

GSM Terminal M485 preliminary datasheet



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1. Introduction

This document describes the hardware of HCP GSM Terminal M485 based on four different Cinterion wireless modules BGS2, MC55i, TC65i and MC75i, with interface specifications, electrical and mechanical characteristics.

GSM Terminal M485 is intended to use in variety of M2M applications, such as parking meters, energy meters, vending machines, basically all devices that have RS485 or RS232 standard for communication.

1.1 Related documents

- [1] BGS2 AT command set
- [2] BGS2 Hardware interface description
- [3] MC55i AT command set
- [4] MC55i Hardware interface description
- [5] TC65i AT command set
- [6] TC65i Hardware interface description
- [7] MC75i AT command set
- [8] MC75i Hardware interface description

1.2 Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
ATC	AT Cellular
BTS	Base Transceiver Station
CB	Cell Broadcast
CODEC	Coder-Decoder
CPU	Central Processing Unit
DCE	Data Circuit terminating Equipment
DSP	Digital Signal Processor
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
FR	Full rate
G.C.F.	GSM Conformity Forum
GSM	Global Standard for Mobile Communication
HF	Hands-free
HR	Half rate
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
Li-Ion	Lithium-Ion
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
PA	Power Amplifier
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCS	Personal Communication System










Abbreviation	Description
PDU	Protocol Data Unit
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory
RF	Radio frequency
RI	Ring Indication
ROM	Read Only Memory
RX	Receive direction
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
SW	Software
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TX	Transmit direction
UART	Universal Asynchronous Receiver and Transmitter
VAD	Voice Activity Detection
ZIF	Zero Insertion Force

Table 1. Terms and Abbreviations

1.3 Safety Precautions

Safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal from HCP d.o.o.

Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. HCP d.o.o 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.</p> <p>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. 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. Check the actual and local laws about these themes.</p>
 	<p>IMPORTANT!</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. 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>
	<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>

2. Product Concept

2.1 Key Features of M485 terminal based on BGS2-E/W module

Feature	Implementation
General	
Incorporates Cinterion BGS2 module	The BGS2 module handles all processing of data within the M485 Terminal. Internal software runs the application interface and the complete GSM/GPRS protocol stack.
Frequency bands	Dual band (BGS2-E): GSM 900/1800MHz Quad band (BGS2-W): GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99, V5)	Class 4 (+33dBm ±2dB) for EGSM850 (quad band only) Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900 (quad band only)
Power supply	Single supply voltage 8V to 30V DC
Ambient operating temperature according to IEC 60068-2	Normal operation: -30°C to +85°C Restricted operation: -40°C to -30°C, +85°C to +90°C
Physical	Dimensions: 64mm x 74mm x 33mm Weight: approx. 110g(approx.)
Housing color	Green
RoHS	All hardware components fully compliant with EU RoHS Directive.
Declaration of Conformity	Report No: PLE120514 Tested by PRO EMV Labor Strausberg GmbH
GSM/GPRS features	
Data transfer	GPRS: <ul style="list-style-type: none"> - Multislot Class 12 - Full PBCCH support - Mobile Station Class B - Coding Scheme 1 – 4 CSD: <ul style="list-style-type: none"> - V.110, RLP, non-transparent - 2.4, 4.8, 9.6, 14.4kbps - USSD PPP-stack for GPRS data transfer
SMS	<ul style="list-style-type: none"> - Point-to-point MT and MO - Cell broadcast - Text and PDU mode - Storage: SIM card plus 25 SMS locations in mobile equipment - Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 1 & 2

Feature	Implementation
TCP/IP stack	Protocols: TCP server/client, UDP, HTTP, FTP, SMTP, POP3 Access by AT commands
Watchdog	Integrated watchdog timer that resets terminal every 8 to 10 hours
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion AT commands for RIL compatibility
Seril Interfaces	
RS485 interface	RS-485 interface for AT commands and data <ul style="list-style-type: none"> - Baud rates from 1200bps to 115200bps - Autobauding: 1,200bps to 115200bps
RS232 interface	RS-232 interface, bi-directional bus for AT commands and data. <ul style="list-style-type: none"> - 2-wire modem interface (RxD,TxD) - Multiplex ability according to GSM 07.10 Multiplexer protocol - Adjustable baud rates: 1,200bps to 230,400bps - Autobauding: 1,200bps to 230,400bps
SIM interface	Supported SIM cards: 3V, 1.8V
Antenna	Connected via antenna FME connector
Power on/off, Reset	
Power on	<ul style="list-style-type: none"> - Automatic switch on when power supply is attached - DTR line at RS232 interface or IGT_IN line at power connector
Power off	<ul style="list-style-type: none"> - Normal switch-off by AT^SMSO command - Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly reset by AT command or DTR line at RS232 interface or reset by integrated Watchdog timer on board.
Phonebook	SIM card and terminal

Table 2. Key feature of M485 (BGS2-E/W) terminal

2.2 Key Features of M485 terminal based on MC55i module

Feature	Implementation
General	
Incorporates Cinterion MC55i module	The MC55i module handles all processing of data within the M485 Terminal.
Frequency bands	Quad band: GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99, V5)	Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900
Power supply	Single supply voltage 8V to 30V DC
Ambient operating temperature according to IEC 60068-2	Normal operation: -20°C to +55°C Restricted operation: -40°C to -20°C, +55°C to +70°C
Physical	Dimensions: 64mm x 74mm x 33mm Weight: approx. 110g(approx.)
Housing color	Green
RoHS	All hardware components fully compliant with EU RoHS Directive
Declaration of Conformity	Report No: PLE120514 Tested by PRO EMV Labor Strausberg GmbH
GSM/GPRS features	
Data transfer	GPRS: <ul style="list-style-type: none"> - Multislot Class 12 - Full PBCCH support - Mobile Station Class B - Coding Scheme 1 – 4 CSD: <ul style="list-style-type: none"> - V.110, RLP, non-transparent - 2.4, 4.8, 9.6, 14.4kbps - USSD PPP-stack for GPRS data transfer
SMS	<ul style="list-style-type: none"> - Point-to-point MT and MO - Cell broadcast - Text and PDU mode - Storage: SIM card plus 25 SMS locations in mobile equipment - Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 2 and Class 1

Feature	Implementation
TCP/IP	Over AT commands
Watchdog	Integrated watchdog timer that resets terminal every 8 to 10 hours
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion
Interfaces	
RS485 interface	RS-485 interface for AT commands and data <ul style="list-style-type: none"> - Baud rates from 1200bps to 115200bps - Autobauding: 1,200bps to 115200bps
RS232 interface	RS-232 interface, bi-directional bus for AT commands and data. <ul style="list-style-type: none"> - 2-wire modem interface (RxD,TxD) - Multiplex ability according to GSM 07.10 Multiplexer protocol - Fixed bit rates: 1,200bps to 230,400bps - Autobauding: 1,200bps to 230,400bps
SIM interface	Supported SIM cards: 3V, 1.8V
Antenna	Connected via antenna FME connector
Power on/off, Reset	
Power on	<ul style="list-style-type: none"> - Automatic switch on when power supply is attached - DTR line at RS232 interface or IGT_IN line at power connector
Power off	<ul style="list-style-type: none"> - Normal switch-off by AT^SMSO command - Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly shutdown and reset by AT command or DTR line at RS232 interface Orderly reset by AT command or DTR line at RS232 interface or reset by integrated Watchdog timer on board.
Phonebook	SIM card and terminal

Table 3. Key feature of M485 (MC55i) terminal

2.3 Key Features of M485 terminal based on TC65i module

Feature	Implementation
General	
Incorporates Cinterion TC65i module	The TC65i module handles all processing for signal and data within the M485 terminal.
Frequency bands	Quad band: GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900 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, 4.8dB for 3Tx and 6.0dB for 4Tx.
Power supply	Single supply voltage 8V to 30V DC
Ambient operating temperature according to IEC 60068-2	Normal operation: -30°C to +65°C Restricted operation: +65°C to +75°C, -30°C to -40°C
Physical	Dimensions: 64mm x 74mm x 33mm Weight: approx. 110g (approx.)
Housing color	Green
RoHS	All hardware components fully compliant with EU RoHS Directive
Declaration of Conformity	Report No: PLE120514 Tested by PRO EMV Labor Strausberg GmbH
GSM/GPRS features	
Data transfer	GPRS: <ul style="list-style-type: none"> - Multislot Class 12 - Full PBCCH support - Mobile Station Class B - Coding Scheme 1 – 4 CSD: <ul style="list-style-type: none"> - V.110, RLP, non-transparent - 2.4, 4.8, 9.6, 14.4kbps - USSD PPP-stack for GPRS data transfer
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus 25 SMS locations in mobile equipment Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 1

Feature	Implementation
TCP/IP stack	Access by AT commands
Phonebook	SIM card and phone
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion
Java platform	<p>Java Virtual Machine with APIs for AT Parser, Serial Interface, FlashFile-System and TCP/IP Stack.</p> <p>Major benefits: seamless integration into Java applications, ease of programming, no need for application microcontroller, extremely cost-efficient hardware and software design – ideal platform for industrial GSM applications.</p> <p>The memory space available for Java programs is around 1.7 MB in the flash file system and around 400k RAM. Application code and data share the space in the flash file system and in RAM.</p>
SIM Application Toolkit	SAT Release 99
Remote SIM Access	<p>TC65i supports Remote SIM Access. RSA enables TC65i to use a remote SIM card via its serial interface and an external application, in addition to the SIM card locally attached to the dedicated lines of the application interface. The connection between the external application and the remote SIM card can be a Bluetooth wireless link or a serial link.</p> <p>The necessary protocols and procedures are implemented according to the “SIM Access Profile Interoperability Specification of the Bluetooth Special Interest Group”.</p>
Interfaces	
RS485 interface	<p>RS-485 interface for AT commands and data</p> <ul style="list-style-type: none"> - Baud rates from 1200bps to 115200bps - Autobauding: 1,200bps to 115200bps
RS232 interface	<p>RS-232 interface, bi-directional bus for AT commands and data.</p> <ul style="list-style-type: none"> - 2-wire modem interface (RxD,TxD) - Adjustable baud rates: 300 bps to 921,600 bps - Autobauding: 1,200 bps to 460,800 bps - Multiplex ability according to GSM 07.10 Multiplexer Protocol.
SIM interface	Supported SIM cards: 3V, 1.8V
Antenna	Connected via antenna FME connector
Power on/off, Reset	
Power on	<ul style="list-style-type: none"> - Automatic switch on when power supply is attached - DTR line at RS232 interface
Power off	<ul style="list-style-type: none"> - Normal switch-off by AT^SMSO command - Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly shutdown and reset by AT command

Table 4. Key features of M485 (TC65i) terminal

2.4 Key Features of M485 terminal based on MC75i module

Feature	Implementation
General	
Incorporates Cinterion MC75i module	The MC75i module handles all processing for signal and data within the M485 terminal.
Frequency bands	Quad band: GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99)	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 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 2.0dB for 2Tx, 4.0dB for 3Tx and 6.0dB for 4Tx.
Power supply	Single supply voltage 8V to 30V DC
Ambient operating temperature according to IEC 60068-2	Normal operation: -30°C to +65°C Restricted operation: +65°C to +75°C, -30°C to -40°C
Physical	Dimensions: 64mm x 74mm x 33mm Weight: approx. 110g(approx.)
Housing color	Green
RoHS	All hardware components fully compliant with EU RoHS Directive
Declaration of Conformity	Report No: PLE120514 Tested by PRO EMV Labor Strausberg GmbH
GSM/GPRS features	
Data transfer	GPRS: <ul style="list-style-type: none"> - Multislot Class 12 - Full PBCCH support - Mobile Station Class B - Coding Scheme 1 – 4 EGPRS: <ul style="list-style-type: none"> - Multislot Class 12 - Mobile Station Class B - Modulation and Coding Scheme MCS 1-9 CSD: <ul style="list-style-type: none"> - V.110, RLP, non-transparent - 2.4, 4.8, 9.6, 14.4kbps - USSD

	PPP-stack for GPRS data transfer
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus 25 SMS locations in mobile equipment Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 1

Feature	Implementation
TCP/IP	Access by AT commands
Phonebook	SIM and phone
Software	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion AT commands for RIL compatibility
SIM Application Toolkit	SAT Release 99
Remote SIM Access	MC75i supports Remote SIM Access. RSA enables MC75i to use a remote SIM card via its serial interface and an external application, in addition to the SIM card locally attached to the dedicated lines of the application interface. The connection between the external application and the remote SIM card can be a Bluetooth wireless link or a serial link. The necessary protocols and procedures are implemented according to the "SIM Access Profile Interoperability Specification of the Bluetooth Special Interest Group" (SAP).
Interfaces	
RS485 interface	RS-485 interface for AT commands and data <ul style="list-style-type: none"> - Baud rates from 1200bps to 115200bps - Autobauding: 1,200bps to 115200bps
RS232 interface	RS-232 interface, bi-directional bus for AT commands and data. <ul style="list-style-type: none"> - 2-wire modem interface (RxD,TxD) - Adjustable baud rates: 300 bps to 921,600 bps - Autobauding: 1,200 bps to 460,800 bps - Multiplex ability according to GSM 07.10 Multiplexer Protocol.
SIM interface	Supported SIM cards: 3V, 1.8V
Antenna	Connected via antenna FME connector
Power on/off, Reset	
Power on	<ul style="list-style-type: none"> - Automatic switch on when power supply is attached - DTR line at RS232 interface
Power off	<ul style="list-style-type: none"> - Normal switch-off by AT^SMSO command - Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly shutdown and reset by AT command

Table 5. Key feature of M485 (MC75i) terminal

3. Interface Description

3.1 Overview

GSM Terminal M485 provides following connectors for power supply, interface and antenna:

- 6-pole RJ11 female connector for power supply
- RS485 connector – 4 pole screw connector
- FME jack (male) antenna connector
- Status LED
- SIM card holder
- RS232 connector – 4-pole RJ11 connector
- Jumper for 120 termination resistor

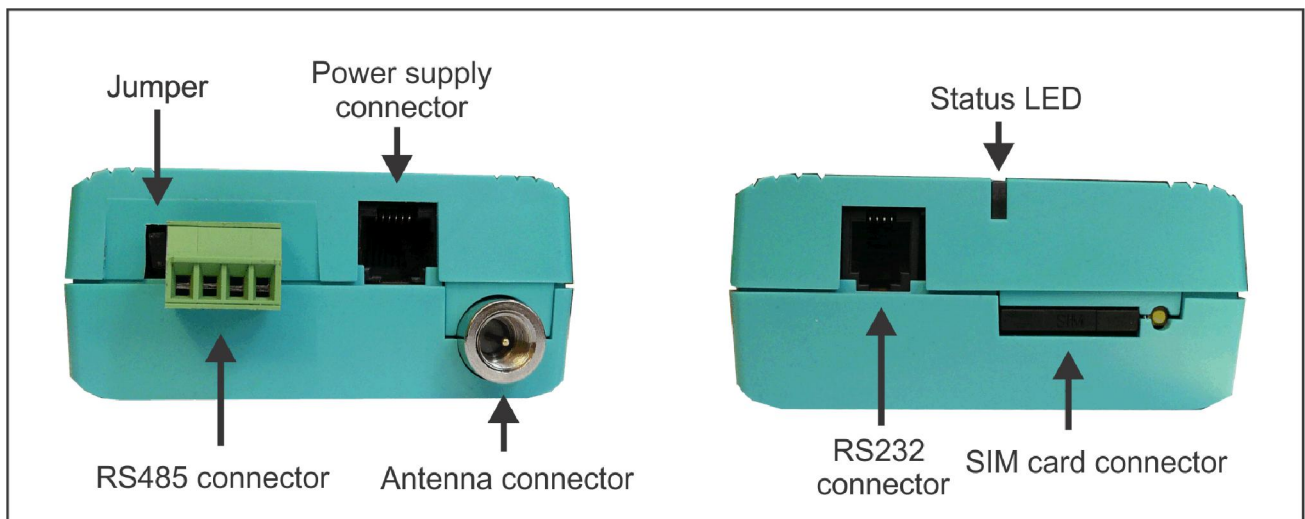


Figure 1. Front and rear view of M485 Terminal

3.2 Block Diagram

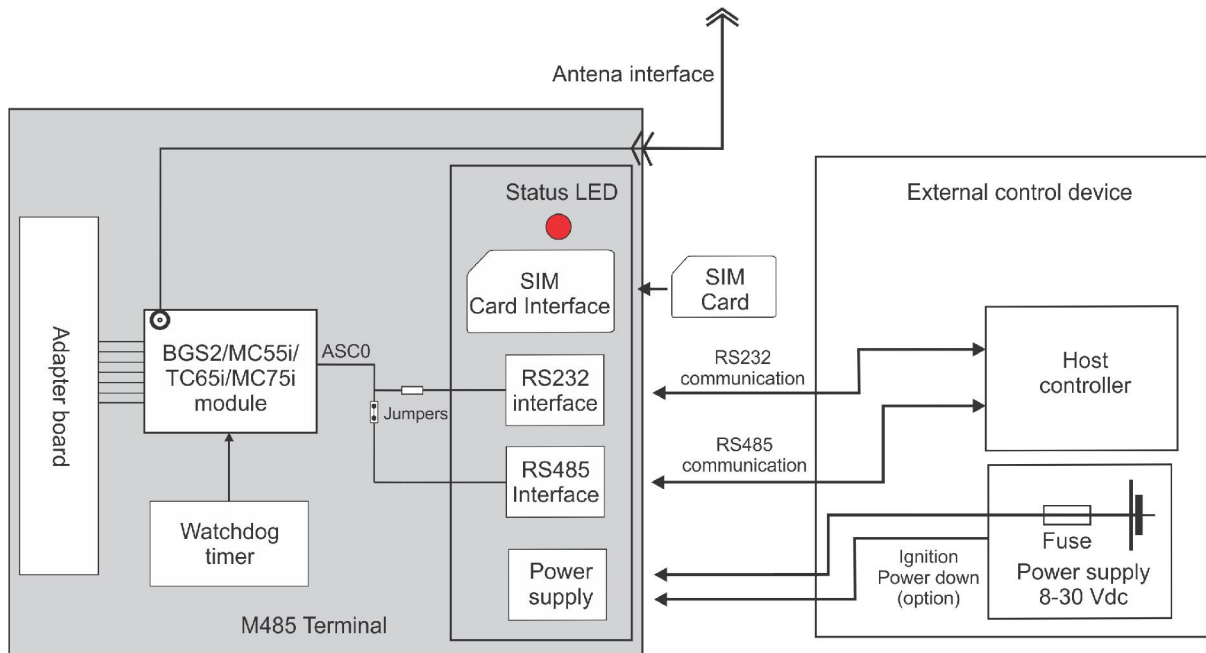


Figure 2. GSM Terminal M485 block diagram

On figure 2. you can see block diagram of M485 terminal, where you can see that M485 is based on four different GSM modules from Cinterion.

RS485 and RS232 interfaces are using the same UART (ASC0) which is switched with jumpers inside the M485 terminal.

3.3 Operating Modes M485 Terminal

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

Mode	Function	
Normal operation	GSM/GPRS SLEEP	<p>Various powersave modes set with AT+CFUN command.</p> <p>Software is active to minimum extent. If the module was registered to the GSM network in IDLE mode, it is registered and paging with the BTS in SLEEP mode, too. Power saving can be chosen at different levels: The NON-CYCLIC SLEEP mode (AT+CFUN=0) disables the AT interface. The CYCLIC SLEEP modes AT+CFUN=5, 6, 7, 8 and 9 (AT+CFUN=7 and 9 for BGS2) alternately activate and deactivate the AT interfaces to allow permanent access to all AT commands.</p>
	GSM IDLE	Software is active. Once registered to the GSM network, paging with BTS is carried out. The module is ready to send and receive.
	GSM TALK	<p>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.</p>
	GPRS IDLE	Module 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 / down-link data rates and GPRS configuration (e.g. used multislot settings).
POWER DOWN	Normal shutdown after sending the AT^SMSO command or after activation of the PD_IN line (M485(BGS2-E/W) resets terminal)	

Table 6. Operating modes of M485 Terminal

3.4 Power Supply

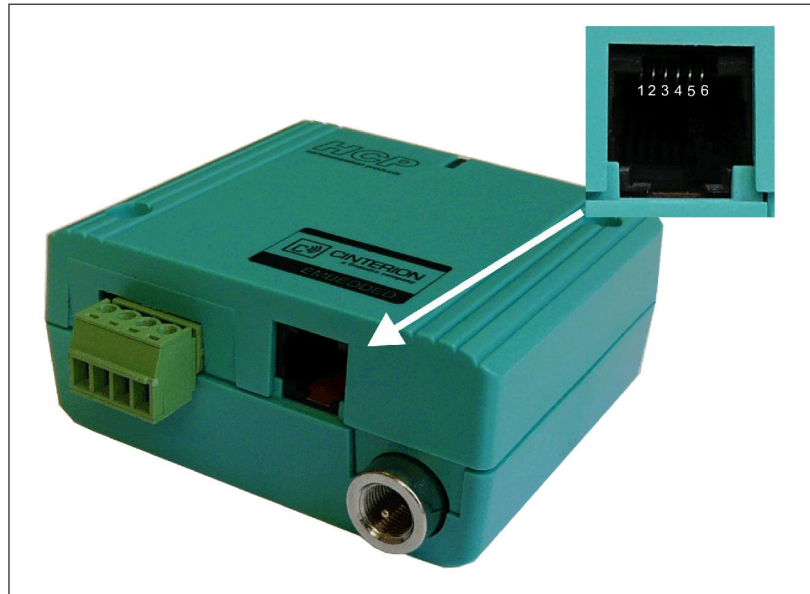


Figure 3. Power supply connector

Pin	Signal name	Use	Parameters
1	+	Positive power supply	+8 to 30V DC
2	NC	---	---
3	PD_IN	Signal for POWER DOWN mode	$U_{IH} > 5V$ for $t > 100ms$ turns the terminal off. $U_{IL} < 2V$ and low level for normal operation.
4	IGT_IN	Ignition	$U_{IH} > 5V$ for $t > 200ms$ turns the terminal on.
5	NC	---	---
6	GND	Ground	0V

Table 7. Operating modes of M485 Terminal

NC – not connected

GSM Terminal M485 will power ON write after power supply is attached. Additional PD_IN and IGT_IN line on power supply connector is an option for controlling ignition and restart/power down from external application. It's not necessary to use pins PD_IN and IGT_IN.

3.4.1 Turn M485 Terminal on

M485 terminal switches on automatically when power supply is attached. After start-up, the M485 Terminal enters the net searching state.

Also, if M485 terminal is switched off over AT command AT^SMSO, you can turn it on by activating the DTR line on RS232 interface.

After startup of the M485 Terminal the RS232/RS485 lines are in an undefined state for approx. 900ms. This may cause undefined characters to be transmitted over the RS232/RS485 lines during this period.

3.4.2 Reset M485 Terminal

One way to reset M485 Terminal is entering AT command AT+CFUN=x,1. For details on AT+CFUN please see [1], [2].

Other ways for restarting M485 terminal is:

- activating the DTR line on RS232 interface
- automatically by integrated watchdog timer on every 8 to 10 hours.

3.4.3 Turn off M485 Terminal

Normal shutdown:

- To turn off the M485 Terminal use the AT^SMSO command, rather than disconnecting the power supply adapter.

This procedure lets the M485 Terminal 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 M485 Terminal returns the following result codes:

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

The "^SHUTDOWN" result code indicates that the M485 Terminal turns off in less than 1 second. After the shutdown procedure is complete the M485 Terminal enters the POWER DOWN mode. The status LED stops flashing (see Section 3.9 for a detailed LED description).

Emergency shutdown (reset)

- In the event of software hang-ups etc. the M485 Terminal can be switched off by applying a voltage >5V to the Emergency_off pin (pin 3) for more than 200ms.

The Emergency_off signal switches the M485 Terminal off (M485 based on MC55i/TC65i/MC75i Terminal switches off, M485 Terminal based on BGS2 resets). All internal supply voltages are off, except for the power down voltage.

When the M485 Terminal enters the POWER DOWN mode, e.g. after you have issued the AT^SMSO command or activated the Emergency_off signal, all RS-232/RS485 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/RS485 lines which can be ignored.

Caution: Use the Emergency_off pin only when, due to serious problems, the software is not responding for more than 5 seconds. Pulling the Emergency_off 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 M485 Terminal fails to shut down properly.

3.4.4 Disconnecting power supply

Before disconnecting the power supply from the Vcc pin, make sure that the M485 Terminal is in a safe condition. The best way is to wait 1s after the "^SHUTDOWN" result code has been indicated.

3.4.5 Automatic thermal shutdown

On-board NTC measures the temperature of the built-in M485 Terminal. If over or under temperature is detected on the module the M485 Terminal automatically shuts down to avoid thermal damage to the system.

Table 15 specifies the ambient temperature threshold for the M485 Terminal.

The automatic shutdown procedure is equivalent to the power-down initiated with the AT^SMSO command, i.e. M485 Terminal 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 M485 Terminal switches off are implemented as Unso-licited Result codes (URCs). For details see the description of AT^SCTM command provided in [1] and [2].

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 [1,3,5] for details.

3.5 RS232 interface

GSM Terminal M485 can communicate with other devices over RS232 serial interface standard if appropriate jumper configuration inside M485 terminal is set.

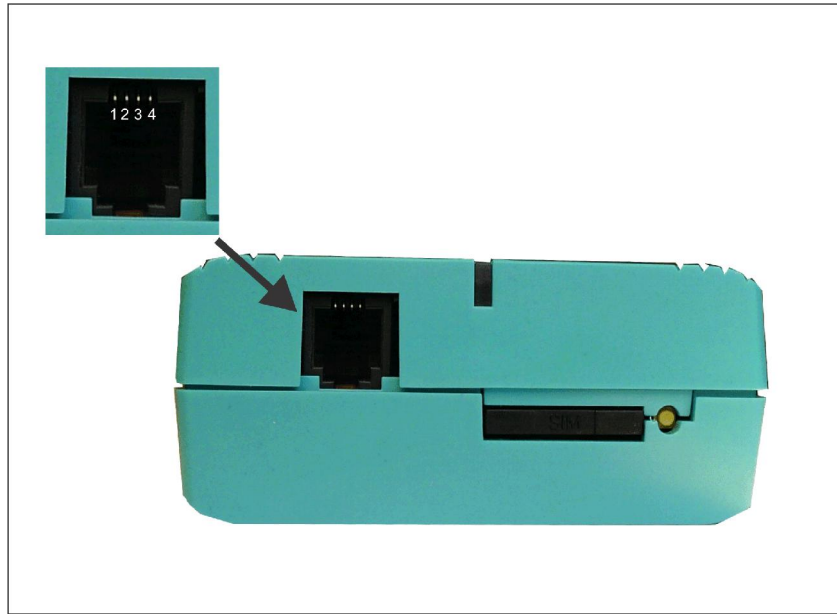


Figure 4. RS232 interface connector

Pin	Signal name	Use	Parameters
1	DTR	Resets M485 terminal	Activating DTR line resets M485 terminal
2	RxD	Serial Input	--
3	TxD	Serial Output	--
4	GND	Ground	0V

Table 8. RS232 interface pins

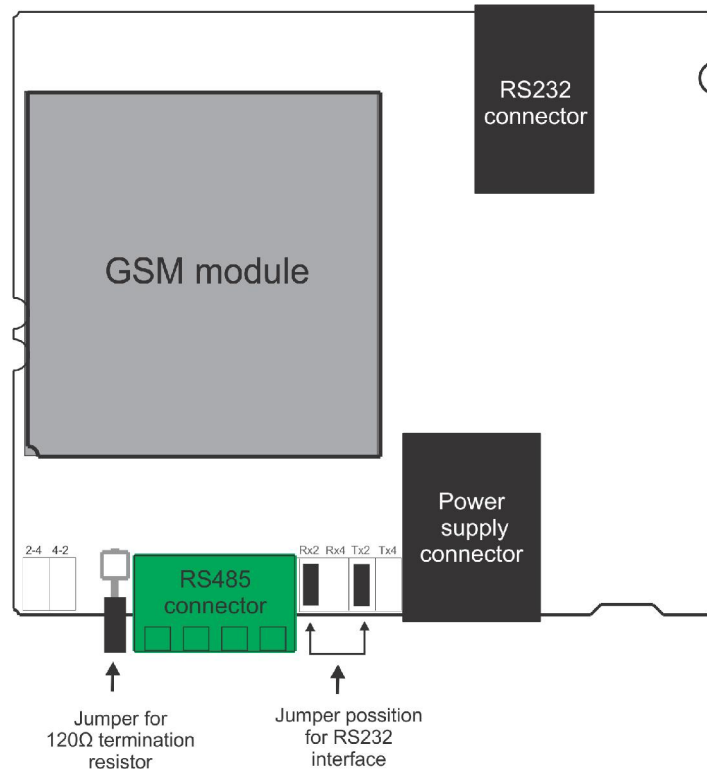


Figure 5. RS232 jumper configuration on PCB of M485

To access jumpers for selecting interface you must unscrew device, put jumpers on location for RS232 and screw device and use it. On figure 5. you can see jumper configuration for RS232 interface.

3.6 RS485 interface

GSM Terminal M485 can communicate with other devices over RS485 half-duplex standard when appropriate jumper configuration inside M485 terminal is set.

RS485 connector is screw type 4 pin connector for easier connection with twisted pair wire. Also there is jumper on the left side of 4 pin connector for activating 120 resistor.

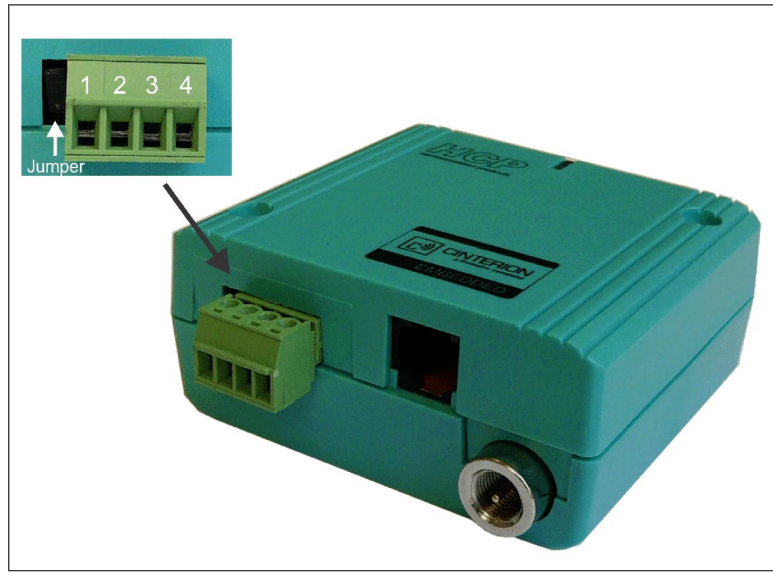


Figure 6. RS485 interface connector

Pin	Signal name	Use	Parameters
1	RS485 – A	Noninverting Receiver Input and Noninverting Driver Output	--
2	RS485 – B	Inverting Receiver Input and Inverting Driver Output	--
3	NC	Not connected	--
4	GND	Signal ground	0V

Table 9. RS485 interface pins

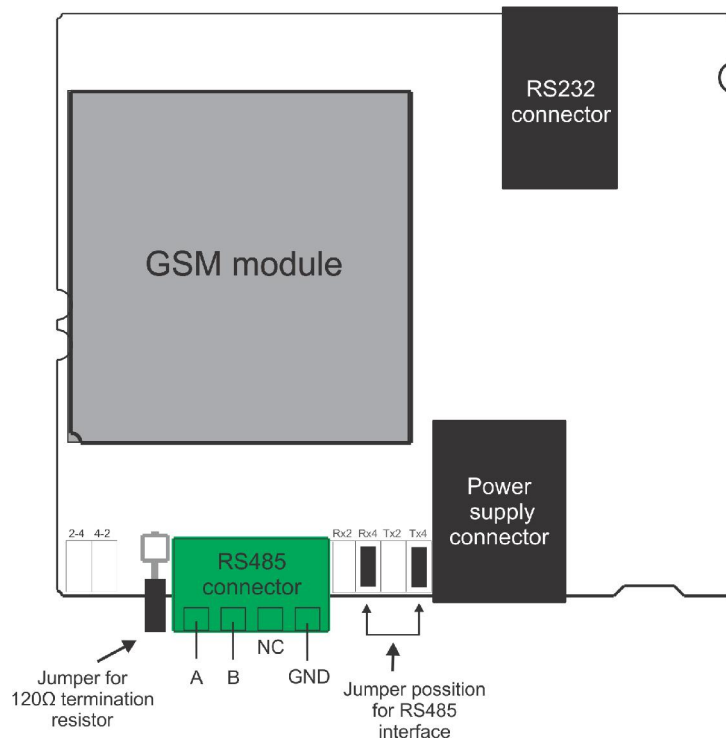


Figure 7. RS485 jumper configuration on PCB of M485

To access jumpers for selecting interface you must unscrew device, put jumpers on location for RS485 and screw device and use it. On figure 7. you can see jumper configuration for RS485 configuration.

3.7 SIM interface

M485 Terminal provides SIM interface with automatic detection for 1.8V and 3V SIM cards in accordance with GSM11.12 Phase 2. The card holder is a six wire interface according to GSM 11.11 with detection whether or not a SIM card is inserted.



Figure 8. SIM interface

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 M485 Terminal.

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 M485 Terminal.

3.8 Status LED

Red status LED displays the operating status of the M485 Terminal.



Figure 9. Red status LED flashing on M485 Terminal

The LED is driven by the SYNC line of the integrated GSM/GPRS module which can be configured by using the AT[^]SSYNC command. For the purpose of the M485 Terminal 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 M485 Terminal 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.

LED mode	Operating status of M Terminal
Permanently off	M485 Terminal is in one of the following modes: <ul style="list-style-type: none"> - POWER DOWN mode - ALARM mode - NON-CYCLIC SLEEP mode - CYCLIC SLEEP mode with no temporary wake-up event1 in progress.
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	Depending on type of call: Voice call: Connected to remote party. CSD call: Connected to remote party or exchange of parameters while setting up or disconnecting a call.

Table 10. Status LED operating status

3.9 Antenna interface

The external antenna is connected via the terminal FME jack (male), look at figure 10.

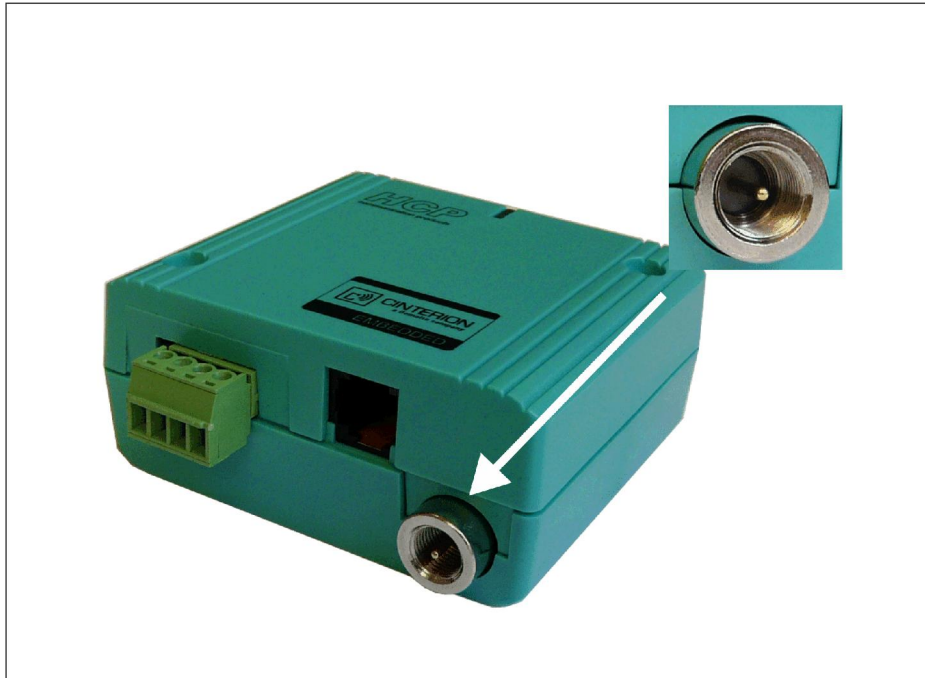


Figure 10. Antenna interface – FME jack

An internal antenna cable adapts the antenna reference point (antenna connector type U.FL-R-SMT from Hirose) to the FME (male) connector.

- Cable loss of the internal cable
<0.4dB @ 900MHz
<0.6dB @ 1800MHz
- The system impedance is 50
- In every case, for good RF performance the return loss of the customer application's antenna should be better than 10dB (VSWR < 2).
- M485 Terminal withstands a total mismatch at this connector when transmitting with power control level for maximum RF power.

4. Electrical and Environmental Characteristics

4.1 Absolute Maximum Ratings

Parameter	Pin / Parameter	Min.	Max.	Unit
Supply voltage	Vcc	8	30	V
Input voltage for on/off control lines	IGT_IN, PD_IN	3	6	V
RS232 input voltage range	TxD	-20	+20	V
	RxD	-0.3	+5.3	V
RS485 input voltage range	A, B	-8	+13	V
Immunity against ESD	RS232 and RS485 lines	-15	+15	kV
Protection Class	IP40(avoid exposing M485 Terminal to liquid or moisture)		IP40	

Table 11. Absolute maximum ratings

4.2 Recommended Operating conditions

Parameter	Pin / Parameter	Min.	Typ.	Max.	Unit
Supply voltage	Vcc		12		V
Operating temperature	M485 (MC55i) Terminal	-20	+25	+70	°C
	M485 (BGS2-E/W) Terminal	-30	+25	+85	°C
	M485 (TC65i) Terminal	-30	+25	+65	°C
	M485 (MC75i) Terminal	-30	+25	+70	°C

Table 12. Recommended operating conditions

4.3 Storage Conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-30 +75	°C	ETS 300 019-2-1: T1.2, IEC 60068-2-1 Ab ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Humidity relative: Low High Condens.	10 90 at 30°C 90-100 at 30°C	%	--- ETS 300 019-2-1: T1.2, IEC 60068-2-56 Cb ETS 300 019-2-1: T1.2, IEC 60068-2-30 Db
Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m ²	ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Chemically active substances	Not recomm.		EC TR 60271-3-1: 1C1L
Mechanically active substances	Not recomm.		IEC TR 60271-3-1: 1S1

Table 13. Storage conditions

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 Power Supply Ratings

Param.	Description	Conditions	Min.	Typ.	Max.	Unit	
V _{cc}	Allowed voltage ripple (peak to peak), drop during transmit	TALK mode			1	V	
I _{cc}	Average supply current (average time 3 min.)	Power Down mode	@8V	460	500	620	μA
			@12V	650	720	800	
			@30V	1600	1800	1900	
		SLEEP mode (GSM/GPRS)	@8V	45	50	64	mA
			@12V	30	35	43	
			@30V	15	19	30	
		Net searching mode(no net)	@8V	60	75	80	mA
			@12V	45	53	64	
			@30V	25	34	40	
		IDLE mode (GSM/GPRS)	@8V	65	71	80	mA
			@12V	43	50	60	
			@30V	25	32	40	
		GSM TALK mode	@8V	260	280	310	mA
			@12V	160	180	200	
			@30V	65	75	84	
		GPRS DATA mode(1 Tx, 4 Rx)	@8V	280	290	320	mA
			@12V	170	185	220	
			@30V	65	80	90	
GPRS DATA mode(2 Tx, 3 Rx)	@8V	360	380	420	mA		
	@12V	184	190	230			
	@30V	65	80	90			
Peak supply current (during 577μs transmission slot every 4.6ms)	Power control level for P _{out} max	@8V	1.2	1.6	1.8	A	
		@12V	1.1	1.2	1.4		
		@30V	0.64	0.75	1.0		
t _{PLUS}	Allowed powerfail time without terminal reset or power down	After this time the M485 Terminal will be reset or switched off			1	ms	
t _{R_PLUS}	Allowed rise time of V _{cc}	0 to 100%			20	ms	

Table 14. Power supply ratings

4.4.2 On/Off Control

Param.	Description	Conditions	Min.	Typ.	Max.	Unit
V _{HIGH}	Input voltage -Ignition, -Emergency_off	active high	4			V
V _{LOW}					2	V
V _{HIGH}	Input voltage DTR	active high	4		+15	V
V _{LOW}			-15		1.2	V
t _{D_IGT}	Duration of active high -Ignition, DTR		200			ms
t _{D_EOff}	Duration of active high -Emergency_off		50			ms
t _{R_IGT}	Rise time on -Ignition pin for power up	0 to 100%			20	ms
t _{R_RTS}	Rise time on DTR pin for power up	0 to 100%			20	ms
t _{D_off}	Passive state(low) of - Ignition and DTR pin before restart	after power down	1s			ms

Table 15. On/off control

4.4.3 RS232 interface

Param.	Description	Conditions	Min.	Typ	Max.	Unit
V _{OUT}	Transmitter output voltage for RxD	@3K to GND	±5	±5.4		V
R _{OUT}	Transmitter output resistance RXD		300	10M		
R _{IN}	Resistance TxD		3	5	7	k
V _{IN}	Receiver input voltage range TxD		-25		+25	V
V _{LOW}	Input threshold low				0.8	V
V _{HIGH}	Input threshold high		2			
Baudrate		Autobauding	1,200		230,400	bps
		Fixed range	1,200		230,400	bps
RS232 cable				1.8	2	m

Table 16. RS232 interface

4.4.4 RS485 interface

Param.	Description	Conditions	Min.	Typ	Max.	Unit
V _{OUT}	Transmitter output voltage for RS485-A, -B	R _{DIFF} =100	2		5	V
R _{IN}	Resistance RS485-A, -B			48		k
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		
Baudrate		Autobauding	1.2		115	kbps
		Fixed range	1.2		230	kbps

Table 17. RS485 interface characteristics

4.4.5 Antenna interface

Parameter		Min.	Typ.	Max.	Unit
Frequency range 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 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 load	GSM 850	31	33	35	dBm
	E-GSM 900	31	33	35	dBm
	GSM 1800	28	30	32	dBm
	GSM 1900	28	30	32	dBm

Table 18. Antena interface

Please refer to [2], [4], [6], [8] for more information about antenna interface (air interface).

5. Mechanical Characteristics

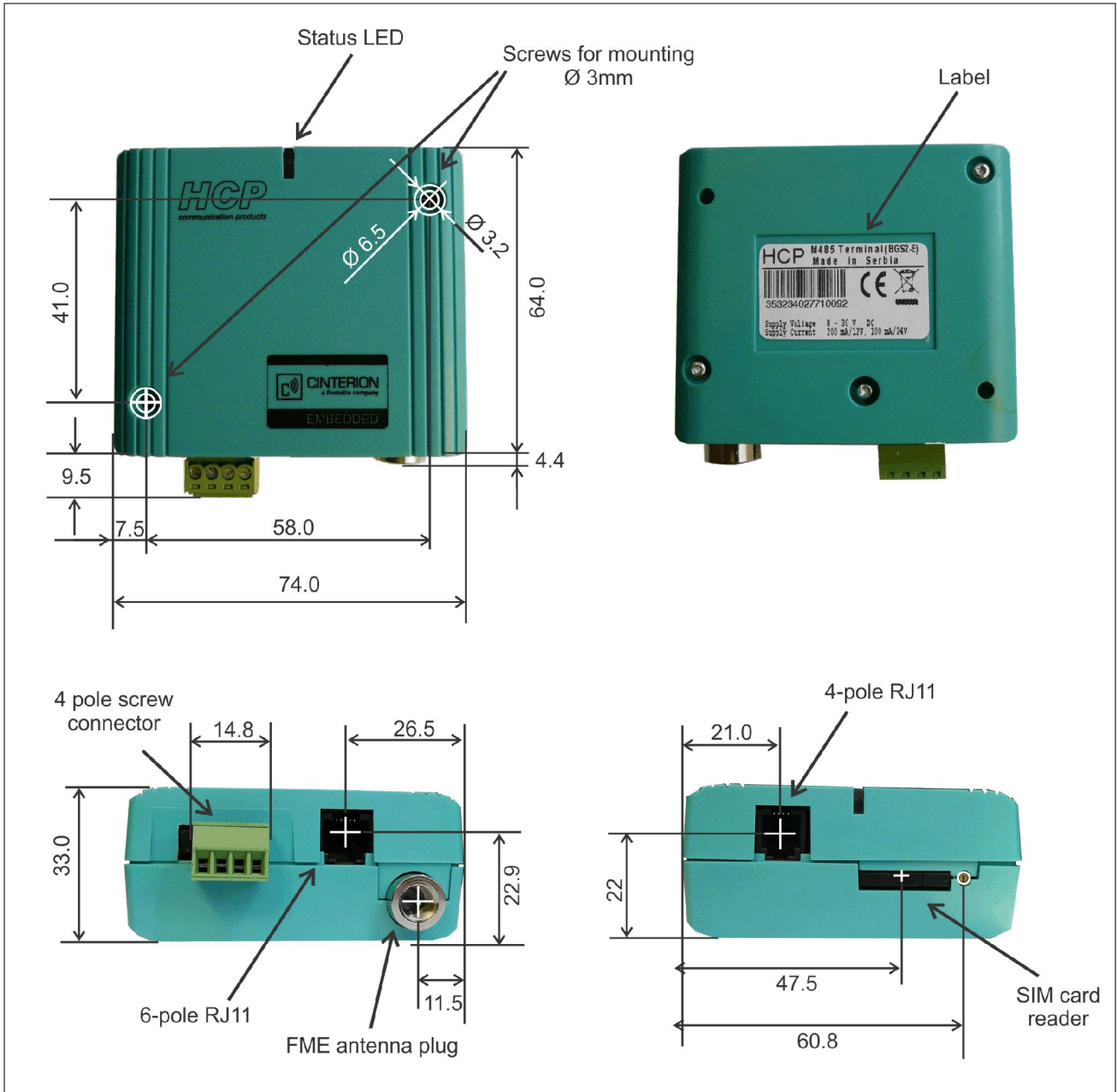


Figure 11. Mechanical characteristics of M485 terminal

6. List of Parts and Accessories








Description	Supplier	Picture
GSM Terminal M485 (BGS2-E/W)	HCP d.o.o	
GSM Terminal M485 (MC55i)	HCP d.o.o	
GSM Terminal M485 (TC65i)	HCP d.o.o	
GSM Terminal M485 (MC75i)	HCP d.o.o	
Power supply (AC/DC 9V/2A)	HCP d.o.o	
FME antenna	HCP d.o.o	
RS232 cable (RJ11 to DB9)	HCP d.o.o	

Table 19. List of part and accessories for M485 terminal



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