

Cinterion[®] Java Terminals

Hardware Interface Overview

Version: 03
DocId: EHSxT_BGS5T_HIO_v03



Document Name: **Cinterion® Java Terminals Hardware Interface Overview**

Version: **03**

Date: **2016-05-26**

DocId: **EHSxT_BGS5T_HIO_v03**

Status **Confidential / Released**

GENERAL NOTE

THE USE OF THE PRODUCT INCLUDING THE SOFTWARE AND DOCUMENTATION (THE "PRODUCT") IS SUBJECT TO THE RELEASE NOTE PROVIDED TOGETHER WITH PRODUCT. IN ANY EVENT THE PROVISIONS OF THE RELEASE NOTE SHALL PREVAIL. THIS DOCUMENT CONTAINS INFORMATION ON GEMALTO M2M PRODUCTS. THE SPECIFICATIONS IN THIS DOCUMENT ARE SUBJECT TO CHANGE AT GEMALTO M2M'S DISCRETION. GEMALTO M2M GMBH GRANTS A NON-EXCLUSIVE RIGHT TO USE THE PRODUCT. THE RECIPIENT SHALL NOT TRANSFER, COPY, MODIFY, TRANSLATE, REVERSE ENGINEER, CREATE DERIVATIVE WORKS; DISASSEMBLE OR DECOMPILE THE PRODUCT OR OTHERWISE USE THE PRODUCT EXCEPT AS SPECIFICALLY AUTHORIZED. THE PRODUCT AND THIS DOCUMENT ARE PROVIDED ON AN "AS IS" BASIS ONLY AND MAY CONTAIN DEFICIENCIES OR INADEQUACIES. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, GEMALTO M2M GMBH DISCLAIMS ALL WARRANTIES AND LIABILITIES. THE RECIPIENT UNDERTAKES FOR AN UNLIMITED PERIOD OF TIME TO OBSERVE SECRECY REGARDING ANY INFORMATION AND DATA PROVIDED TO HIM IN THE CONTEXT OF THE DELIVERY OF THE PRODUCT. THIS GENERAL NOTE SHALL BE GOVERNED AND CONSTRUED ACCORDING TO GERMAN LAW.

Copyright

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

Copyright © 2016, Gemalto M2M GmbH, a Gemalto Company

Trademark Notice

Gemalto, the Gemalto logo, are trademarks and service marks of Gemalto and are registered in certain countries. Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. All other registered trademarks or trademarks mentioned in this document are property of their respective owners.

Contents

0	Document History	7
1	Introduction	8
1.1	Related Documents	9
1.2	Terms and Abbreviations	9
1.3	Regulatory and Type Approval Information	11
1.3.1	Directives and Standards	11
1.3.2	Safety Precautions	14
1.4	Product Label	16
2	Product Concept	17
2.1	Key Features at a Glance	17
3	Interface Description	20
3.1	Overview	20
3.2	Block Diagram	21
3.3	Operating Modes	22
3.4	RS-232 Interface	23
3.4.1	9-Pole D-sub Connector	23
3.5	USB Interface	24
3.6	GPIO Interface	24
3.6.1	Serial Interface ASC1	27
3.6.2	Digital Audio Interface	28
3.6.3	I ² C Interface	29
3.6.4	SPI Interface	30
3.6.5	PWM Interface	31
3.6.6	Pulse Counter	31
3.6.7	Analog-to-Digital Converter (ADC)	31
3.6.8	DSR0 signal	31
3.7	Ethernet Interface	32
3.8	Power Supply	33
3.9	Power Up/Power Down Scenarios	34
3.9.1	Turn Java Terminals on	34
3.9.2	Reset/Restart Java Terminals	34
3.9.3	Turn Java Terminals off	35
3.9.4	Disconnecting power supply	35
3.10	Automatic thermal shutdown	36
3.11	Hardware Watchdog	36
3.12	RTC	36
3.13	SIM Interface	37
3.14	Status LEDs	38
3.15	RF Antenna Interface	39

4	Mechanics, Mounting and Packaging	40
4.1	Mechanical Dimensions	40
4.2	Mounting the Java Terminals	43
4.3	Packaging	44
5	Full Type Approval	45
5.1	Gemalto M2M Reference Setup	45
5.2	Restrictions	46
5.3	CE Conformity	46
5.4	EMC	46
5.5	Compliance with FCC and IC Rules and Regulations	47
6	List of Parts and Accessories	49

Tables

Table 1: Cinterion® Java Terminals overview 8

Table 2: Terms and abbreviations..... 9

Table 3: Directives 11

Table 4: Standards of North American type approval 11

Table 5: Standards of European type approval..... 11

Table 6: Requirements of quality 12

Table 7: Standards of the Ministry of Information Industry of the
People’s Republic of China 13

Table 8: Toxic or hazardous substances or elements with defined concentration
limits 13

Table 9: Java Terminals label information 16

Table 10: Java Terminals’ interfaces 20

Table 11: Overview of operating modes 22

Table 12: 9-pole D-sub (female) RS-232 23

Table 13: GPIO connector pin availability and alternate pin functionalities 26

Table 14: Overview of DAI/PCM signals 28

Table 15: Female 8-pole RJ-45 Ethernet connector 32

Table 16: Female 6-pole Western plug for power supply, ignition, power down..... 33

Table 17: Allowed maximum antenna gain (including cable loss)..... 39

Table 18: List of parts and accessories..... 49

Figures

- Figure 1: Sample Java Terminal label (BGS5T USB) 16
- Figure 2: Java Terminals 3D view 20
- Figure 3: Block diagram 21
- Figure 4: Pin assignment RS-232 (D-sub 9-pole female)..... 23
- Figure 5: EHS5T RS485: GPIO connectors (8-pin and 12-pin)..... 24
- Figure 6: EHS6T USB/EHS6T LAN: GPIO connectors (8-pin and 12-pin)..... 25
- Figure 7: BGS5T USB: GPIO connectors (8-pin and 12-pin) 25
- Figure 8: Long frame PCM timing, 256kHz 28
- Figure 9: Characteristics of SPI modes..... 30
- Figure 10: 8-pole RJ-45 Ethernet connector (female) 32
- Figure 11: 6-pole Western jack for power supply, ignition, reset, typical connection 33
- Figure 12: SIM interface 37
- Figure 13: Status LED 38
- Figure 14: Antenna connector 39
- Figure 15: Java Terminals 3D overview 40
- Figure 16: Java Terminals mechanical dimensions 41
- Figure 17: Java Terminals exploded view 42
- Figure 18: Mounting the Java Terminals 43
- Figure 19: Reference equipment for approval 45

0 Document History

Preceding document: "Cinterion® Java Terminals Hardware Interface Overview" Version 02

New document: "Cinterion® Java Terminals Hardware Interface Overview" Version 03

Chapter	What is new
1.4	Revised Table 9 .
3.7	Added support for Power-over-Ethernet (PoE).

Preceding document: "Cinterion® Java Terminals Hardware Interface Overview" Version 01

New document: "Cinterion® Java Terminals Hardware Interface Overview" Version 02

Chapter	What is new
Throughout document	Added EHS5T-US RS485 as new product.

New document: "Cinterion® Java Terminals Hardware Interface Overview" Version 01

Chapter	What is new
--	Initial document setup.

1 Introduction

This document¹ describes the hardware of the Cinterion® Java Terminals. The Java Terminals come in five variants depending on the included Cinterion® module and the available interfaces:

- **EHS5T RS485** contains a Cinterion® EHS5-E module and implements a USB 2.0 interface with a USB-B connector as well as a 6-pole Western jack as plug-in power supply connector. Via a GPIO interface it also implements a RS-485 interface including power supply and ignition line.
- **EHS5T-US RS485** is identical to EHS5T RS485, but contains a Cinterion® EHS5-US module instead of a Cinterion® EHS5-E module. Note: Unless otherwise mentioned EHS5T RS485 refers to both product variants.
- **EHS6T USB** contains a Cinterion® EHS6 module and implements a USB 2.0 interface with a USB-B connector and also a V.24 / V.28 RS-232 interface with a D-sub 9-pole female socket as well as a 6-pole Western jack as plug-in power supply connector.
- **EHS6T LAN** contains a Cinterion® EHS6 module and implements an Ethernet interface with a RJ-45 8-pin connector and also a V.24 / V.28 RS-232 interface with a D-sub 9-pole female socket as well as a 6-pole Western jack as plug-in power supply connector.
- **BGS5T USB** contains a Cinterion® BGS5 module and implements a USB 2.0 interface with a USB-B connector and also a V.24 / V.28 RS-232 interface with a D-sub 9-pole female socket as well as a 6-pole Western jack as plug-in power supply connector.

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

[Table 1](#) gives a short overview of the available interfaces for the different Java Terminals.

Table 1: Cinterion® Java Terminals overview

Module/Interface	EHS5T RS485 and EHS5T-US RS485	EHS6T USB	EHS6T LAN	BGS5T USB
Cinterion® module	EHS5-E or EHS5-US	EHS6	EHS6	BGS5
RS-232 (Sub-D)	-	✓	✓	✓
USB (USB-B)	✓	✓	-	✓
GPIO interface (GPIOs, Power, ASC1, DAI, SPI, I ² C, RS-485)	✓ (no SPI)	✓ (no RS-485)	✓ (no RS-485)	✓ (no RS-485, no SPI)
Ethernet (RJ-45)	-	-	✓	-
Power supply (RJ-11)	✓	✓	✓	✓
RF antenna	✓	✓	✓	✓

The scope of this document includes interface specifications, electrical as well as mechanical characteristics of the Java Terminals. It specifies standards pertaining to wireless applications and outlines requirements that must be adhered to for successful product design. The Java Terminals are compact GSM/UMTS modems for the transfer of data in GSM/UMTS networks. Industrial standard interfaces and an integrated SIM card reader allow using the Java Terminals easily as GSM/GPRS/UMTS terminals.

1. The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Gemalto M2M product.

1.1 Related Documents

- [1] AT Command Set for your Java Terminal product
- [2] Release Notes for your Java Terminal product

To visit the Gemalto M2M GmbH Website please use the following link:

<http://m2m.gemalto.com>

1.2 Terms and Abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
ARP	Antenna Reference Point
ATC	AT Command
BTS	Base Transceiver Station
CB	Cell Broadcast
CODEC	Coder-Decoder
DAI	Digital Audio Interface
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
kbits	kbits per second

1.2 Terms and Abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
LVD	Low voltage Directive
Mbps	Mbits per second
MCU	Microprocessor Control Unit
MMI	Machine Machine Interface
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NC	Not Connected
NTC	Negative Temperature Coefficient
PA	Power Amplifier
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCS	Personal Communication System
PD	Power Down
PDU	Protocol Data Unit
PoE	Power over Ethernet
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 Regulatory and Type Approval Information

1.3.1 Directives and Standards

Java Terminals have been designed to comply with the directives and standards listed below¹.

Table 3: 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). The product is labeled with the CE conformity mark - see Section 5.3.
2002/95/EC (RoHS 1) 2011/65/EC (RoHS 2)	Directive of the European Parliament and of the Council of 27 January 2003 (and revised on 8 June 2011) on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 
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 4: 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
OET Bulletin 65 (Edition 97-01)	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
UL 60 950-1	Product Safety Certification (Safety requirements)
NAPRD.03 V5.15	"Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control" PCS Type Certification Review board (PTCRB)
RSS102 (Issue 4) RSS132 (Issue 3) RSS133 (Issue 6)	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 5: 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) 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) (GSM 13.11 version 7.0.1 Release 1998)
GCF-CC V3.49	Global Certification Forum - Certification Criteria

1. Standards of North American type approval do not apply to EHS5T RS485, 3G/WCDMA related standards do not apply to BGS5T USB.

1.3 Regulatory and Type Approval Information

Table 5: Standards of European type approval

ETSI EN 301 489-1 V1.9.2	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 1: Common Technical Requirements
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)
ETSI EN 301 489-24 V1.5.1	Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
ETSI EN 301 908-01 V5.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 1: Harmonized EN for IMT-2000, introduction and common requirements of article 3.2 of the R&TTE Directive
ETSI EN 301 908-02 V5.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
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)+ A11:2009+A1:2010+ AC:2011+A12:2011	Safety of information technology equipment

Table 6: Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes

1.3 Regulatory and Type Approval Information

Table 7: 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 Table 1.3.2 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 8: Toxic or hazardous substances or elements with defined concentration limits

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

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 Java Terminals. 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. Gemalto M2M 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>

1.3 Regulatory and Type Approval Information

	<p>IMPORTANT! 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. Some networks require a valid SIM card to be properly inserted in the cellular terminal or mobile.</p>
	<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.</p>
	<p>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.</p>

1.4 Product Label

1.4 Product Label

The label fixed to the bottom of a Java Terminal comprises the following information.

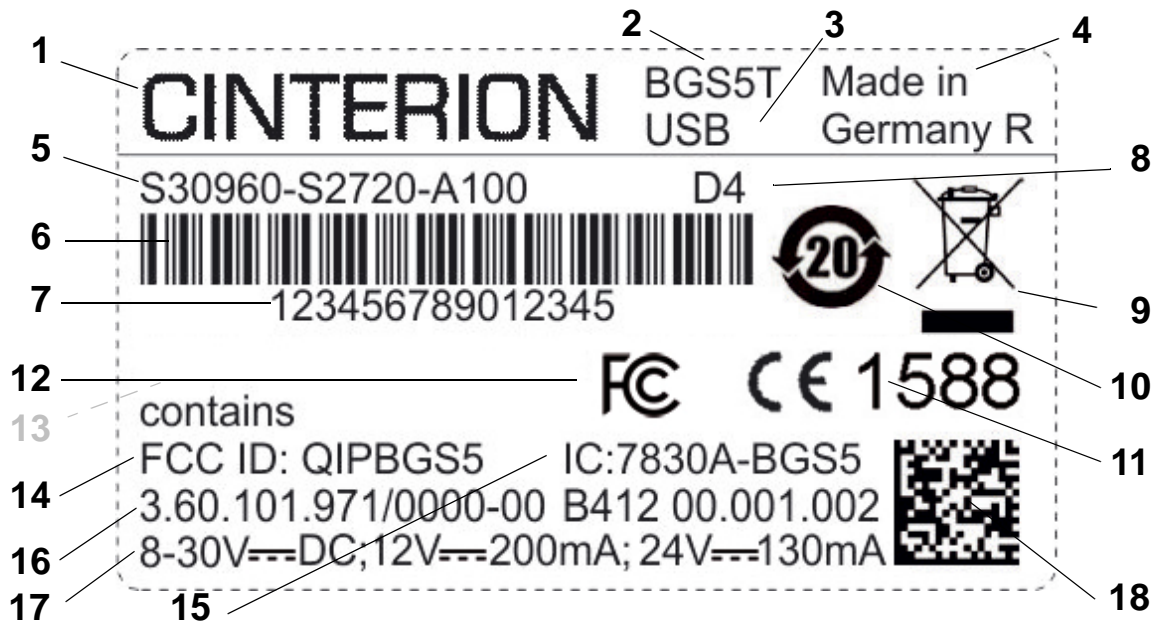


Figure 1: Sample Java Terminal label (BGS5T USB)

Table 9: Java Terminals label information

No.	Information
1	Cinterion logo
2	Product name
3	Product variant
4	Marking "Made in Germany"
5	Product ordering number
6	Bar code (Code128)
7	Product IMEI
8	Date code
9	WEEE symbol (see Table 3)
10	Chinese RoHS symbol (see Table 7)
11	CE logo with fixed notified body number. May be replaced for samples with "Not for sale" (see also Section 5.3)
12	FCC Declaration of Conformity (DoC) logo (BGS5T USB, EHS6T LAN only; with EHS6T LAN, a smaller FCC logo is placed between bar code and Chinese RoHS symbol)
13	FCC ID for Java Terminal (EHS5T-US RS485, EHS6T USB), or FCC and IC ID (EHS6T LAN)
14	FCC ID for Java module contained in Java Terminal (BGS5T USB, EHS5T-US RS485 and EHS6T USB/LAN only)
15	IC ID for Java module contained in Java Terminal (BGS5T USB, EHS6T USB/LAN only)
16	Manufacturer code
17	Power supply unit ratings
18	Manufacturer code (2D)

2 Product Concept

2.1 Key Features at a Glance

Feature	Implementation
General	
Incorporates Cinterion® Java module	The Java module handles all signal and data processing within the Java Terminals. Internal software runs the application interface and the complete GSM/UMTS protocol stack.
Frequency bands	<p>EHS5T RS485 (with EHS5-E module): GSM/GPRS/EDGE: Dual band GSM 900/1800MHz UMTS/HSPA+: Dual band UMTS 900/2100MHz</p> <p>EHS5T-US RS485 (with EHS5-US module): GSM/GPRS/EDGE: Dual band GSM 850/1900MHz UMTS/HSPA+: Dual band UMTS 850/1900MHz</p> <p>EHS6T USB (with EHS6 module): GSM/GPRS/EDGE: Quad band 850/900/1800/1900MHz UMTS/HSPA+: Five band 800/850/900/1900/2100MHz</p> <p>EHS6T LAN (with EHS6 module): GSM/GPRS/EDGE: Quad band 850/900/1800/1900MHz UMTS/HSPA+: Five band 800/850/900/1900/2100MHz</p> <p>BGS5T USB (with BGS5 module): GSM/GPRS: Quad band 850/900/1800/1900MHz</p>
GSM class	Small MS
Output power (according to Release 99, V5) depending on frequency band supported by module	<p>Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900 Class E2 (+27dBm ± 3dB) for GSM 850 8-PSK Class E2 (+27dBm ± 3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1900 8-PSK Class 3 (+24dBm +1/-3dB) for UMTS 2100, WCDMA FDD BdI Class 3 (+24dBm +1/-3dB) for UMTS 1900, WCDMA FDD BdII Class 3 (+24dBm +1/-3dB) for UMTS 900, WCDMA FDD BdVIII Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV Class 3 (+24dBm +1/-3dB) for UMTS 800, WCDMA FDD BdVI</p> <p>The values stated above are maximum limits. According to Release 99, the maximum output power in a multislot 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 (Java module board temperature)	<p>Normal operation: -30°C to +85°C Extended operation: -40°C to -30°C and +85°C to +90°C</p>
Physical	<p>Dimensions: 113.5mm x 75mm x 25.5mm (excluding antenna and serial interface connectors) Weight: 120g (approx.)</p>

2.1 Key Features at a Glance

Feature	Implementation
RoHS, WEEE	All hardware components are fully compliant with the EU RoHS and WEEE Directives
HSPA features	
3GPP Release 6,7 (EHSxT only)	DL 7.2Mbps, UL 5.7Mbps HSDPA Cat.8 / HSUPA Cat.6 data rates Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
3GPP Release 4 (EHSxT only)	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL
GSM / GPRS / EDGE features	
Data transfer	<p>GPRS:</p> <ul style="list-style-type: none"> • Multislot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 <p>EGPRS (EHSxT only):</p> <ul style="list-style-type: none"> • Multislot Class 12 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B <p>CSD:</p> <ul style="list-style-type: none"> • V.110, RLP, non-transparent • 2.4, 4.8, 9.6, 14.4kbps • USSD
SMS	<ul style="list-style-type: none"> • Point-to-point MT and MO • Cell broadcast • Text and PDU mode
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Gemalto M2M
Java™ Open Platform	<p>Java™ Open Platform with</p> <ul style="list-style-type: none"> • Java™ profile IMP-NG & CLDC 1.1 HI • Secure data transmission via HTTPS/SSL • Multi-threading programming and multi-application execution <p>Major benefits: seamless integration into Java applications, ease of programming, no need for application micro-controller, extremely cost-efficient hardware and software design – ideal platform for industrial GSM applications.</p> <p>The memory space available for Java programs is around 10MB in the flash file system and around 10MB RAM. Application code and data share the space in the flash file system and in RAM.</p>

2.1 Key Features at a Glance

Feature	Implementation
SIM Application Toolkit	SAT Release 99
TCP/IP stack	Protocols: TCP server/client, UDP, HTTP, FTP, SMTP, POP3 Access by AT commands
Firmware update	Upgradeable via serial ASC0 (RS-232 or RS-485) or USB interface
Interfaces	
USB interfaces	USB 2.0 Slave interface
RS232	RS-232 interface for AT commands and data: <ul style="list-style-type: none"> • Supports RTS/CTS hardware handshake • Supports software XON/XOFF flow control • Multiplex ability according to GSM 07.10 Multiplexer protocol • Baud rates from 1200bps to 230400bps • Autobauding supported
GPIO connector	20-pin (8-pin and 12-pin) header with GPIO interface, external power supply, serial interface ASC1, ADC, DAI/PCM, SPI, I ² C and RS-485 option, depending on variant
Ethernet	8-pole RJ-45 Ethernet connector Support for Power over Ethernet (PoE)
Power connector	6-pole Western connector (female) for power supply, ignition, power down signal
SIM card reader	Supported SIM cards: 3V, 1.8V
Antenna	Antenna connected via female SMA connector
Power on/off, Reset	
Power on	DTR line at RS-232 interface, IGT_IN line at power connector or watchdog
Power off	Normal switch-off by AT^SMSO Automatic switch-off in case of critical temperature conditions
Reset	Orderly shutdown and reset by AT command Emergency restart via RST_IN line at power connector or via watchdog
Special features	
Real time clock	Timer functions via AT commands
Phonebook	SIM card and terminal
(Hardware) Watchdog	Configurable watchdog to control module

3 Interface Description

3.1 Overview

Java Terminals provide the following interfaces for power supply, antenna, SIM card and data transfer:

Table 10: Java Terminals' interfaces

No.	Description
1	6-pin Western connector (female) for power supply, ignition, power down signal
2	8-pin (female) RJ-45 Ethernet connector
3	9-pin (female) D-sub connector (RS-232 interface)
4	SMA connector (female) for GPS antennas (for future use, currently not available)
5	SIM card reader
6	SMA connector (female) for RF antenna
7	SMA connector (female) for Rx diversity antenna (for future use, currently not available)
8	12-pin and 8-pin GPIO connectors (male) (including RS-485)
9	4-pin (female) USB-B connector

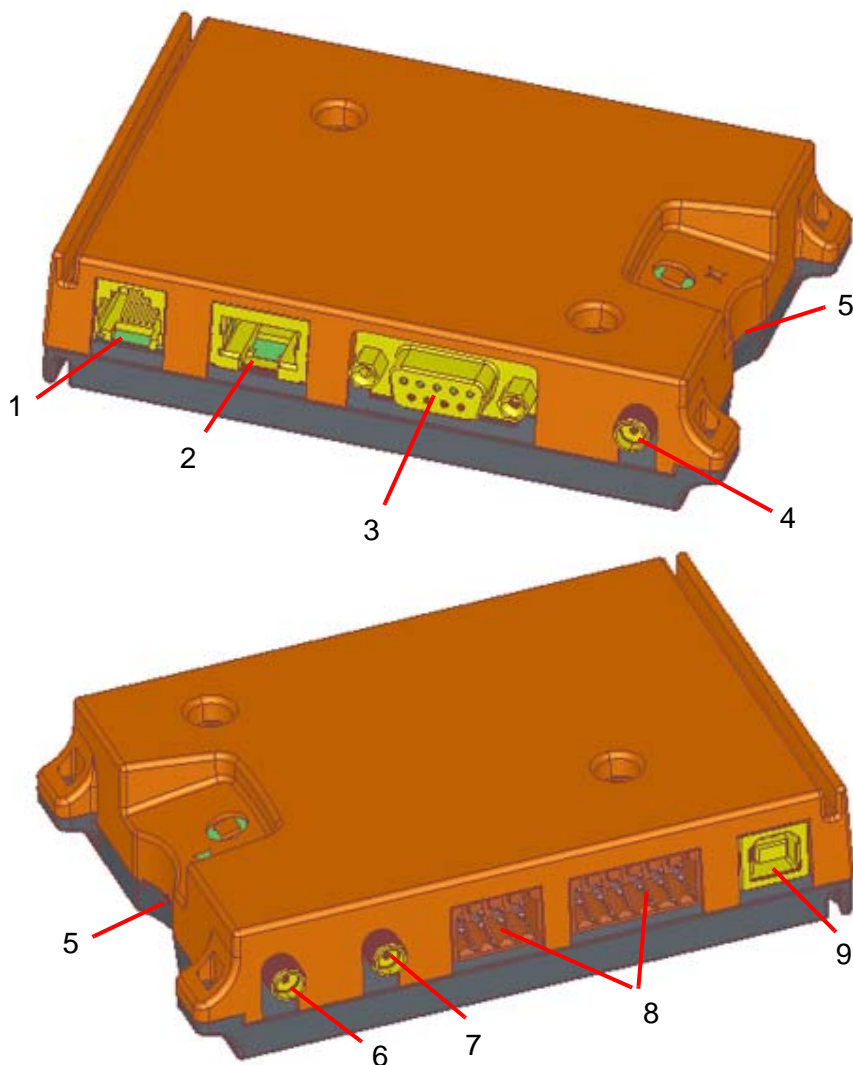


Figure 2: Java Terminals 3D view

3.2 Block Diagram

3.2 Block Diagram

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

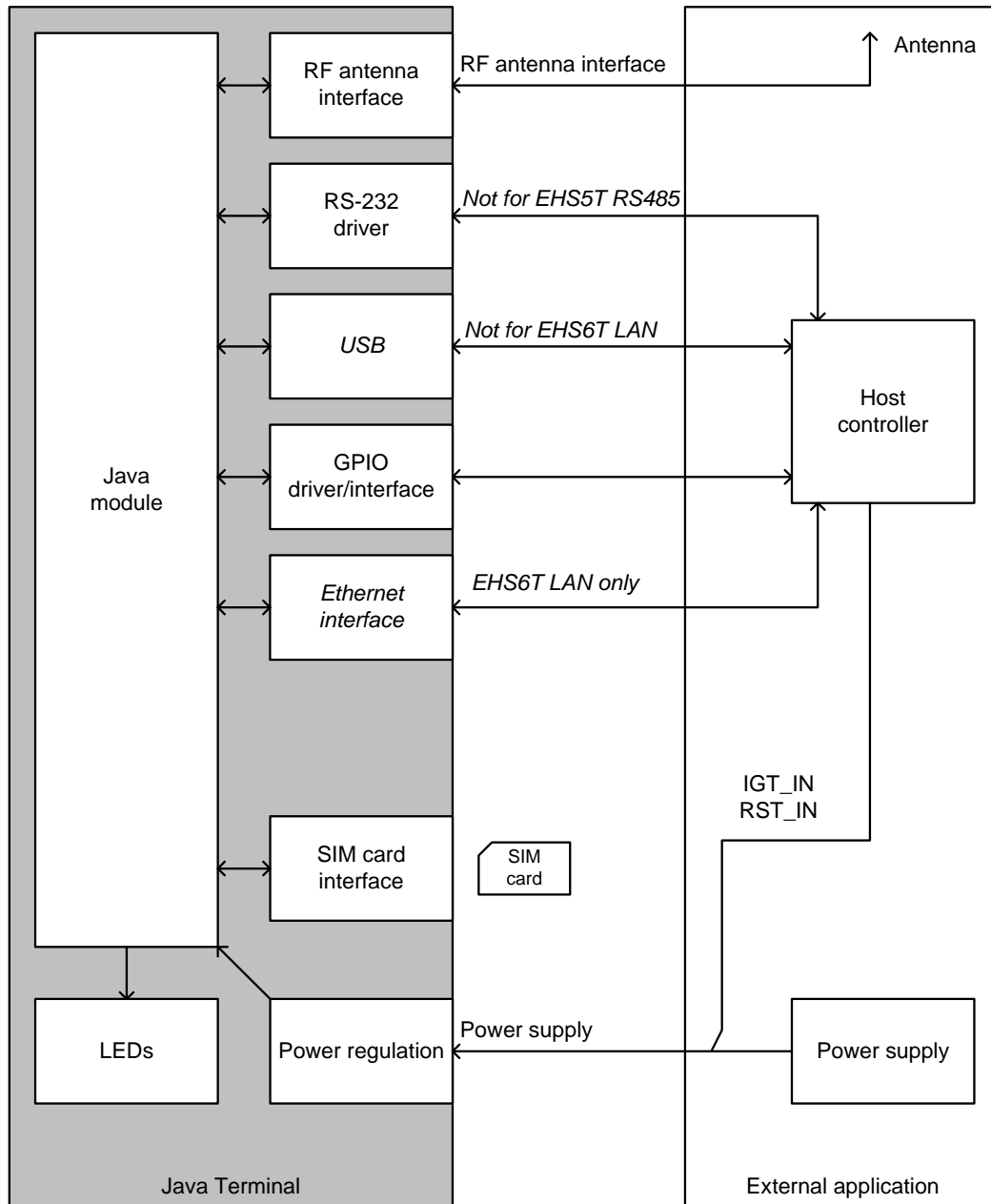


Figure 3: Block diagram

3.3 Operating Modes

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

Table 11: 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. Watchdog active.
	GSM TALK GSM DATA	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. Watchdog active.
	GPRS/UMTS/HSPA 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). Watchdog active.
	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. Watchdog active.
	EGPRS DATA (EHSxT only)	EGPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates, EGPRS configuration (e.g. used multislot settings) and reduction of maximum output power. Watchdog active.
	UMTS TALK UMTS DATA (EHSxT only)	UMTS data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate. Watchdog active.
	HSPA DATA (EHSxT only)	HSPA data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate. Watchdog active.
Power Down	Normal shutdown after sending the AT^SMSO command. The RTC works continuously, but the software is not active. Interfaces are not accessible. Watchdog continues to operate, depending on its configuration.	

3.4 RS-232 Interface

The RS-232 interface is not available for EHS5T RS485. The 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 921kbps. Autobauding supports bit rates from 1.2kbps to 230kbps.

For more information see also [Section 3.4.1](#).

3.4.1 9-Pole D-sub Connector

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

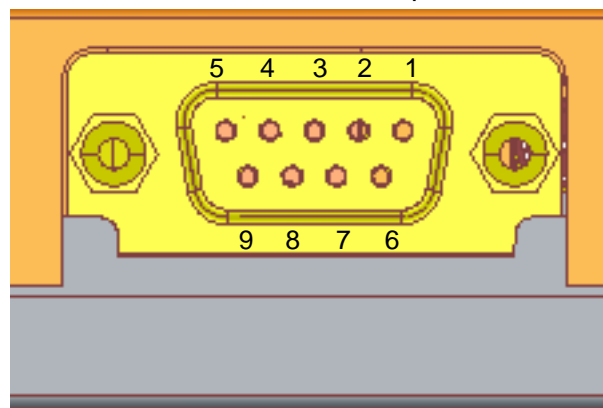


Figure 4: Pin assignment RS-232 (D-sub 9-pole female)

Table 12: 9-pole D-sub (female) RS-232

Pin no.	Signal name	I/O	Function
1	DCD0	O	Data Carrier Detected
2	RXD0	O	Receive Data
3	TXD0	I	Transmit Data
4	DTR0	I	Data Terminal Ready Attention: The ignition of Java Terminals is activated via a rising edge of high potential (+3 ... +15 V)
5	GND	-	Ground
6	DSR0 ¹	O	Data Set Ready
7	RTS0	I	Request To Send
8	CTS0	O	Clear To Send
9	RING0	O	Ring Indication

1. Note that DSR0 may also be available via GPIO connector pin - see [Section 3.6](#).

Java Terminals are 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 TxD @ application sends data to TXD0 of the Java Terminals
- Port RxD @ application receives data from RXD0 of the Java Terminals

Hardware handshake using the RTS0 and CTS0 signals and XON/XOFF software flow control are supported.

3.5 USB Interface

In addition, the modem control signals DTR0, DSR0, DCD0 and RING0 are available. The modem control signal RING0 (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 DTR0 signal will only be polled once per second from the internal firmware of Java Terminals.

3.5 USB Interface

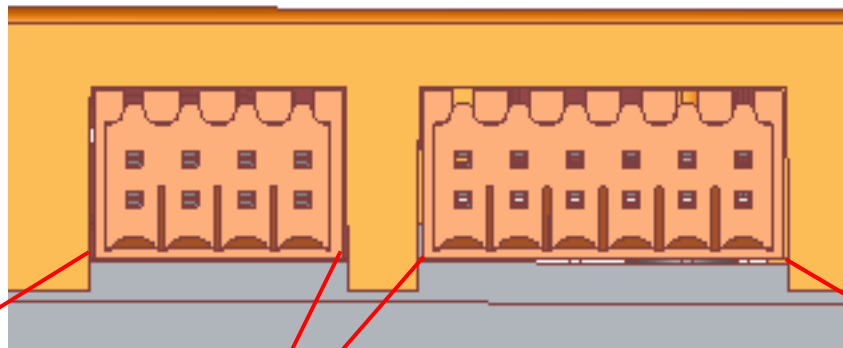
The USB interface is not available for EHS6T LAN. The other Java Terminals support a USB 2.0 High Speed (480Mbit/s) device interface that is Full Speed (12Mbit/s) compliant.

The USB interface can be used as command and data interface and for downloading Java module firmware. It is only available as a slave device and not able to act as a USB host.

3.6 GPIO Interface

The GPIO connectors (8-pin and 12-pin) provide access to various module signals including a number of configurable GPIOs. Note that not all of the pins are available for every Java Terminal variant. The following figures show the available pins for the Java Terminal variants and the below [Table 13](#) lists the overall availability of the pins.

**EHS5T
RS485:**



1	2	3	4
GPIO6	GPIO7	GPIO8	n/a
5	6	7	8
n/a	n/a	GPIO22	GPIO23

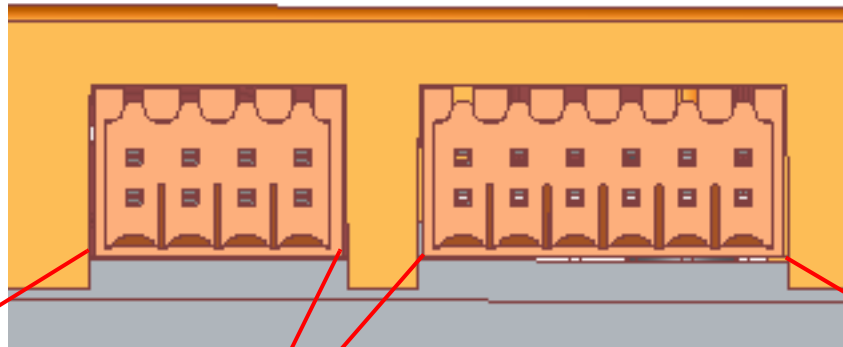
1	2	3	4	5	6
VCCref	GND	TXD1	RXD1	A+ (RS-485)	B- (RS-485)
7	8	9	10	11	12
+5Vout	DSR0/ADC1_IN	I2CDAT	I2CCLK	GPIO20	GPIO21

n/a: not applicable

Figure 5: EHS5T RS485: GPIO connectors (8-pin and 12-pin)

3.6 GPIO Interface

**EHS6T
USB/LAN:**



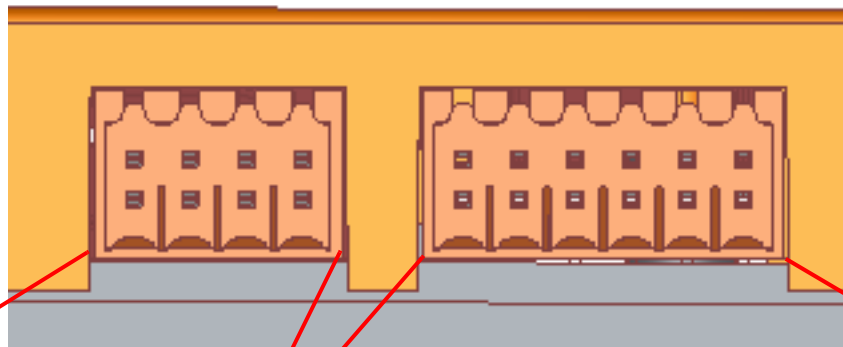
1	2	3	4
GPIO6	GPIO7	GPIO8	GPIO11
5	6	7	8
GPIO12	GPIO13	GPIO22	GPIO23

1	2	3	4	5	6
VCCref	GND	TXD1/ SPI_MISO	RXD1/ SPI_MOSI	CTS1 (RS232)/ SPI_CS	RTS1 (RS232/
7	8	9	10	11	12
+5Vout	DSR0/ ADC1_IN/ SPI_CLK	I2CDAT	I2CCLK	GPIO20	GPIO21

n/a: not applicable

Figure 6: EHS6T USB/EHS6T LAN: GPIO connectors (8-pin and 12-pin)

**BGS5T
USB:**



1	2	3	4
GPIO6	GPIO7	GPIO8	n/a
5	6	7	8
n/a	n/a	GPIO22	GPIO23

1	2	3	4	5	6
VCCref	GND	TXD1	RXD1	CTS1 (RS232)/	RTS1 (RS232/
7	8	9	10	11	12
+5Vout	DSR0/ ADC1_IN	I2CDAT	I2CCLK	GPIO20	GPIO21

n/a: not applicable

Figure 7: BGS5T USB: GPIO connectors (8-pin and 12-pin)

3.6 GPIO Interface

The following [Table 13](#) shows the availability of the GPIO connector pins for various Java Terminal variants.

Table 13: GPIO connector pin availability and alternate pin functionalities

PIN	Signal	Comment	EHS5T RS485	EHS6T USB	EHS6T LAN	BGS5T USB
8-pin connector						
1	GPIO6	Configurable via AT command, also as PWM2 signal	✓	✓	✓	✓
2	GPIO7	Configurable via AT command, also as PWM1 signal	✓	✓	✓	✓
3	GPIO8	Configurable via AT command, also as COUNTER signal	✓	✓	✓	✓
4	GPIO11	Configurable via AT command	-	✓	✓	-
5	GPIO12	Configurable via AT command	-	✓	✓	-
6	GPIO13	Configurable via AT command	-	✓	✓	-
7	GPIO22	Configurable via AT command also as TFSDAI	✓	✓	✓	✓
8	GPIO23	Configurable via AT command also as SCLK	✓	✓	✓	✓
12-pin connector						
1	VCCref	Input supply for level adjustment. E.g., connect +5Vout for 5V IO operation	✓	✓	✓	✓
2	GND		✓	✓	✓	✓
3	TXD1 or SPI_MISO	Configurable via AT command, also as SPI_MISO signal	TXD1	TXD1 / SPI_MISO	TXD1 / SPI_MISO	TXD1
4	RXD1 or SPI_MOSI	Configurable via AT command, also as SPI_MOSI signal	RXD1	RXD1 / SPI_MOSI	RXD1 / SPI_MOSI	RXD1
5	CTS1 or SPI_CS or A+	CTS1 (RS-232) or SPI_CS or A+ (for RS-485) depending on product variant	A+ (RS-485)	CTS1 / SPI_CS	CTS1 / SPI_CS	CTS1
6	RTS1 or B-	RTS1 (RS-232) or B- (for RS-485) depending on product variant	B- (RS-485)	RTS1	RTS1	RTS1
7	+5Vout	External power supply up to 100mA, usable as VCCref input	✓	✓	✓	✓
8	DSR0 or ADC1_IN or SPI_CLK	Configurable via AT command	DSR0 / ADC1_IN	✓	✓	DSR0 / ADC1_IN
9	I2CDAT	I ² C interface	✓	✓	✓	✓
10	I2CCLK	I ² C interface	✓	✓	✓	✓
11	GPIO20	Configurable via AT command also as TXDDAI	✓	✓	✓	✓
12	GPIO21	Configurable via AT command also as RXDDAI	✓	✓	✓	✓

Please refer to the respective “AT Command Set” for details on how to configure the GPIO pins using AT commands.

EHS5T's 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 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.

Note: If employing EHS5T's RS-485 interface be sure not to switch off the EHS5 module, e.g., by calling AT^SMSO, to put the module into Power Down mode. This completely occupies and therefore blocks the RS-485 bus, and may thus lead to a higher current consumption.

Also, be sure not to activate SLEEP mode, e.g., by setting AT^SPOW with <mode>=2, for the EHS5 module, as the module may no longer be able to wake up from SLEEP mode, and will then have to be reset.

3.6.1 Serial Interface ASC1

With EHS5T and EHS6T Java Terminals two respectively four pins at the GPIO connector can be configured as ASC1 interface signals to provide a 2- or 4-wire serial modem interface ASC1.

The following pins at the GPIO connector can be configured as ASC1 interface signals: RXD1, TXD1, RTS1 and CTS1 (see also [Table 13](#)). The configuration is done by AT command AT^SCFG - see [\[1\]](#). It is non-volatile and becomes active after a Java Terminal restart.

Java Terminals are designed for use as a DCE. Based on the conventions for DCE-DTE connections they communicate with the customer application (DTE) using the following signals:

- Port TXD @ application sends data to Java Terminal's TXD1 signal line
- Port RXD @ application receives data from the Java Terminal's RXD1 signal line

Hardware handshake using the RTS1 and CTS1 signals is only supported for EHS6T.

3.6.2 Digital Audio Interface

Four pins at the Java Terminals' GPIO connector can be configured as digital audio interface (DAI). The DAI can be used to connect audio devices capable of pulse code modulation (PCM). The PCM functionality allows for the use of an external codec like the W681360.

The DAI interface supports a 256kHz, long frame synchronization master mode with the following features:

- 16 Bit linear
- 8kHz sample rate / 125µs frame duration
- The most significant bit MSB is transferred first
- Data write at rising edge / data read at falling edge
- Common frame sync signal for transmit and receive

The following pins at the GPIO connector can be configured as DAI/PCM interface signals: TXDDAI, RXDDAI, TFSDAI and SCLK (see also Table 13). The configuration is done by AT^SCFG command - see [1]. It is non-volatile and becomes active after a module restart. DAI/PCM and GPIO functionalities for these lines are mutually exclusive. Table 14 describes the available DAI/PCM lines at the digital audio interface¹.

Table 14: Overview of DAI/PCM signals

Signal name	Input/Output	Description
TXDDAI (GPIO20)	O	PCM data from Java Terminals to external codec.
RXDDAI (GPIO21)	I	PCM data from external codec to Java Terminals.
TFSDAI (GPIO22)	O	Frame synchronization signal to external codec: Long frame (8kHz)
SCLK (GPIO23)	O	Bit clock to external codec: 256kHz

Figure 8 shows the PCM timing for the master mode available with Java Terminals.

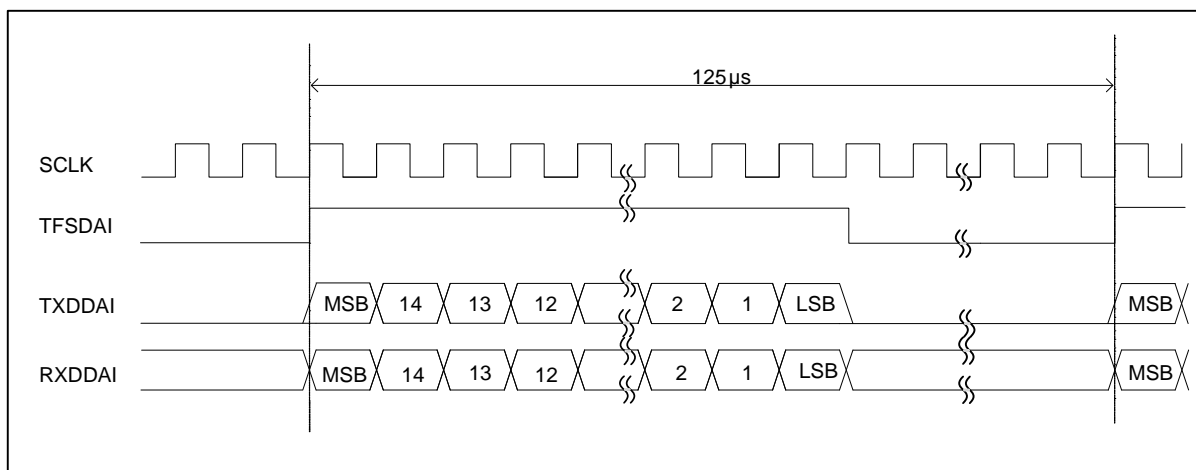


Figure 8: Long frame PCM timing, 256kHz

1. **Note:** For the DAI interface to operate, the directions of the Java Terminals' GPIO level shifters must be set according to the defined directions of the DAI signals.

3.6.3 I²C Interface

Two lines of the Java Terminals' GPIO connector are I²C lines. I²C is a serial, 8-bit oriented data transfer bus for bit rates up to 400kbps in Fast mode. It consists of two lines, the serial data line I2CDAT and the serial clock line I2CCLK. The Java Terminals' internal Java module act as a single master device, e.g. the clock I2CCLK is driven by the Java module. I2CDAT is a bi-directional line. Each device connected to the bus is software addressable by a unique 7-bit address, and simple master/slave relationships exist at all times. The Java module operates as master-transmitter or as master-receiver. An external application transmits or receives data only on request of the module.

To configure and activate the I2C bus use the AT^SSPI command. Detailed information on the AT^SSPI command as well explanations on the protocol and syntax required for data transmission can be found in [\[1\]](#).

With the external application, I2CDAT and I2CCLK lines need to be connected to a positive supply voltage via a pull-up resistor.

Note: Good care should be taken when connecting the I2C lines to the external application: The wires of I2CCLK and I2CDAT should be equal in length and as short as possible.

3.6.4 SPI Interface

For EHS6T Java Terminals four GPIO interface pins can be configured as Serial Peripheral Interface (SPI). The SPI is a synchronous serial interface for control and data transfer between Java Terminals and the external application. Only one application can be connected to the SPI and the interface supports only master mode. The transmission rates are up to 6.5Mbit/s. The SPI interface comprises the two data lines MOSI and MISO, the clock line SPI_CLK a well as the chip select line SPI_CS.

The following pins at the GPIO connector can be configured as SPI interface signals: SPI_CLK, SPI_MOSI, SPI_MISO and SPI_CS (see also [Table 13](#)). The configuration is done by AT command (see [\[1\]](#)). It is non-volatile and becomes active after a module restart.

To configure and activate the SPI interface use the AT^{SSPI} command. Detailed information on the AT^{SSPI} command as well explanations on the SPI modes required for data transmission can be found in [\[1\]](#). SPI, ADC1_IN and DSR0 functionalities are mutually exclusive.

In general, SPI supports four operation modes. The modes are different in clock phase and clock polarity. The module's SPI mode can be configured by using the AT command AT^{SSPI}. Make sure the module and the connected slave device works with the same SPI mode.

[Figure 9](#) shows the characteristics of the four SPI modes. The SPI modes 0 and 3 are the most common used modes.

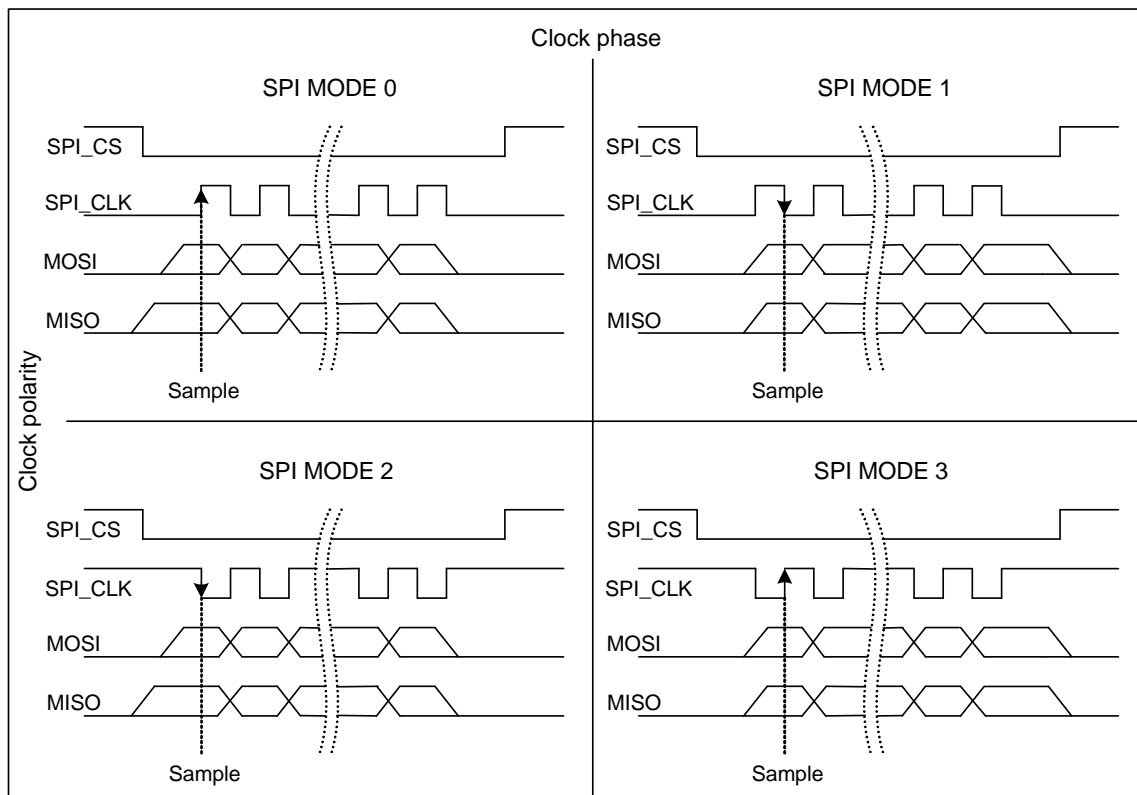


Figure 9: Characteristics of SPI modes

3.6.5 PWM Interface

The GPIO6 and GPIO7 pins at the GPIO connector can be configured as Pulse Width Modulation signals PWM1 and PWM2 by AT^SCFG command - see [1]. The PWM interface lines are output lines and can be used, for example, to connect buzzers. The PWM1 line is shared with GPIO7 and the PWM2 line is shared with GPIO6 (see also Table 13). GPIO and PWM functionalities are mutually exclusive¹.

3.6.6 Pulse Counter

The GPIO8 pin at the GPIO connector can be configured as pulse counter line COUNTER by AT^SCFG command - see [1]. The pulse counter interface is an input line and can be used, for example, as a clock (see also Table 13). GPIO and COUNTER functionalities are mutually exclusive¹.

3.6.7 Analog-to-Digital Converter (ADC)

ADC1_IN can be used for general purpose voltage measurements. ADC1_IN is configured and read by the AT^SRADC command - see [1]. ADC1_IN, DSR0 and SPI functionalities are mutually exclusive.

3.6.8 DSR0 signal

The DSR0 line available at the RS-232 interface is also routed to the GPIO connector and available as a separate pin. DSR0 can be configured by AT^SCFG command - see [1]. DSR0, ADC1_IN and SPI functionalities are mutually exclusive.

1. **Note:** For the PWM interface and pulse counter to operate, the directions of the Java Terminals' GPIO level shifters must be set according to the defined directions of the PWM and COUNTER signals.

3.7 Ethernet Interface

The Ethernet interface is available for EHS6T LAN only. The other Java Terminals do not support an Ethernet interface.

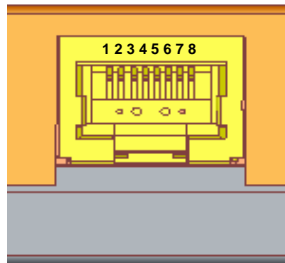


Figure 10: 8-pole RJ-45 Ethernet connector (female)

Table 15: Female 8-pole RJ-45 Ethernet connector

Pin	Signal name	Use
1	TX+	Transmit +
2	TX-	Transmit -
3	RX+	Receive +
4	n/c	Reserved
5	n/c	Reserved
6	RX-	Receive +
7	n/c	Reserved
8	n/c	Reserved

The Ethernet interface can be used as transparent data interface, for downloading new Java Terminal firmware releases - module firmware as well as Ethernet sub-system software, and also to access the implemented EHS6 module via AT command interface.

The Ethernet interface supports Power over Ethernet (PoE) according to IEEE standard 802.3. This means that if connected to a PoE enabled router or PoE injector, the EHS6T LAN does no longer need a separate power supply unit such as the mains adapter mentioned below.

3.8 Power Supply

3.8 Power Supply

The Java Terminals power supply via Western jack 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 $8V$ during an active transmission¹. The uplink burst causes strong ripple (drop) on the power lines. The drop voltage should not exceed $1V$.

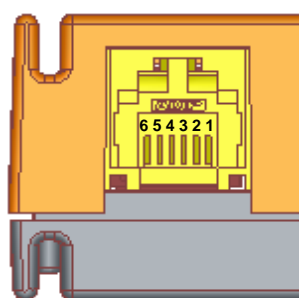
The Java Terminals are protected from supply voltage reversal. An external fast acting fuse $\geq 0.4A$ with melting integral I^2t ($0.15 \dots 0.25$) A^2s is necessary to use the Java Terminals at a $12V$ or $24V$ unlimited power supply system.

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 $>1ms$, Java Terminals reset or switch off. The watchdog can be configured to restart the Java Terminals. When power fails for $>15s$ the RTC will be reset.

Table 16: Female 6-pole Western plug for power supply, ignition, power down

Pin	Signal name	Use	Parameters
1	PLUS	Power supply	$8V - 30V$ DC
2	PLUS	Power supply	$8V - 30V$ DC
3	RST_IN	Signal for module reset	$U_{IH} \geq 8V$ for $t > 10ms$ resets the terminal. $U_{IL} < 2V$ and low level for normal operation.
4	IGT_IN	Ignition	$U_{IH} \geq 8V$ Ignition $\geq 8V$ for more than $200ms$ switches the Java Terminals 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:

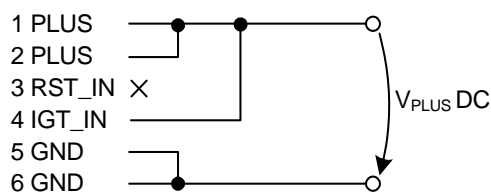


Figure 11: 6-pole Western jack for power supply, ignition, reset, typical connection

1. As an alternative to the power supply via Western jack, Power over Ethernet (PoE) can be employed. The PoE feature complies with IEEE 802.3 standards, and can be made available in Ethernet networks via PoE enabled devices such as PoE routers or injectors.

3.9 Power Up/Power Down Scenarios

Mains adapter: If it fits into the design of your application we recommend the plug-in supply unit used with the type approved Gemalto M2M reference setup. Ordering information can be found in Chapter 6. This 12V mains adapter comes with a 6-pole Western plug and provides an internal connection between IGT_IN pin and PLUS pin. If there is such an “auto ignition” connection between PLUS and IGT_IN, the module will restart automatically after a normal shutdown. Note that if employing PoE for EHS6T LAN, the module will also restart automatically after a normal shutdown.

3.9 Power Up/Power Down Scenarios

In general, be sure not to turn on the Java Terminals while it is beyond the safety limits of voltage and temperature. Java Terminals immediately switch off after having started and detected these inappropriate conditions. In extreme cases this can cause permanent damage to the Java Terminals.

3.9.1 Turn Java Terminals on

There are various possibilities to turn on Java Terminals and start into normal mode, depending on connecting and/or operating states.

If powered off (i.e., if Java Terminals' power supply is disconnected):

- Java Terminals can simply be started up by plugging an appropriate power supply unit between PLUS and GND of the 6-pole Western jack. If using the PoE feature, EHS6T LAN can also be started up by connecting simply the Ethernet interface

If switched off (i.e., while in Power Down mode):

- Java Terminals can be started up by activating the IGT_IN signal (pin 4).
- Java Terminals can be started up by activating the RS-232 DTR line (as long as RST_IN signal (pin 3) is not active (voltage <2V)
- Java Terminals can be started up by configuring the watchdog appropriately.

Note: With an “auto-ignition” connection between IGT_IN and PLUS, or if employing PoE (see [Section 3.8](#)), Java Terminals will automatically restart into normal mode after switch off (see [Section 3.9.3](#)). The start up variant from Power Down mode is therefore only applicable if there is no such “auto-ignition” connection at the power supply unit.

3.9.2 Reset/Restart Java Terminals

There are various possibilities to reset/restart Java Terminals:

- Java Terminals can be reset/restarted by entering the command AT+CFUN=x,1. For details on AT+CFUN please see [\[1\]](#).
- Java Terminals can be reset/restarted by configuring the watchdog appropriately.
- Java Terminals can be reset/restarted by configuring a wake-up alarm (see [Section 3.12](#)) before using AT^SMSO to turn them off and send them into Power Down mode.
- Java Terminals can be reset/restarted by simply shutting them down as described in [Section 3.9.3](#) and then restarting them as described in [Section 3.9.1](#). Note: With an “auto ignition” connection between IGT_IN and PLUS, or if employing PoE (see [Section 3.8](#)), it is ensured that the module will automatically restart after a normal shutdown using AT^SMSO.

Emergency restart:

- Finally, Java Terminals can be reset/restarted in the event of software hang-ups etc. by applying a voltage >8V to the RST_IN pin (pin 3) for more than 10ms. The RST_IN signal then restarts the Java Terminals.

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 Java Terminals fails to shut down properly.

3.9.3 Turn Java Terminals off

Normal shutdown:

- To turn off the Java Terminals use the AT^SMSO command, rather than disconnecting the mains adapter. This switch off procedure lets the Java Terminals 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 Java Terminals returns the following result codes:

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

The "^SHUTDOWN" result code indicates that the Java Terminals turns off in less than 1 second. After the shutdown procedure is complete the Java Terminals enters the Power Down mode. The yellow LED stops flashing (see [Section 3.14](#) 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, or if employing PoE (see [Section 3.8](#)), the module will restart automatically after a normal shutdown.

3.9.4 Disconnecting power supply

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

3.10 Automatic thermal shutdown

An on-board NTC measures the temperature of the built-in Java module. If over- or undertemperature is detected on the module the Java Terminals automatically shut down to avoid thermal damage to the system.

The automatic shutdown procedure is equivalent to the power-down initiated with the AT^SM-SO command, i.e. Java Terminals log off from the network and the software enters a secure state avoiding loss of data.

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

The watchdog can be configured to restart the Java Terminals after a defined period of time.

3.11 Hardware Watchdog

The Java Terminals feature a programmable hardware watchdog that permanently monitors the terminals hardware and can be configured to react to various hardware states. The watchdog may for example be configured to periodically restart the terminal, independent of its current operating state.

3.12 RTC

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

A dedicated voltage regulator backs up the RTC even in Power Down mode and enables Java Terminals to keep track of time and date.

However, please note that the Alarm function described in [\[1\]](#), Section AT+CALA, will only work if there is no “auto ignition“ connection active between IGT_IN pin and PLUS pin at the power supply unit that will automatically trigger a restart (see [Section 3.8](#)). Otherwise, the AT+CALA command can only be used to set a reminder message, but not to configure the Java Terminals to wake up from Power Down mode.

3.13 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.

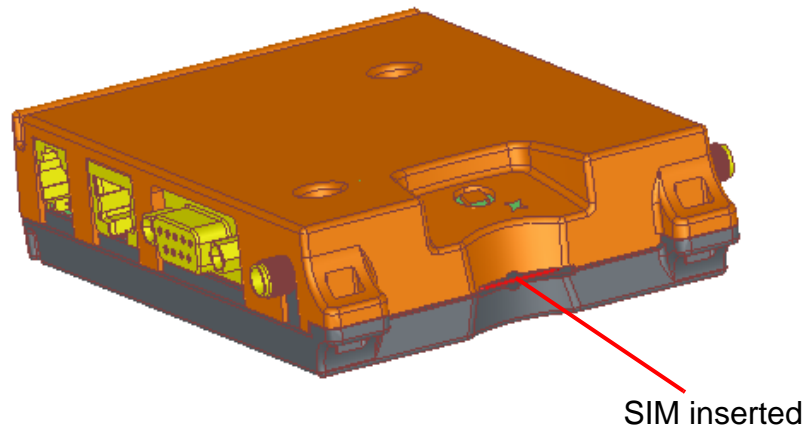


Figure 12: SIM interface

The SIM - with the circuit side facing upwards - 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.

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 Java Terminals.

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 Java Terminals.

3.14 Status LEDs

Java Terminals have two LEDs indicating its operating states through the semitransparent casing:

- A green LED indicates whether the Java Terminals are ready to operate and reports certain watchdog operations.
- A yellow LED indicates the network registration state of the Java Terminals.

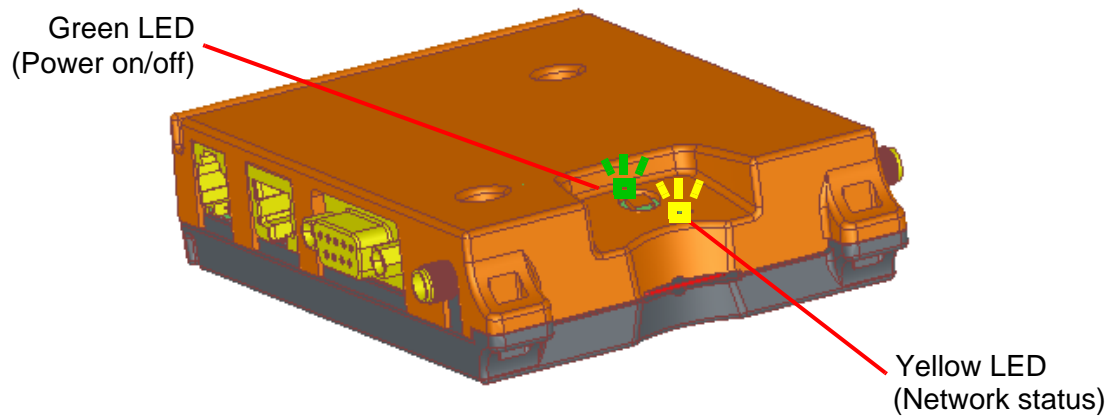


Figure 13: Status LED

The yellow LED can be configured by using the AT^SLED command to either light permanently or to flash. For details on the AT command please refer to [\[1\]](#).

3.15 RF Antenna Interface

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

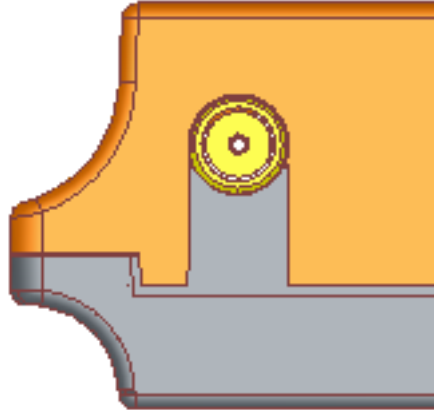


Figure 14: Antenna connector

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

Additional ESD protection to the antenna connector is provided. No DC voltage must be applied to the antenna circuit to protect it from damage.

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 (including cable loss) for stand-alone situation is given below in [Table 17](#).

Table 17: Allowed maximum antenna gain (including cable loss)

Module	850MHz	900MHz	1800MHz	1900MHz	2100MHz
EHS6T USB EHS6T LAN	3.42dBi	4.18dBi	9.64dBi	2.51dBi	15.54dBi
BGS5T USB	2.15dBi	2.15dBi	2.15dBi	2.15dBi	na
EHS5T RS485 and EHS5T-US RS485	3.10dBi	6.10dBi	12.30dBi	2.50dBi	12.30dBi

4 Mechanics, Mounting and Packaging

4.1 Mechanical Dimensions

Figure 15 shows a 3D view of the Java Terminal and provides an overview of the mechanical dimensions of the board. For further details see Figure 16 and Figure 17.

Length: 113.5mm (including fixtures for cable straps)
Width: 75mm (excluding antenna and serial interface connectors)
Height: 25.5mm

Weight: 120g

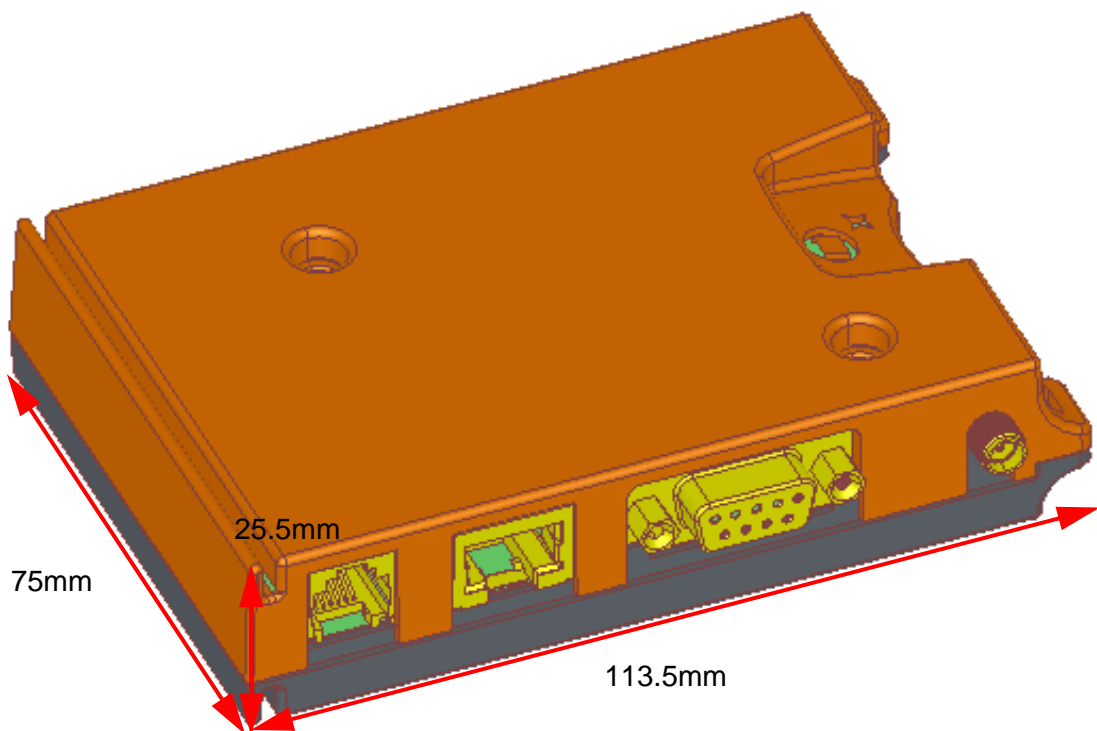


Figure 15: Java Terminals 3D overview

4.1 Mechanical Dimensions

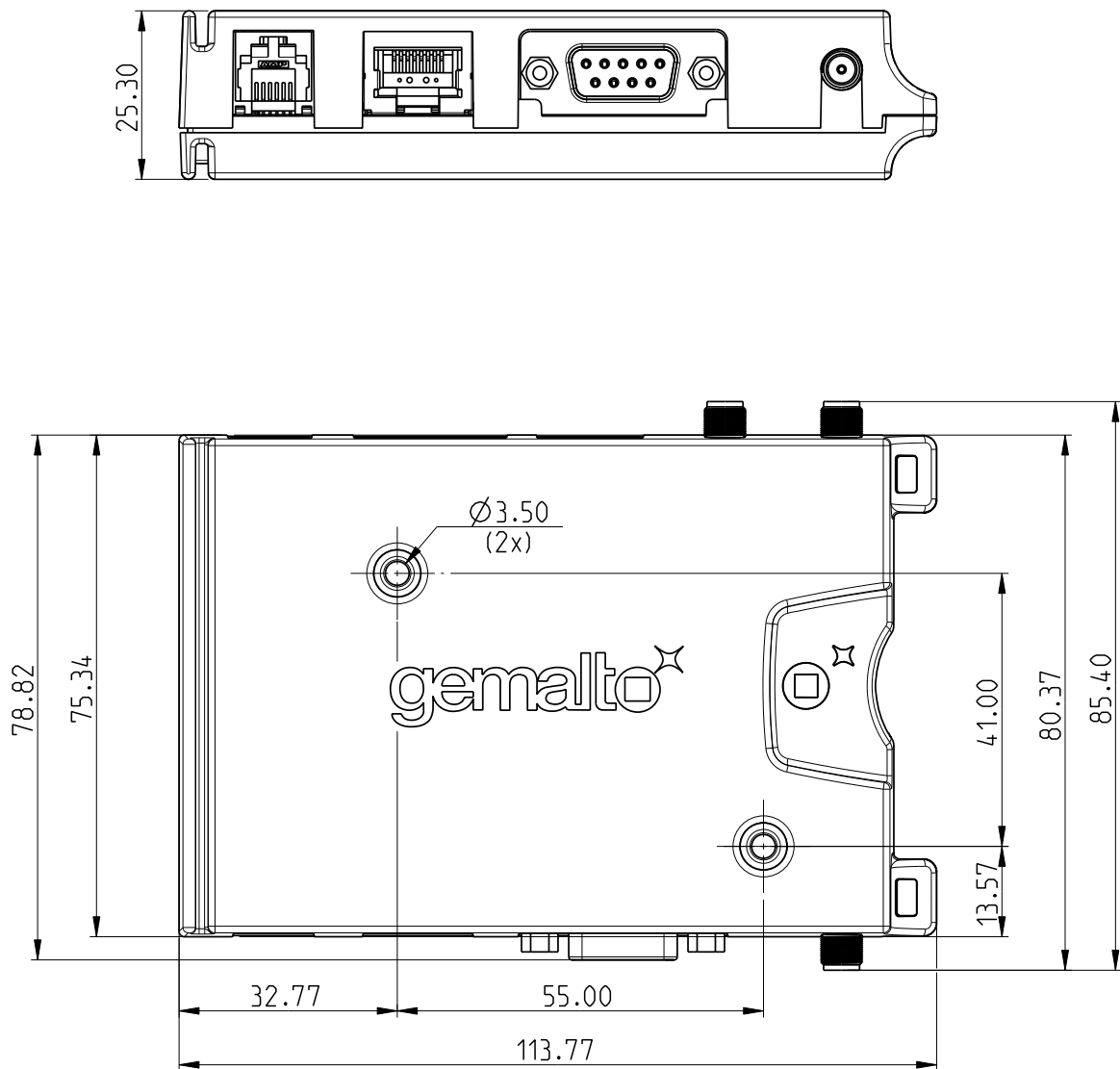


Figure 16: Java Terminals mechanical dimensions

4.1 Mechanical Dimensions

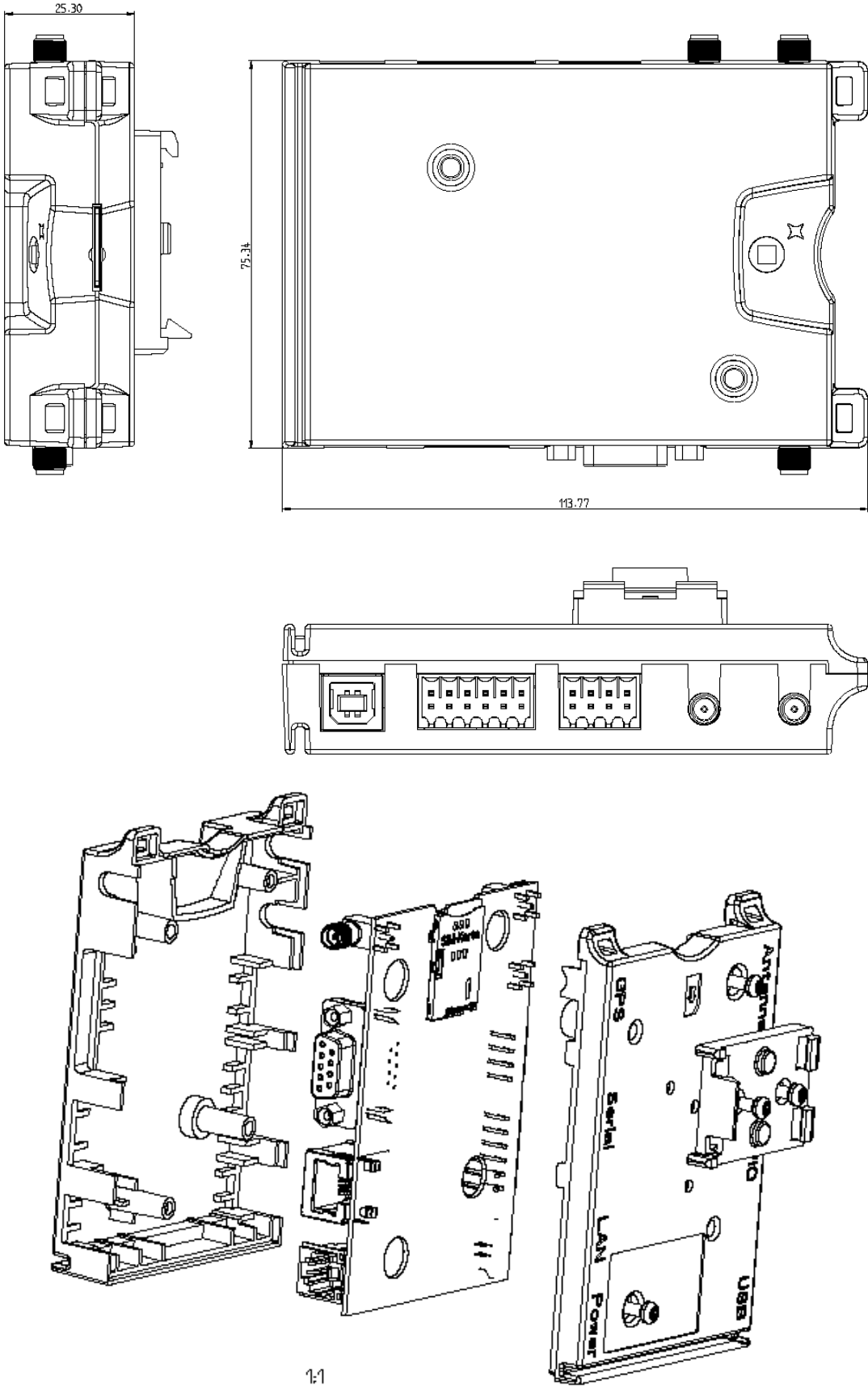


Figure 17: Java Terminals exploded view

4.2 Mounting the Java Terminals

There are a number of ways to mount the Java Terminals:

- Java Terminals can be attached to a rail installation or other surface using the two provided screw holes for screws, e.g., size M3.
- Java Terminals can be fastened to a rack or holding using the two provided fixtures for cable straps.
- Java Terminals 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 BOPLA TSH 35-2 universal DIN rail holder the Java Terminals 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 Java Terminals.

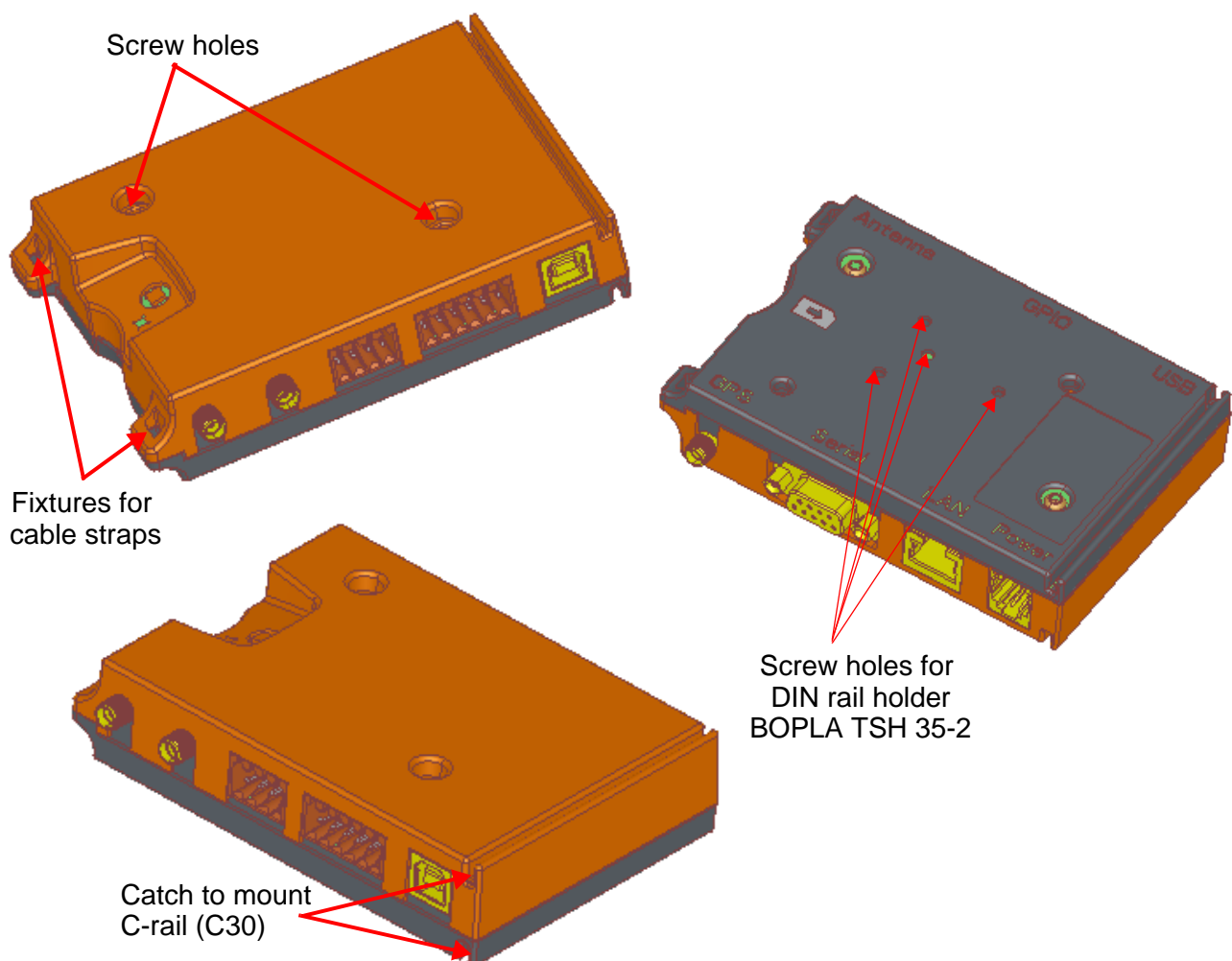


Figure 18: Mounting the Java Terminals

The various ways to mount the Java Terminals 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.

4.3 Packaging

Java Terminals come in terminal boxes:

- Terminal box size: 191mm x 143mm x 44mm.

5 Full Type Approval

5.1 Gemalto M2M Reference Setup

The Gemalto M2M reference setup submitted to type approve Java Terminals consists of the following components:

- Java Terminals with approved Java module
- PC as MMI
- Power Supply

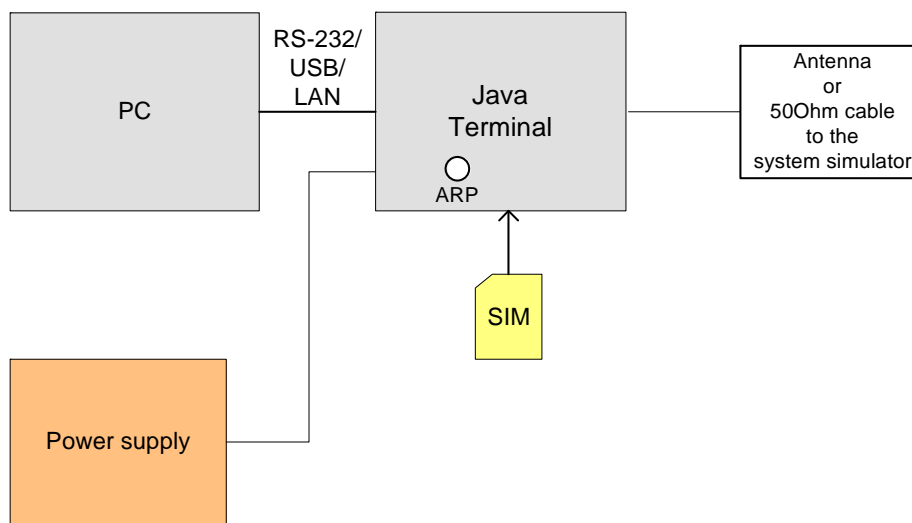


Figure 19: Reference equipment for approval

For ordering information please refer to Chapter 6.

5.2 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 Java Terminals configuration.
- Extra approval must be obtained for applications using other accessories than those included in the approved Java Terminals configuration (power supply, MMI implementation supported by AT commands).

5.3 CE Conformity

The Java Terminals meet the requirements of the EU directives listed below:

- R&TTE Directive 1999/5/EC

The Java Terminals are marked with the CE conformity mark (including notified body number):

EHSxT	BGS5T USB
CE 0682	CE 1588

5.4 EMC

The Java Terminals comply with the equipment requirements specified in EN 301489-1, -7 and -24 are covered by the R&TTE Directive. For details see [Section 1.3](#).

5.5 Compliance with FCC and IC Rules and Regulations

As an integrated product, the Java Terminals EHS5T-US RS485, EHS6T USB, EHS6T LAN and BGS5T USB are fully compliant with the grant of the FCC Equipment Authorization and the Industry Canada Certificates issued for the built-in Java modules, and therefore, bear the labels “Contains FCC ID: QIPEHS6” or “Contains FCC ID: QIPBGS5” or “Contains FCC ID: QIPEHS5-US”.

The Equipment Authorization Certification for the Cinterion® Java modules is listed under the following identifiers:

FCC Identifier: QIPEHS6 or QIPBGS5 or QIPEHS5-US

Industry Canada Certification Number: 7830A-EHS6 or 7830A-BGS5 or 7830A-EHS5US

Granted to Gemalto M2M GmbH

Notes (FCC):

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.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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 Gemalto M2M may void the FCC authorization to operate this equipment.

This device contains UMTS, GSM and GPRS class functions in the 900, 1800 and 2100MHz bands that 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: For more information on the RF antenna interface please refer to [Section 3.15](#).

Notes (IC):

(EN) This Class B digital apparatus complies with Canadian ICES-003 and RSS-210. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

(FR) Cet appareil numérique de classe B est conforme aux normes canadiennes ICES-003 et RSS-210. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

(EN) Radio frequency (RF) Exposure Information

The radiated output power of the Wireless Device is below the Industry Canada (IC) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.

This device has also been evaluated and shown compliant with the IC RF Exposure limits under mobile exposure conditions. (antennas are greater than 20cm from a person's body).

(FR) Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil de façon à minimiser les contacts humains lors du fonctionnement normal.

Ce périphérique a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles (les antennes se situent à moins de 20cm du corps d'une personne).

6 List of Parts and Accessories

Table 18: List of parts and accessories

Description	Supplier	Ordering information
Java Terminals	Gemalto M2M	Ordering number EHS5T RS485: L30960-N2730-A100 EHS5T-US RS485: L30960-N2760-A100 EHS6T USB: L30960-N2740-A100 EHS6T LAN: L30960-N2750-A100 BGS5T USB: L30960-N2720-A100
Power supply unit Input: 100-240V / 47-63Hz / 400mA Output: 12V / 1,25A 	Gemalto M2M	Terminal Power Supply (incl. EU adapter) Ordering number: L36880-N8490-A12 UK adapter for above Terminal Power Supply Ordering number: L36880-N8490-A13 US adapter for above Terminal Power Supply Ordering number: L36880-N8490-A14 AU adapter for above Terminal Power Supply Ordering number: L36880-N8490-A15
DIN rail holder - BOPLA TSH 35-2 	BOPLA	Ordering number: 20035000 BOPLA Gehäuse Systeme GmbH Borsigstr. 17-25 D-32257 Bünde Phone: +49 (0)5223 / 969 - 0 Fax: +49 (0)5223 / 969 - 100 Email: info@bopla.de Web: http://www.bopla.de
Antenna - SMARTEQ-MiniMAG Dualband, 0dBd, 2.6m RG174, SMA (m)	KÖBEL Mobile Communication	Ordering number: 1140.26 with crimped SMA connector KÖBEL Mobile Communication Sesamstrasse 12 D-24632 Lentföhrden
RS-232 cable with 9-pin D-sub connector (male)	Tecline	Tecline GmbH Behrener Straße 8 D-66117 Saarbrücken Phone: +49-681-926-78-70 Fax: +49-681-926-78-555 Web: http://www.tecline-edv.de/
8-pin and 12-pin header GPIO connector (female plug) for GPIO interface Type: 8-pin: B2CF 3.50/08/180 SN BK BX 12-pin: B2CF 3.50/12/180 SN BK BX 	Weidmueller	Ordering number (12-pin): 1277510000 Ordering number (8-pin): 1277480000 Weidmüller Interface GmbH & Co. KG Klingenbergstraße 16 D-32758 Detmold Phone: +49 5231 14-0 Fax: +49 5231 14-2083 Email: info@weidmueller.de Web: http://www.weidmueller.com

About Gemalto

Gemalto (Euronext NL0000400653 GTO) is the world leader in digital security with 2015 annual revenues of €3.1 billion and blue-chip customers in over 180 countries. Our 14,000 employees operate out of 118 offices, 45 personalization and data centers, and 27 research and software development centers located in 49 countries.

We are at the heart of the rapidly evolving digital society. Billions of people worldwide increasingly want the freedom to communicate, travel, shop, bank, entertain and work - anytime, everywhere - in ways that are enjoyable and safe. Gemalto delivers on their expanding needs for personal mobile services, payment security, authenticated cloud access, identity and privacy protection, eHealthcare and eGovernment efficiency, convenient ticketing and dependable machine-to-machine (M2M) applications.

Gemalto develops secure embedded software and secure products which we design and personalize. Our platforms and services manage these secure products, the confidential data they contain and the trusted end-user services they enable. Our innovations enable our clients to offer trusted and convenient digital services to billions of individuals.

Gemalto thrives with the growing number of people using its solutions to interact with the digital and wireless world.

For more information please visit

m2m.gemalto.com, www.facebook.com/gemalto, or [Follow@gemaltom2m](https://twitter.com/gemaltom2m) on twitter.

Gemalto M2M GmbH
Werinherstrasse 81
81541 Munich
Germany

➔ M2M.GEMALTO.COM

gemalto
security to be free