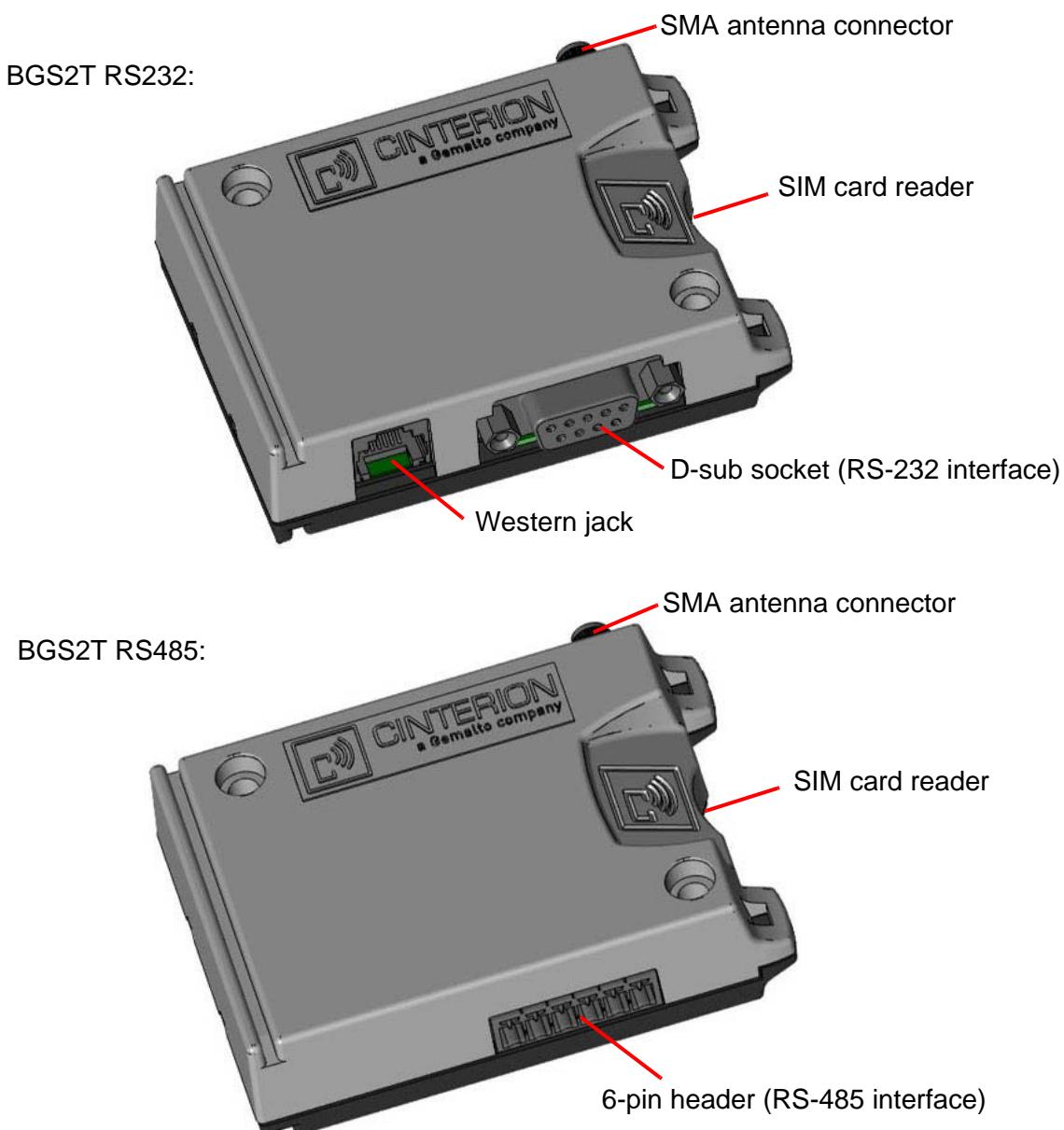


Figure 2: BGS2T 3D view

## 3.2 Block Diagram

Figure 3 shows a block diagram of a sample configuration that incorporates a BGS2T and typical accessories.

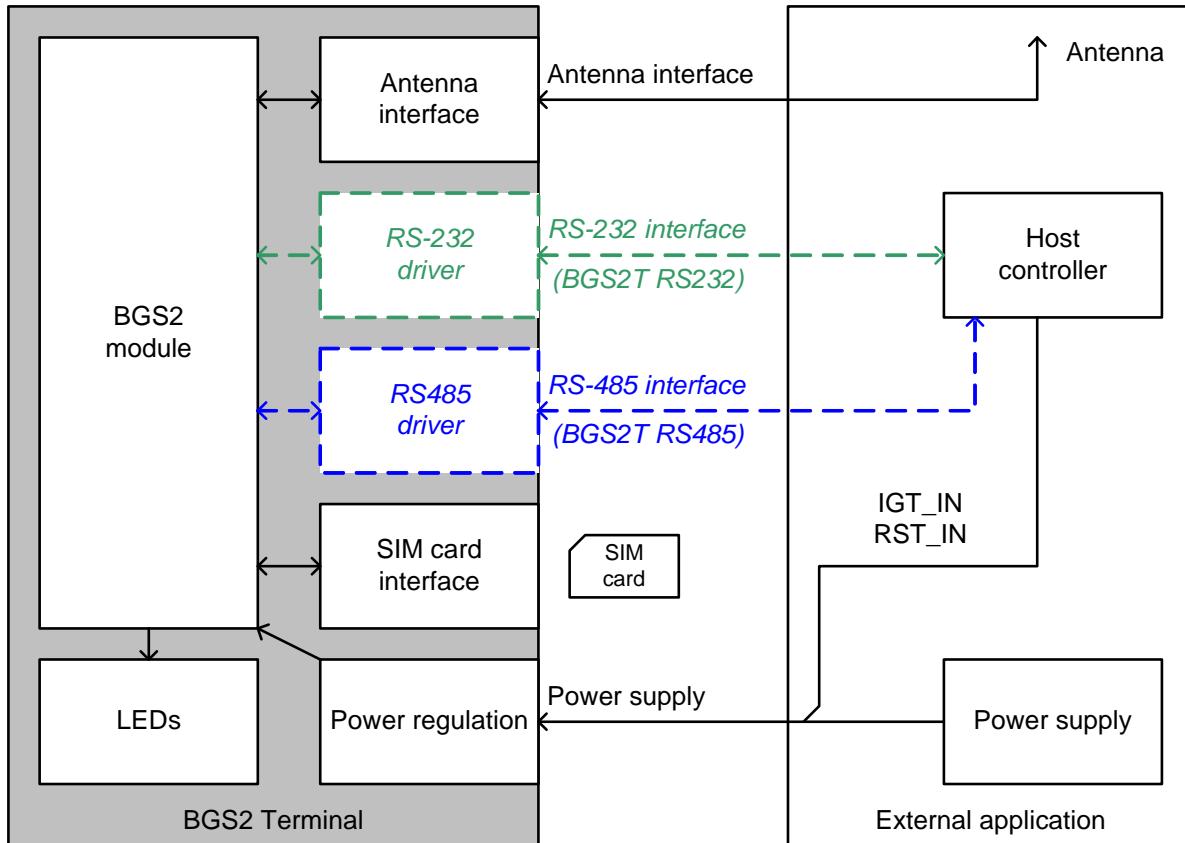


Figure 3: Block diagram

### 3.3 Terminal Circuit

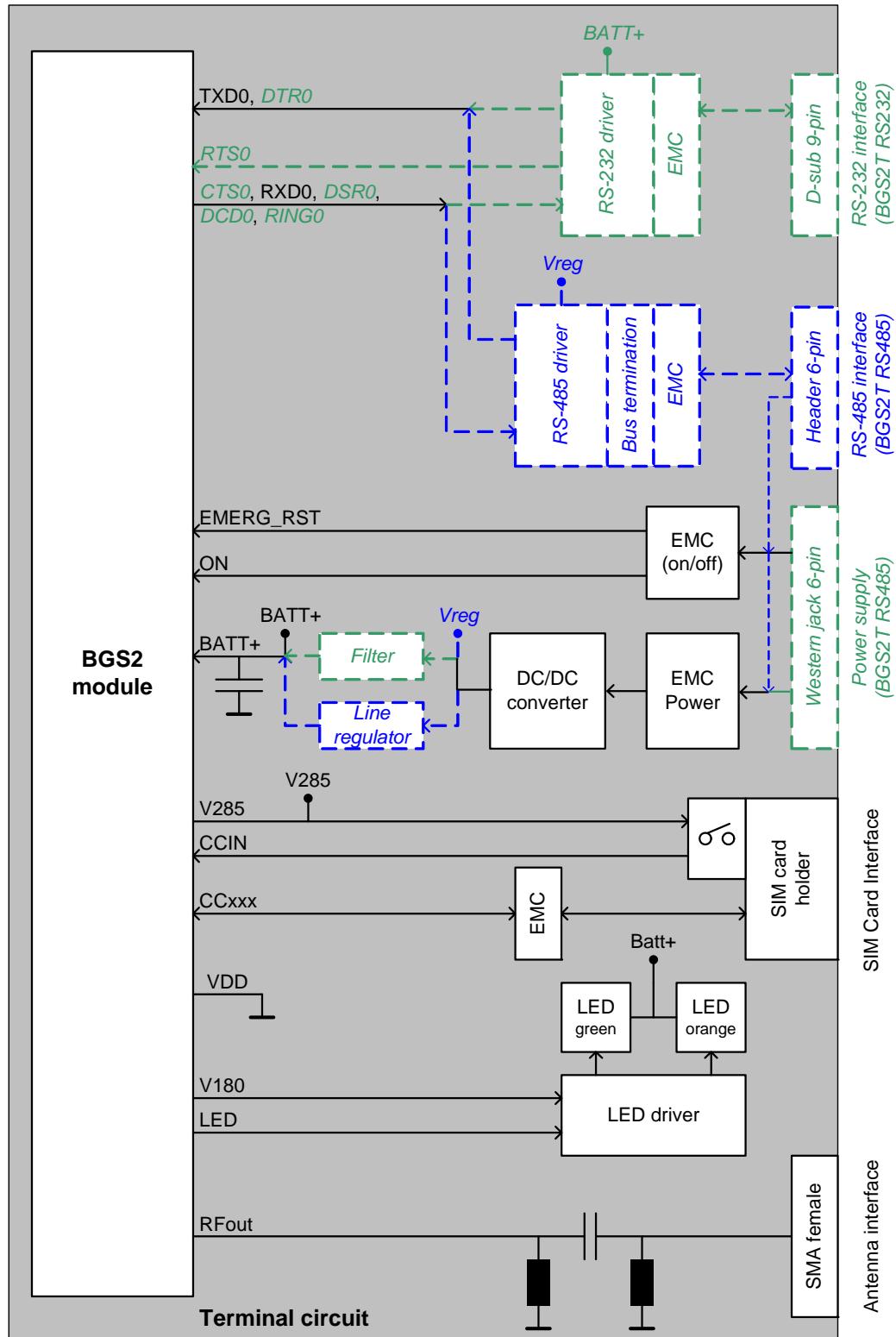


Figure 4: BGS2T circuit block diagram

With BGS2T RS232 there are separate connectors for data interface and power supply (D-sub RS-232 socket and Western jack). With BGS2T RS485 there is a single connector for these interfaces (6-pin header socket).

## 3.4 Operating Modes

The table below briefly summarizes the various operating modes referred to in the following chapters.

**Table 9:** Overview of operating modes

|                  |  |  |
|------------------|--|--|
| Normal operation | GSM IDLE   | Software is active. Once registered to the GSM network paging with BTS is carried out. The Terminal is ready to send and receive.  |
|                  | GSM TALK   | Connection between two subscribers is in progress. Power consumption depends on network coverage individual settings, such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.   |
|                  | GPRS IDLE  | Terminal is ready for GPRS data transfer, but no data is currently sent or received. Power consumption depends on network settings and GPRS configuration (e.g. multislot settings).   |
|                  | GPRS DATA  | GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates, GPRS configuration (e.g. used multislot settings) and reduction of maximum output power. |
| POWER DOWN       | Normal shutdown after sending the AT^SMSO command.<br>The RTC works continuously, but the software is not active. Interfaces are not accessible. |  |

## 3.5 RS-232 Interface Variant

The RS-232 interface is implemented as a serial asynchronous transmitter and receiver conforming to ITU-T V.24 Interchange Circuits DCE. It is configured for 8 data bits, no parity and 1 stop bit, and can be operated at bit rates from 1200bps to 230kbps. Autobauding supports bit rates from 1.2kbps to 230kbps.

For more information see also [Section 3.5.1](#) and [Section 3.5.2](#).

### 3.5.1 Power Supply

The power supply of BGS2T RS232 has to be a single voltage source of  $V_{PLUS}=8V\dots30V$  capable of providing a peak current (pulsed  $2\times577ms$  at  $T=4.615ms$ ) of about 1.2A at 12V during an active transmission. The uplink burst causes strong ripple (drop) on the power lines. The drop voltage should not exceed 1V, but the absolute minimum voltage during drops must be  $>7.6V$ .

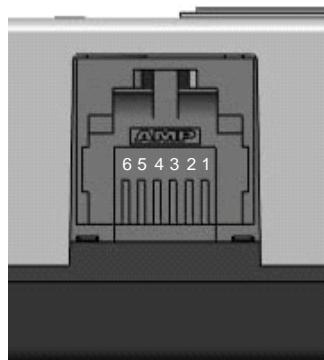
The BGS2T is protected from supply voltage reversal. An external fast acting fuse  $\geq0.4A$  with melting integral  $I^2t$  ( $0.15\dots0.25A^2s$ ) is necessary to use the BGS2T at a 12V or 24V unlimited power supply system.

The power supply must be compliant with the EN60950 guidelines. A switching regulator regulates the input voltage for the internal supply.

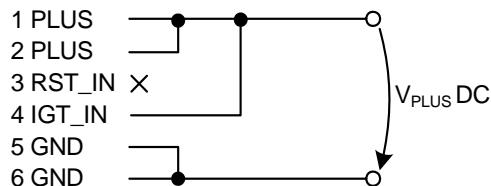
When power fails for  $>1ms$ , BGS2T resets or switches off. When power fails for  $>15s$  the RTC will be reset.

**Table 10:** Female 6-pole Western plug for power supply, ignition, power down

| Pin | Signal name | Use                     | Parameters  |
|-----|-------------|-------------------------|---|
| 1   | PLUS        | Power supply            | 8V – 30V DC, max. 33V for 1 min   |
| 2   | PLUS        | Power supply            | 8V – 30V DC, max. 33V for 1 min   |
| 3   | RST_IN      | Signal for module reset | $U_{IH} \geq 8V$ for $t > 10ms$ resets the terminal.<br>$U_{IL} < 2V$ and low level for normal operation.   |
| 4   | IGT_IN      | Ignition                | $U_{IH} \geq 8V$<br>Ignition $\geq 8V$ for more than 200ms switches the BGS2T on. Ignition is activated only by a rising edge. The rise time is $<20ms$ |
| 5   | GND         | Ground                  | 0V  |
| 6   | GND         | Ground                  | 0V  |



Pin assignment and typical connection:

**Figure 5:** 6-pole Western jack for power supply, ignition, reset, typical connection

Mains adapter: If it fits into the design of your GSM application we recommend the plug-in supply unit used with the type approved Cinterion reference setup. Ordering information can be found in [Chapter 7](#). This 12V mains adapter comes with a 6-pole Western plug and provides an internal connection between IGT\_IN pin and PLUS pin for auto ignition (power up).

### 3.5.1.1 Turn BGS2T on

BGS2T is turned on by plugging an appropriate power supply unit between PLUS and GND of the 6-pole Western jack.

While the RST\_IN pin (pin4) is not active (voltage <2V) you can start the BGS2T by activating the RS-232 DTR line if in POWER DOWN mode.

The IGT\_IN signal (pin3) may be used to switch on BGS2T if in POWER DOWN mode.

After startup of the BGS2T the RS-232 lines are in an undefined state for approx. 900ms. This may cause undefined characters to be transmitted over the RS-232 lines during this period.

### 3.5.1.2 Reset BGS2T

An easy way to reset the BGS2T is entering the command AT+CFUN=x,1. For details on AT+CFUN please see [\[1\]](#).

As an alternative, you can shut down the BGS2T as described in [Section 3.5.1.3](#) and then restart it as described in [Section 3.5.1.1](#).

### 3.5.1.3 Turn BGS2T off

Normal shutdown:

- To turn off the BGS2T use the AT^SMSO command, rather than disconnecting the mains adapter.

This procedure lets the BGS2T log off from the network and allows the software to enter a secure state and save data before disconnecting the power supply. After AT^SMSO has been entered the BGS2T returns the following result codes:

^SMSO: MS OFF  
OK  
^SHUTDOWN

The "**^SHUTDOWN**" result code indicates that the BGS2T turns off in less than 1 second. After the shutdown procedure is complete the BGS2T enters the POWER DOWN mode. The orange LED stops flashing (see [Section 3.11](#) for a detailed LED description). The RTC is still fed from the voltage regulator in the power supply ASIC. Please note that if there is an auto ignition connection between PLUS and IGT\_IN the module will restart automatically after a normal shutdown.

Emergency restart:

- In the event of software hang-ups etc. the BGS2T can be restarted by applying a voltage >8V to the RST\_IN pin (pin 3) for more than 10ms.  
The RST\_IN signal restarts the BGS2T.

Caution: Use the RST\_IN pin only when, due to serious problems, the software is not responding for more than 5 seconds. Pulling the RST\_IN pin causes the loss of all information stored in the volatile memory since power is cut off immediately. Therefore, this procedure is intended only for use in case of emergency, e.g. if BGS2T fails to shut down properly.

When the BGS2T enters the POWER DOWN mode, e.g. after you have issued the AT^SMSO command or activated the RST\_IN signal, all RS-232 interface lines are active for a period of 50ms to max. 3.5s. This may cause undefined characters to be transmitted on the RS-232 lines which can be ignored.

### 3.5.1.4 Disconnecting power supply

Before disconnecting the power supply from the PLUS pin, make sure that the BGS2T is in a safe condition. The best way is to wait 1s after the "**^SHUTDOWN**" result code has been indicated.

### 3.5.2 9-Pole D-sub Connector

Via RS-232 interface, the host controller controls the BGS2T and transports data.

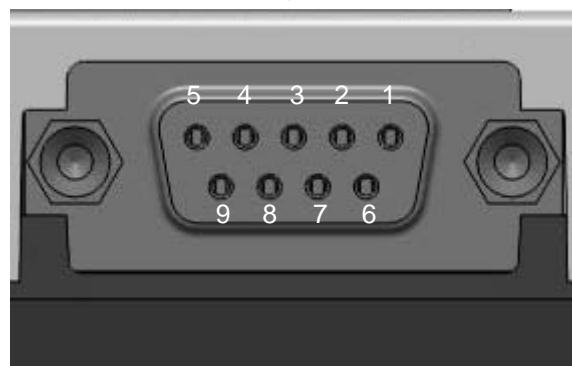


Figure 6: Pin assignment RS-232 (D-sub 9-pole female)

Table 11: 9-pole D-sub (female) RS-232

| Pin no. | Signal name | I/O | Function  |
|---------|-------------|-----|---|
| 1       | DCD         | O   | Data Carrier Detected   |
| 2       | RXD         | O   | Receive Data  |
| 3       | TXD         | I   | Transmit Data   |
| 4       | DTR         | I   | Data Terminal Ready<br>Attention: The ignition of BGS2T is activated via a rising edge of high potential (+3 ... +15 V) |
| 5       | GND         | -   | Ground  |
| 6       | DSR         | O   | Data Set Ready  |
| 7       | RTS         | I   | Request To Send   |
| 8       | CTS         | O   | Clear To Send   |
| 9       | RING        | O   | Ring Indication   |

BGS2T is designed for use as a DCE. Based on the conventions for DCE-DTE connections it communicates with the customer application (DTE) using the following signals:

- Port TxT @ application sends data to TXD of BGS2T
- Port RxT @ application receives data from RXD of BGS2T

Hardware handshake using the RTS and CTS signals and XON/XOFF software flow control are supported.

In addition, the modem control signals DTR, DSR, DCD and RING are available. The modem control signal RING (Ring Indication) can be used to indicate, to the cellular device application, that a call or Unsolicited Result Code (URC) is received. There are different modes of operation, which can be set with AT commands.

**Note:** The DTR signal will only be polled once per second from the internal firmware of BGS2T.

## 3.6 RS-485 Interface Variant

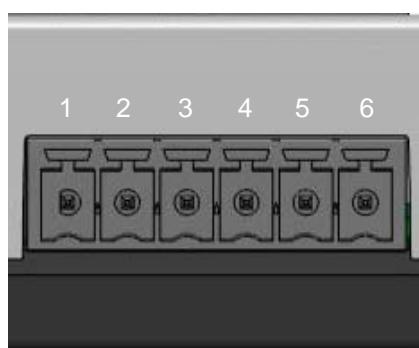
The RS-485 interface is based on the TIA/EIA-485 standard defining electrical characteristics of drivers and receivers for use in balanced multidrop communication systems. RS-485 is used in a lot of different fieldbus systems like Profibus, Interbus, Modbus and P-net.

RS-485 uses a shielded twisted pair cable where the shield is used as ground return, and the inner pairs are used for balanced communication. The two conductors in each pair are called A and B. RS-485 is usually half-duplex.

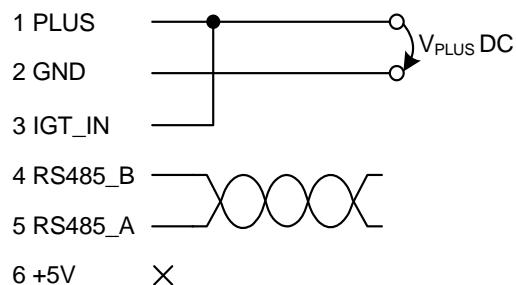
Data transmission speed depends on the length of the RS-485 bus cable and may be up to 115kbps.

### 3.6.1 6-Pin Header and Power Supply

Via RS-485 interface, the host controller controls BGS2T RS485 including power supply and data transmission.



Pin assignment and typical connection:



**Figure 7:** Pin assignment RS-485 (6-pin header female), typical connection

**Table 12:** 6-pin header pin assignment

| Pin | Signal name | Use               | Parameters  |
|-----|-------------|-------------------|---|
| 1   | PLUS        | Power supply      | 8V-30V DC   |
| 2   | GND         | Ground            | 0V  |
| 3   | IGT_IN      | Ignition          | $U_{IH} \geq 8V$<br>Ignition $\geq 8V$ for more than 200ms switches the BGS2T on. Ignition is activated only by a rising edge. The rise time is $<20ms$ |
| 4   | RS485-B     | Data transmission | Receive and transmit data for conductor B   |
| 5   | RS485-A     | Data transmission | Receive and transmit data for conductor A   |
| 6   | +5V         | Power output      | Output: +5V, max. 200mA   |

The power supply of the BGS2T has to be a single voltage source of  $V_{PLUS}=8V\dots 30V$  capable of providing a peak current (pulsed  $2\times 577ms$  at  $T=4.615ms$ ) of about 1.2A at 12V during an active transmission. The uplink burst causes strong ripple (drop) on the power lines. The drop voltage should not exceed 1V, but the absolute minimum voltage during drops must be  $>7.6V$ .



The BGS2T is protected from supply voltage reversal. An external fast acting fuse  $\geq 0.4\text{A}$  with melting integral  $I^2t$  ( $0.15 \dots 0.25\text{A}^2\text{s}$ ) is necessary to use the BGS2T at a 12V or 24V unlimited power supply system.

The power supply must be compliant with the EN60950 guidelines. A switching regulator regulates the input voltage for the internal supply. It is recommended that the power supply provides an internal connection between IGT\_IN pin and PLUS pin for auto ignition (power up).

When power fails for  $>1\text{ms}$ , BGS2T resets or switches off. When power fails for  $>15\text{s}$  the RTC will be reset.

### **3.6.1.1 Turn BGS2T on**

Before switching BGS2T on the SIM should be inserted. Now, BGS2T is turned on by connecting an appropriate power supply between PLUS and GND of the 6-pin header.

The IGT\_IN signal (pin3) may be used to switch on BGS2T if in POWER DOWN mode.

After startup of the BGS2T the RS-485 lines are in an undefined state for approx. 900ms. This may cause undefined characters to be transmitted over the RS-485 lines during this period.

### **3.6.1.2 Reset BGS2T**

As an alternative, BGS2T can be shut down as described in [Section 3.5.1.3](#) and then restarted as described in [Section 3.5.1.1](#).

### **3.6.1.3 Turn BGS2T off**

Normal shutdown:

- To turn off the BGS2T use the AT^SMSO command, rather than disconnecting the mains adapter.  
This procedure lets the BGS2T log off from the network and allows the software to enter a secure state and save data before disconnecting the power supply. After AT^SMSO has been entered the BGS2T returns the following result codes:

```
^SMSO: MS OFF
OK
^SHUTDOWN
```

The "<sup>A</sup>SHUTDOWN" result code indicates that the BGS2T turns off in less than 1 second. After the shutdown procedure is complete the BGS2T enters the POWER DOWN mode. The orange LED stops flashing (see [Section 3.11](#) for a detailed LED description). The RTC is still fed from the voltage regulator in the power supply ASIC. Please note that if there is an auto ignition connection between PLUS and IGT\_IN the module will restart automatically after a normal shutdown.

When the BGS2T enters the POWER DOWN mode, e.g. after you have issued the AT^SMSO command or after emergency shutdown, all data transmission lines are active for a period of 50ms to max. 3.5s. This may cause undefined characters to be transmitted on the data transmission lines which can be ignored.

### 3.6.1.4 Disconnecting power supply

Before disconnecting the power supply lines, make sure that the BGS2T is in a safe condition. The best way is to wait 1s after the "`^SHUTDOWN`" result code has been indicated.

## 3.7 Automatic thermal shutdown

An on-board NTC measures the temperature of the built-in BGS2 module. If over- or undertemperature is detected on the module the BGS2T automatically shuts down to avoid thermal damage to the system. [Table 16](#) specifies the ambient temperature threshold for the BGS2T.

The automatic shutdown procedure is equivalent to the power-down initiated with the `AT^SMSO` command, i.e. BGS2T logs off from the network and the software enters a secure state avoiding loss of data. In IDLE mode it takes typically one minute to deregister from the network and to switch off.

Alert messages transmitted before the BGS2T switches off are implemented as Unsolicited Result codes (URCs). For details see the description of `AT^SCTM` command provided in [\[1\]](#).

Thermal shutdown will be deferred if a critical temperature limit is exceeded, while an emergency call or a call to a predefined phone number is in progress, or during a two minute guard period after power up. See [\[1\]](#) for details.

## 3.8 Hardware Watchdog

The chipset of the internally used BGS2 module features a built-in hardware watchdog. The watchdog is activated automatically after the module powers on. In case the watchdog will not be reset within 2.5 seconds, the module will send a shutdown notification on the serial interface and will shut down itself. The module's firmware is designed in such a way that all the main tasks register to the reset procedure of the watchdog. If one of these tasks is not responding, the module will be shutdown.

When using a power supply with the ignition line permanently active (as we use on our reference power supply) the BGS2T will be restarted automatically after such a shutdown.

## 3.9 RTC

The internal Real Time Clock (RTC) of the BGS2T retains the time and date and handles the alarm (reminder) function. The `AT+CCLK` command serves to set the time and date, and `AT+CALA` specifies a reminder message. See [\[1\]](#) for details.

A dedicated voltage regulator backs up the RTC even in POWER DOWN mode and enables BGS2T to keep track of time and date.

However, please note that the Alarm mode described in [\[1\]](#), Section `AT+CALA`, is not intended for the BGS2T. The `AT+CALA` command can only be used to set a reminder message, but not to configure the mobile to wake up from POWER DOWN mode into Alarm mode. Therefore, after setting a timer with `AT+CALA` be sure not to shut down the BGS2T by `AT^SMSO` or `RST_IN` signal (BGS2T RS232 variant).

### 3.10 SIM Interface

The SIM interface is intended for 1.8V and 3V SIM cards in accordance with GSM 11.12 Phase 2. The card holder is a five wire interface according to GSM 11.11. A sixth pin has been added to detect whether or not a SIM card is inserted.

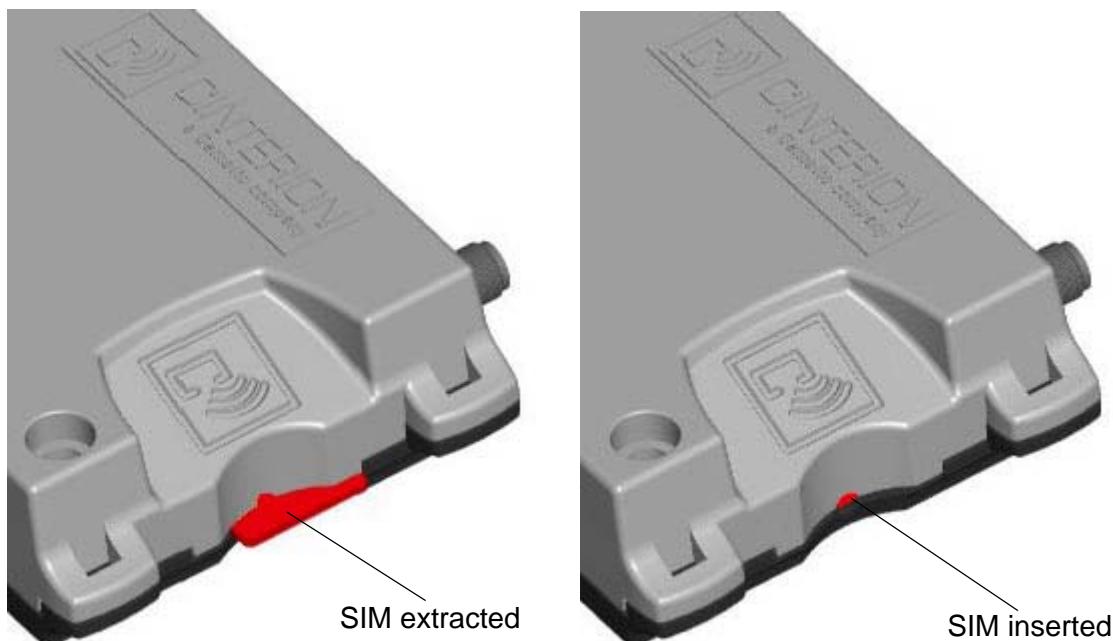


Figure 8: SIM interface

The SIM - with the circuit side facing towards the Cinterion logo - is inserted by gently pushing it into the SIM card holder until it snaps hold. It is now protected from accidental removal. The SIM can be removed from the card holder by using a flat object such as a screwdriver to carefully press the inserted SIM until it snaps out again.

All signals of the SIM interface are protected from electrostatic discharge with spark gaps to GND and clamp diodes to 1.8V resp. 2.9V and GND.

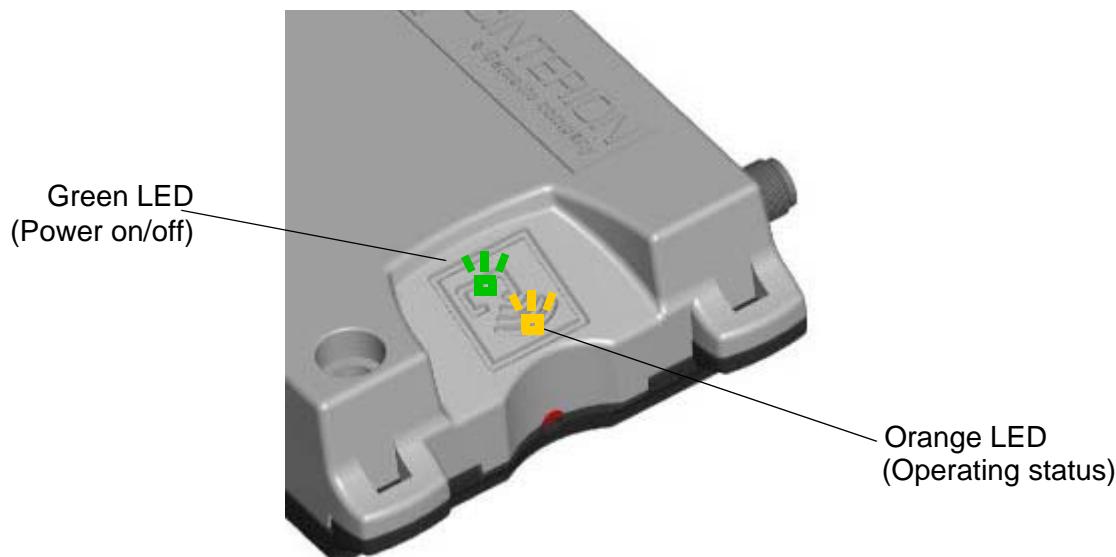
Removing and inserting the SIM card during operation requires the software to be reinitialized. Therefore, after reinserting the SIM card it is necessary to restart BGS2T.

**Note:** No guarantee can be given, nor any liability accepted, if loss of data is encountered after removing the SIM card during operation. Also, no guarantee can be given for properly initializing any SIM card that the user inserts after having removed a SIM card during operation. In this case, the application must restart the BGS2T.

### 3.11 Status LEDs

BGS2T has two LEDs indicating its operating states through the semitransparent casing:

- A green LED indicates whether the BGS2T is ready to operate.
- An orange LED indicates the various operating states of the terminal.



**Figure 9:** Status LED

The orange LED is driven by a line of the integrated BGS2 module which can be configured by using the AT^SSYNC command. For the purpose of the BGS2T it is recommended to retain the default setting of AT^SSYNC=1 (AT^SSYNC=0 is not applicable).

The following table lists the possible LED patterns and describes the operating status of the BGS2T indicated by each pattern if AT^SSYNC=1.

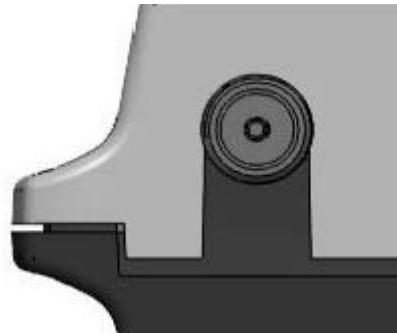
During the transition from one LED pattern to another the "on" and/or "off" periods of the LED may vary in length. This is because an event that triggers the change may occur any time and, thus, truncate the current LED pattern at any point.

**Table 13:** Coding of the orange status LED

| LED mode                                  | Operating status of BGS2T   |
|---|---|
| Permanently off                           | BGS2T is in POWER DOWN mode   |
| 600 ms on / 600 ms off                    | Limited Network Service: No SIM card inserted or no PIN entered, or network search in progress, or ongoing user authentication, or network login in progress. |
| 75 ms on / 3 s off                        | IDLE mode: The mobile is logged to the network (monitoring control channels and user interactions). No call in progress.                                      |
| 75 ms on / 75 ms off / 75 ms on / 3 s off | One or more GPRS contexts activated.  |
| 500 ms on / 25 ms off                     | Packet switched data transfer in progress.  |
| Permanently on                            | Connected to remote party or exchange of parameters while setting up or disconnecting a call.   |

## 3.12 Antenna Interface

An external antenna is connected via the terminal's female SMA connector that is also the antenna reference point (ARP).



**Figure 10:** Antenna connector

The system impedance is  $50\Omega$ . In any case, for good RF performance, the return loss of the customer application's antenna should be better than 10dB (VSWR < 2). BGS2T withstands a total mismatch at this connector when transmitting with power control level for maximum RF power.

Inside the BGS2 module an inductor to ground provides additional ESD protection to the antenna connector. To protect the inductor from damage no DC voltage must be applied to the antenna circuit.

For the application it is recommended to use an antenna with an SMA (male) connector:

Please note that the terminal should be installed and operated with a minimum distance of 20cm between the antenna connected to the terminal and any human bodies. Also, the transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. The allowed maximum antenna gain for stand-alone situation is 7.24dBi (<1GHz) and 3.30dBi for the high bands (>1.7GHz).

## 4 Electrical and Environmental Characteristics

### 4.1 Absolute Maximum Ratings

**Table 14:** Absolute maximum ratings

| Parameter  | Port / Description  | Min.      | Max.      | Unit     |
|--|---|-----------|-----------|----------|
| Supply voltage                                   | PLUS  | -50       | 30        | V        |
| Oversupply                                       | PLUS / for 1min   |           | 33        | V        |
| Input voltage for on/off control lines           | IGT_IN, RST_IN  | -5        | 30        | V        |
| RS-232 input voltage range                       | TXD, DTR, RTS   | -25       | +25       | V        |
| RS-232 output voltage range                      | RXD, CTS, DSR, DCD, RING  | -0.3      | +4.3      | V        |
| RS-485 input voltage range                       | RS485-A, RS485-B  | -8        | +13       | V        |
| Immunity against discharge of static electricity | All interfaces (lines)<br>Contact discharge<br>Human body model | -8<br>-15 | +8<br>+15 | kV<br>kV |

**Table 15:** Operating supply voltage for BGS2T

| Parameter   | Min  | Typ | Max | Unit |
|---|--|-----|-----|------|
| Supply voltage PLUS measured at (6-pole) western jack plug (1 to 6) | 5.5 lowest voltage (minimum peak) incl. all ripple and drops | 12  | 30  | V    |
| Supply voltage PLUS for RS-485 at 6-pin header                      | 7.6 lowest voltage (minimum peak) incl. all ripple and drops | 12  | 30  | V    |

## 4.2 Operating Temperatures

**Table 16:** Board temperature of BGS2 module

| Parameter                               | Min        | Max        | Unit |
|---|------------|------------|------|
| Normal operation                        | -30        | +85        | °C   |
| Extended operation <sup>1</sup>         | -40 to -30 | +85 to +90 | °C   |
| Automatic thermal shutdown <sup>2</sup> | <-40       | >+90       | °C   |

- <sup>1</sup>. Extended operation allows normal mode speech calls or data transmission for limited time until automatic thermal shutdown takes effect. Within the extended temperature range (outside the normal operating temperature range) the specified electrical characteristics may be in- or decreased.
- <sup>2</sup>. Due to temperature measurement uncertainty, a tolerance of ±3°C on these switching thresholds may occur.

If the BGS2 module temperature rises close to the limit specified for normal operation, while data is transmitted over GPRS, the module automatically reverts from GPRS Multislot Class 10 (2Tx slots) to GPRS Multislot Class 8 (1Tx). This reduces the power consumption and, consequently, causes the board's temperature to decrease. Once the temperature drops by 5 degrees, the module returns to the higher Multislot Class.

## 4.3 Storage Conditions

**Table 17:** Storage conditions

| Type   | Condition               | Unit                               | Reference  |
|--|-------------------------|------------------------------------|--|
| Air temperature:   | Low<br>High             | -30<br>+75                         | °C<br>ETS 300 019-2-1: T1.2, IEC 60068-2-1 Ab<br>ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb               |
| Humidity relative:   | Low<br>High<br>Condens. | 10<br>90 at 30°C<br>90-100 at 30°C | %<br>---<br>ETS 300 019-2-1: T1.2, IEC 60068-2-56<br>Cb<br>ETS 300 019-2-1: T1.2, IEC 60068-2-30<br>Db |
| Air pressure:  | Low<br>High             | 70<br>106                          | kPa<br>IEC TR 60271-3-1: 1K4<br>IEC TR 60271-3-1: 1K4  |
| Movement of surrounding air  |                         | 1.0                                | m/s<br>IEC TR 60271-3-1: 1K4   |
| Water: rain, dripping, icing and frosting                                |                         | Not allowed                        | ---  |
| Radiation:   | Solar<br>Heat           | 1120<br>600                        | W/m <sup>2</sup><br>ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb<br>ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb |
| Chemically active substances   |                         | Not recommended                    | IEC TR 60271-3-1: 1C1L   |
| Mechanically active substances   |                         | Not recommended                    | IEC TR 60271-3-1: 1S1  |
| Vibration sinusoidal:<br>Displacement<br>Acceleration<br>Frequency range |                         | 1.5<br>5<br>2-9 9-200              | mm<br>m/s <sup>2</sup><br>Hz<br>IEC TR 60271-3-1: 1M2  |
| Shocks:<br>Shock spectrum<br>Duration<br>Acceleration                    |                         | semi-sinusoidal<br>1<br>50         | ms<br>m/s <sup>2</sup><br>IEC 60068-2-27 Ea  |

The conditions stated above are only valid for devices in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

## 4.4 Electrical Specifications of the Application Interface

### 4.4.1 On/Off Control (BGS2T RS232)

**Table 18:** RS-232 On/Off control line specifications (requirements)

| Parameter         | Description                           | Conditions  | Min. | Typ | Max. | Unit |
|-------------------|---------------------------------------|-------------|------|-----|------|------|
| $V_{\text{high}}$ | Input voltage<br>IGT_IN, RST_IN       | active high | 5    |     |      | V    |
| $V_{\text{low}}$  |                                       |             |      |     | 2    | V    |
| $V_{\text{high}}$ | Input voltage<br>DTR                  | active high | 3    |     | +15  | V    |
| $V_{\text{low}}$  |                                       |             | -15  |     | 1.2  | V    |
| $R_{\text{IN}}$   | Input resistance of<br>IGT_IN, RST_IN |             | 1    |     |      | MΩ   |
| $R_{\text{IN}}$   | Input resistance of<br>DTR            |             | 3    | 5   | 7    | kΩ   |

### 4.4.2 On/Off Control (BGS2T RS485)

**Table 19:** RS-485 On/Off control line specifications (requirements).

| Parameter         | Description                   | Conditions  | Min. | Typ | Max. | Unit |
|-------------------|-------------------------------|-------------|------|-----|------|------|
| $V_{\text{high}}$ | Input voltage<br>IGT_IN       | active high | 5    |     |      | V    |
| $V_{\text{low}}$  |                               |             |      |     | 2    | V    |
| $R_{\text{IN}}$   | Input resistance of<br>IGT_IN |             | 1    |     |      | MΩ   |

### 4.4.3 RS-232 Interface

**Table 20:** RS-232 interface specifications (requirements)

| Parameter    | Description   | Conditions  | Min. | Typ | Max. | Unit |
|--------------|---|-------------|------|-----|------|------|
| $V_{OUT}$    | Transmitter output voltage for RXD, CTS, DSR, DCD, RING | @ 3kΩ load  | ±5   | ±6  | ±7   | V    |
| $R_{OUT}$    | Transmitter output resistance RXD, CTS, DSR, DCD, RING  |             | 300  |     |      | Ω    |
| $R_{IN}$     | Resistance TXD, RTS, DTR                                |             | 3    | 5   | 7    | kΩ   |
| $V_{IN}$     | Receiver input voltage range TXD, RTS, DTR              |             | -25  |     | +25  | V    |
| $V_{RIHYS}$  | Input hysteresis  |             |      | 0.5 |      | V    |
| $V_{low}$    | Input threshold low                                     |             | 0.6  | 1.2 |      | V    |
| $V_{high}$   | Input threshold high                                    |             |      | 1.5 | 2.4  | V    |
| Baudrate     |   | Autobausing | 1.2  |     | 230  | kbps |
|              |   | Fixed range | 1.2  |     | 230  | kbps |
| $LE_{Cable}$ | Length of RS-232 cable                                  |             |      | 1.8 | 2    | m    |

### 4.4.4 RS-485 Interface

**Table 21:** RS-485 interface specifications (requirements)

| Parameter         | Description                                | Conditions             | Min. | Typ | Max. | Unit |
|-------------------|--|------------------------|------|-----|------|------|
| $V_{OUT}$         | Transmitter output voltage for RS485-A, -B | $R_{Diff} = 100\Omega$ | 2    |     | 5    | V    |
| $R_{IN}$          | Resistance RS485-A, -B                     |                        |      | 48  |      | kΩ   |
| $V_{IN}$          | Receiver input voltage range RS485-A, -B   |                        | -7   |     | +12  | V    |
| $V_{RIHYS}$       | Input hysteresis                           |                        |      | 25  |      | mV   |
| Threshold voltage | Receiver diff. threshold voltage           |                        | -200 |     | +200 | mV   |
| Bus termination   |  |                        |      | 120 |      | Ω    |
| Baudrate          |  | Autobausing            | 1.2  |     | 230  | kbps |
|                   |  | Fixed range            | 1.2  |     | 230  | kbps |
| $LE_{Cable}$      | Length of RS-485 indoor cable              |                        |      |     | 10   | m    |

## 4.5 Power Supply Ratings

Table 22: Power supply specifications

| Parameter               | Description   | Conditions   |  | Min. | Typ | Max. | Unit |
|-------------------------|---|--|--|------|-----|------|------|
| $V_{PLUS}$              | Allowed voltage ripple (peak-peak), drop during transmit burst peak current | TALK mode, power control level for $P_{out}$ max <sup>1</sup>    |  |      |     | 1    | V    |
| $I_{PLUS}$ <sup>2</sup> | Average supply current (average time 3 min.)                                | Power Down mode  | @8V  |      | 9   |      | mA   |
|                         |   |  | @30V   |      | 3,7 |      |      |
|                         |   | IDLE mode (GSM/GPRS, 850/900MHz, 1800/1900MHz)                   | @8V  |      | 25  |      | mA   |
|                         |   |  | @30V   |      | 10  |      |      |
|                         |   | GSM TALK mode, 850/900MHz  | @8V  |      | 135 |      | mA   |
|                         |   |  | @30V   |      | 40  |      |      |
|                         |   | GSM TALK mode, 1800/1900MHz                                      | @8V  |      | 100 |      | mA   |
|                         |   |  | @30V   |      | 35  |      |      |
|                         |   | GPRS DATA mode(1 Tx, 4 Rx, 850/900MHz)                           | @8V  |      | 125 |      | mA   |
|                         |   |  | @30V   |      | 35  |      |      |
|                         |   | GPRS DATA mode(1 Tx, 4 Rx, 1800/1900MHz)                         | @8V  |      | 90  |      | mA   |
|                         |   |  | @30V   |      | 30  |      |      |
|                         |   | GPRS DATA mode(2 Tx, 3 Rx, 850/900MHz)                           | @8V  |      | 215 |      | mA   |
|                         |   |  | @30V   |      | 60  |      |      |
|                         |   | GPRS DATA mode(2 Tx, 3 Rx, 1800/1900MHz)                         | @8V  |      | 150 |      | mA   |
|                         |   |  | @30V   |      | 45  |      |      |
|                         |   | Peak supply current (during 577µs transmission slot every 4.6ms) | Power control level for $P_{out}$ max (850/900MHz) | @8V  |     | 810  | mA   |
|                         |   |  |  | @30V |     | 200  |      |
|                         |   | Power control level for $P_{out}$ max (1800/1900MHz)             | @8V  |      | 490 |      | mA   |
|                         |   |  |  | @30V |     | 130  |      |

<sup>1</sup>. Lowest voltage (minimum peak) incl. all ripple and drops >7.6V including voltage drop, ripple and spikes, measured at western jack (6-pole) pins (BGS2T RS232) and 6-pin header (BGS2T RS485).

<sup>2</sup>. Typical values measured with antenna impedance = 50 Ohm (return loss >20dB).

## 4.6 Antenna Interface

**Table 23:** Antenna interface characteristics

| Parameter  |                        | Min               | Typ               | Max  | Unit             |
|--|------------------------|-------------------|-------------------|------|------------------|
| Frequency range<br>Uplink (MS → BTS)   | GSM 850                | 824               |                   | 849  | MHz              |
|  | E-GSM 900              | 880               |                   | 915  | MHz              |
|  | GSM 1800               | 1710              |                   | 1785 | MHz              |
|  | GSM 1900               | 1850              |                   | 1910 | MHz              |
| Frequency range<br>Downlink (BTS → MS)                                       | GSM 850                | 869               |                   | 894  | MHz              |
|  | E-GSM 900              | 925               |                   | 960  | MHz              |
|  | GSM 1800               | 1805              |                   | 1880 | MHz              |
|  | GSM 1900               | 1930              |                   | 1990 | MHz              |
| RF power @ ARP with $50\Omega$ load  | GSM 850 <sup>1</sup>   | 31                |                   | 35   | dBm              |
|  | E-GSM 900 <sup>1</sup> | 31                |                   | 35   | dBm              |
|  | GSM 1800 <sup>2</sup>  | 28                |                   | 32   | dBm              |
|  | GSM 1900 <sup>2</sup>  | 28                |                   | 32   | dBm              |
| Number of carriers   | GSM 850                |                   | 124               |      |                  |
|  | E-GSM 900              |                   | 174               |      |                  |
|  | GSM 1800               |                   | 374               |      |                  |
|  | GSM 1900               |                   | 299               |      |                  |
| Duplex spacing   | GSM 850                |                   | 45                |      | MHz              |
|  | E-GSM 900              |                   | 45                |      | MHz              |
|  | GSM 1800               |                   | 95                |      | MHz              |
|  | GSM 1900               |                   | 80                |      | MHz              |
| Carrier spacing  |                        |                   | 200               |      | kHz              |
| Multiplex, Duplex  |                        |                   |                   |      | TDMA / FDMA, FDD |
| Time slots per TDMA frame  |                        |                   | 8                 |      |                  |
| Frame duration   |                        |                   | 4.615             |      | ms               |
| Time slot duration   |                        |                   | 577               |      | μs               |
| Modulation   |                        |                   |                   |      | GMSK             |
| Receiver input sensitivity @ ARP<br>BER Class II < 2.4% (static input level) | GSM 850                | -102 <sup>3</sup> | -107 <sup>4</sup> |      | dBm              |
|  | E-GSM 900              | -102 <sup>3</sup> | -107 <sup>4</sup> |      | dBm              |
|  | GSM 1800               | -102 <sup>3</sup> | -107 <sup>4</sup> |      | dBm              |
|  | GSM 1900               | -102 <sup>3</sup> | -107 <sup>4</sup> |      | dBm              |

1. Power control level PCL 5

2. Power control level PCL 0

3. Under fading conditions

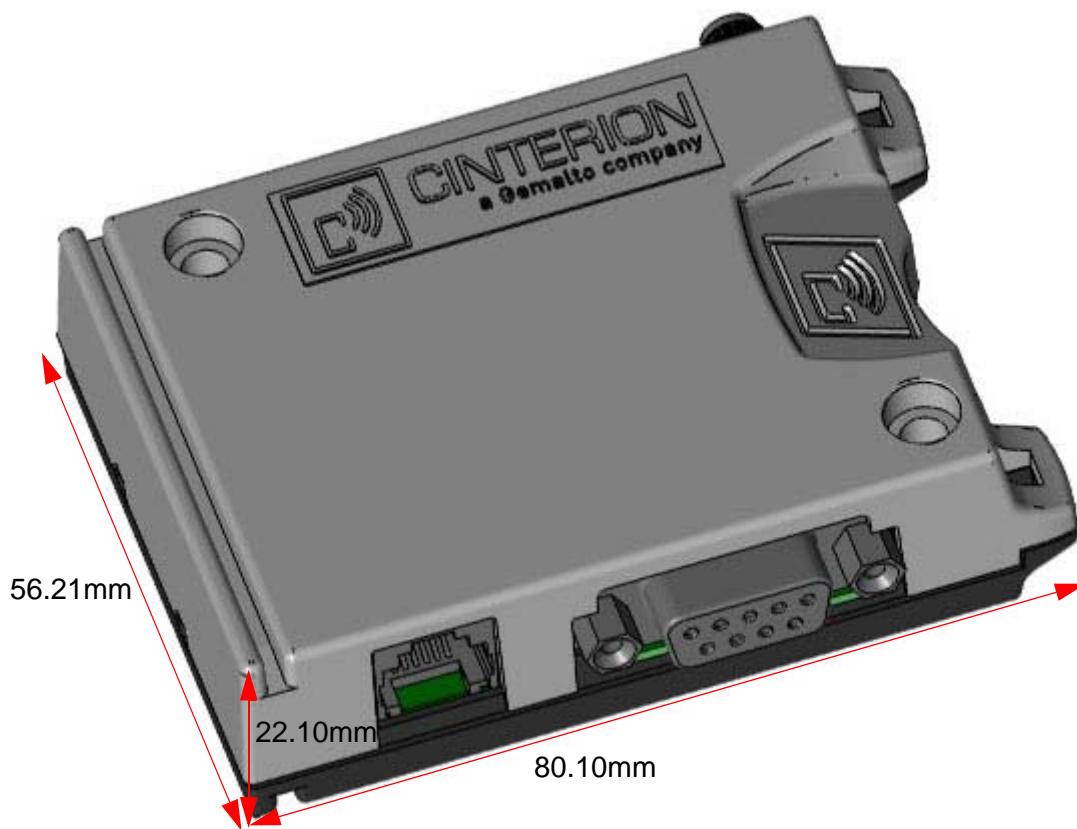
4. Typical value is at least -107dBm.

## 5 Mechanics, Mounting and Packaging

### 5.1 Mechanical Dimensions

[Figure 11](#) shows a 3D view of the BGS2T and provides an overview of the mechanical dimensions of the board. For further details see [Figure 12](#). To allow for an easier mechanical implementation into an external application a set of 3D STEP data for BGS2T RS232 is attached to this PDF. Please open the [Attachments](#) navigation panel to view and save these files.

Length: 80.10mm (including fixtures for cable straps)  
Width: 56.21mm (excluding antenna and serial interface connectors)  
Height: 22.10mm  
  
Weight: 65g



**Figure 11:** BGS2T 3D overview

# BGS2T Hardware Interface Description

## 5.1 Mechanical Dimensions

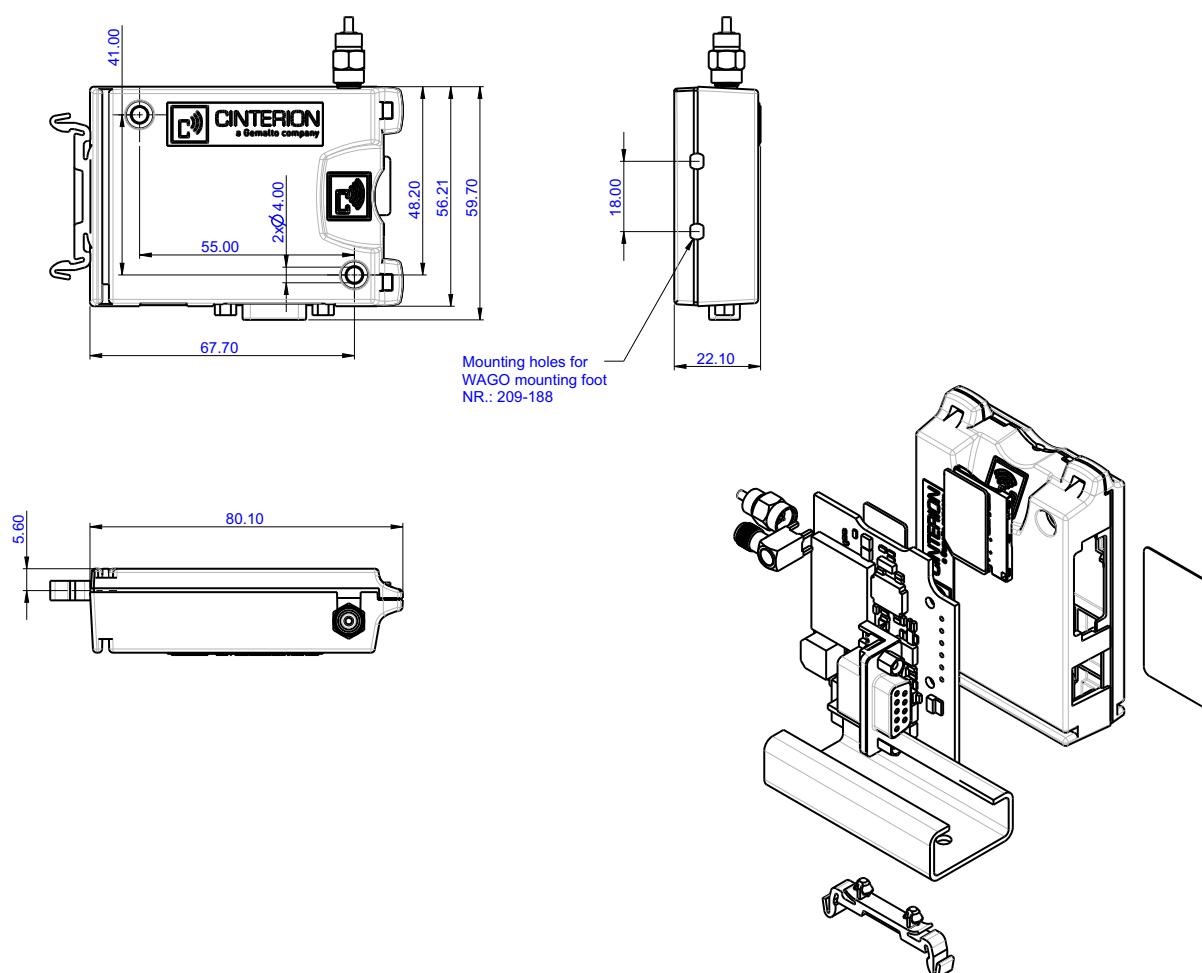


Figure 12: BGS2T mechanical dimensions

## 5.2 Mounting the BGS2T

There are a number of ways to mount the BGS2T:

- BGS2T can be attached to a rail installation or other surface using the two provided screw holes.
- BGS2T can be fastened to a rack or holding using the two provided fixtures for cable straps.
- BGS2T can be slid onto a specific DIN rail made according to DIN EN 60715 - C section, C30 format. A catch at the terminal's bottom side will have to be removed to slide multiple terminals onto a single rail.
- Using a Wago 209-188 mounting foot for terminal blocks the BGS2T can be fitted onto another special type of DIN rail made according to DIN EN 60715 - Top hat section, 35mm (e.g., Wago 210-113 steel carrier rail).

The following figure shows the various possibilities provided to mount the BGS2T.

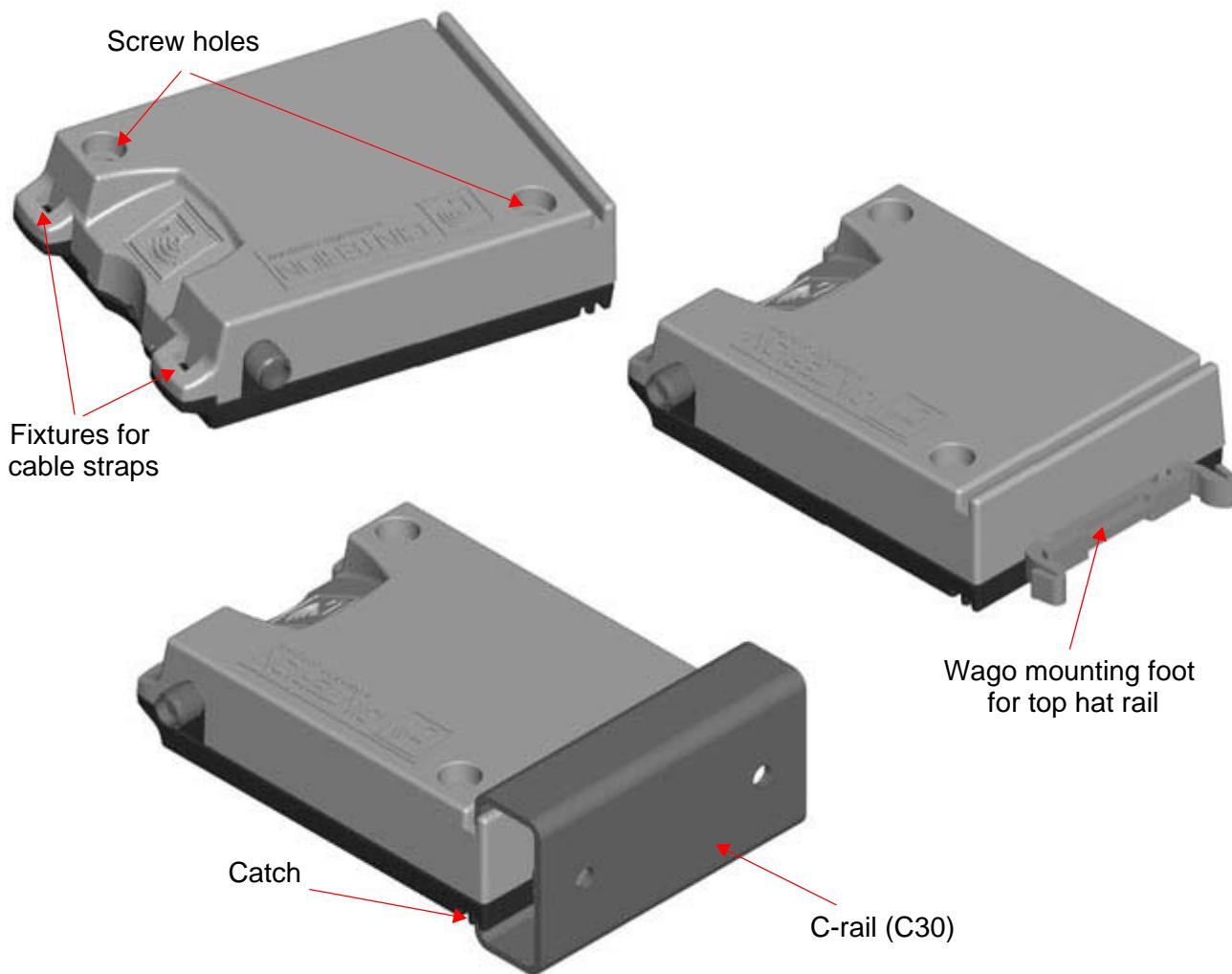


Figure 13: Mounting the BGS2T

The various ways to mount the BGS2T may be combined where appropriate. It is for example possible to slide the terminal onto a DIN rail and in addition use cable straps to fasten it to a holding.

## 5.3 Packaging

BGS2T comes in terminal boxes and is shipped in transportation cardboards:

- Terminal box size: 35mm x 83mm x 67mm.
- Transportation cardboard size: 363mm x 353mm x 205mm.

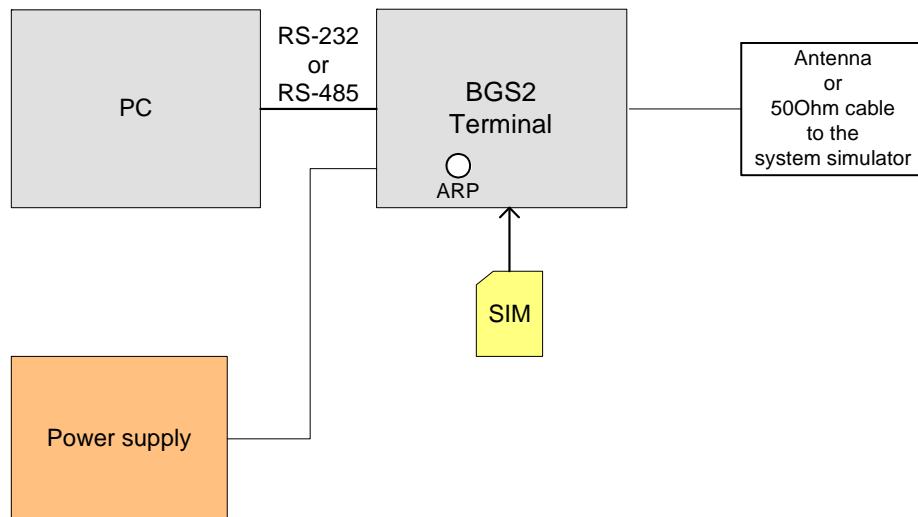
Each transportation cardboard contains 100 terminal boxes.

## 6 Full Type Approval

### 6.1 Cinterion Reference Setup

The Cinterion reference setup submitted to type approve BGS2T consists of the following components:

- BGS2T with approved GSM module (BGS2T RS232 or BGS2T RS485)
- PC as MMI
- Power Supply



**Figure 14:** Reference equipment for approval

For ordering information please refer to [Chapter 7](#).

## 6.2      **Restrictions**

Later enhancements and modifications beyond the certified configuration require extra approvals. Each supplementary approval process includes submittal of the technical documentation as well as testing of the changes made.

- No further approvals are required for customer applications that comply with the approved BGS2T configuration.
- Extra approval must be obtained for applications using other accessories than those included in the approved BGS2T configuration (power supply, MMI implementation supported by AT commands).

## 6.3      **CE Conformity**

The BGS2T meets the requirements of the EU directives listed below:

- R&TTE Directive 1999/5/EC

## 6.4      **EMC**

The BGS2T complies with the equipment requirements specified in EN 301489-1, -7 and is covered by the R&TTE Directive.

## 6.5 Compliance with FCC Rules and Regulations

As an integrated product, the BGS2T is fully compliant with the grant of the FCC Equipment Authorization issued for the built-in BGS2 module, and therefore, bears the label "Contains FCC ID QIPBGS2".

The Equipment Authorization Certification for the BGS2 module is listed under the following identifiers:

*FCC Identifier: QIPBGS2*

*Industry Canada Certification Number: 7830A-BGS2*

*Granted to Cinterion Wireless Modules GmbH*

### Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

**Note:** This terminal equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

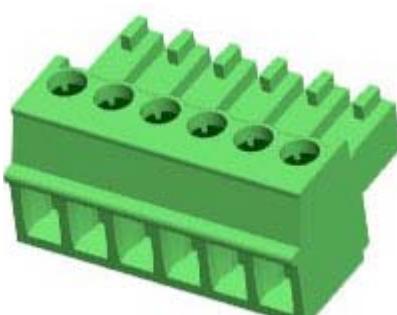
Changes or modifications made to this equipment not expressly approved by Cinterion may void the FCC authorization to operate this equipment.

This device contains GSM and GPRS Class10 functions in the 900 and 1800MHz Band which are not operational in U.S. Territories. This device is to be used only for mobile and fixed applications.

Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

## 7 List of Parts and Accessories

**Table 24:** List of parts and accessories

| Description   | Supplier                   | Ordering information  |
|---|----------------------------|---|
| BGS2T   | Cinterion                  | Ordering number<br>BGS2T RS232: L30960-N2700-A100<br>BGS2T RS485: L30960-N2710-A100   |
| Power supply unit   | Cinterion                  | Terminal Power Supply<br>Ordering number: L36880-N8490-A12<br><br>UK adapter for Terminal Power Supply<br>Ordering number: L36880-N8490-A13<br><br>US adapter for Terminal Power Supply<br>Ordering number: L36880-N8490-A14<br><br>AU adapter for Terminal Power Supply<br>Ordering number: L36880-N8490-A15                               |
| Mounting foot (209-188)<br>Top hat rail, i.e., 35mm DIN rail<br>(210-113)   | Wago                       | WAGO Kontakttechnik GmbH & Co. KG<br>Hansastra. 27<br>32423 Minden<br>Phone: +49-571-887-0<br>Fax: +49-571-887-169<br><br>Email: <a href="mailto:info@wago.com">info@wago.com</a><br>Web: <a href="http://www.wago.com/">http://www.wago.com/</a>   |
| Antenna - SMARTEQ-MiniMAG<br>Dualband, 0dBD, 2.6m RG174,<br>SMA (m)   | KÖBEL Mobile Communication | Ordering number: 1140.26 with crimped SMA connector<br>KÖBEL Mobile Communication<br>Sesamstrasse 12<br>D-24632 Lentföhrden   |
| RS-232 cable with 9-pin D-sub connector (male)  | Tecline                    | Ordering number: 300574<br>Tecline GmbH<br>Behrener Straße 8<br>D-66117 Saarbrücken<br>Phone: +49-681-926-78-70<br>Fax: +49-681-926-78-555<br>Web: <a href="http://www.tecline-edv.de/">http://www.tecline-edv.de/</a>  |
| 6-pin header connector (male) for RS-485 interface<br><br> | PHOENIX CONTACT            | Ordering number: 1803617<br>PHOENIX CONTACT<br>Deutschland GmbH<br>Flachsmarktstr. 8<br>D-32825 Blomberg<br><br>Phone: +49 52 35/3-1 20 00<br>Fax: +49 52 35/3-1 29 99<br><br>Email: <a href="mailto:iinfo@phoenixcontact.de">iinfo@phoenixcontact.de</a><br>Web: <a href="http://www.phoenixcontact.com">http://www.phoenixcontact.com</a> |