



HT910 E Terminal User Manual

Rev. 2.0



Telit Module



GSM & UMTS



Industrial Interfaces



M2M & IoT

Important information

This technical description contains important information for the installation and use of the HT910 E terminal. Read it carefully before you start working with the HT910 E terminal.

We cannot be held responsible for material loss or personal injury that is due to non-compliance with the safety instructions. The warranty will be void in such circumstances.

Telic reserves the right to change the included information without prior notice and does not take responsibility for errors in the document and/or for any missing information.

NOTICE

Please notice that the content of this User Manual only applies to the HT910 E terminal starting with serial number 06301.

Table of Contents

Important information.....	2
1 General Information	6
1.1 Contact for Support	6
1.2 Conventions Used in this Manual	6
1.3 Related Documentation	7
1.4 Abbreviations	7
1.5 Revision History.....	8
2 Product Description	9
2.1 Overview	9
2.2 Identification.....	11
2.3 Physical Dimensions and Weight	11
2.4 Product Features and Technical Data	12
2.5 Telic Certified Accessories.....	14
3 Safety and Product Care	16
3.1 Audience and Intended Use.....	16
3.2 Safety instructions	16
3.3 General precautions.....	17
3.4 SIM card precautions	17
3.5 Antenna precautions.....	18
3.6 Storage Conditions.....	18
4 Electrical Description	19
4.1 Power Connector	19
4.2 Antenna Connector	20
4.3 SIM card reader.....	20
4.4 RS232 Serial Port.....	21
4.4.1 Serial Data	21
4.5 Mini USB Connector.....	21
4.5.1 Analog Input.....	22
4.5.3 Digital Output (Optional)	23
5 Operation	24
5.1 Switch ON the modem.....	24

5.2	Switching OFF the modem	25
5.3	Configuration of the bit rate on the serial interface.....	25
5.4	Power cycle the modem	25
5.5	Using low power mode of the modem	25
5.5.1	Enabling the low power mode	25
5.5.2	Disabling the low power mode by user	26
5.5.3	Disabling the low power mode upon receiving GSM activity	26
5.6	Operating states / green LED	26
5.7	Status LEDs (one yellow, one red).....	27
5.8	Power Consumption.....	27
5.9	Additional Software Configuration	28
5.9.1	Deactivating Antenna Diversity in the Terminal	28
6	Installation of the modem	29
6.1	Where to install the modem.....	29
6.1.1	Environmental conditions	29
6.1.2	GSM Signal strength.....	29
6.1.3	Connection of components to the Terminal.....	29
6.1.4	Network and Subscription.....	29
6.2	How to install the modem	29
6.2.1	Power supply.....	29
6.2.2	Securing the modem	30
6.3	Antenna.....	30
6.3.1	General.....	30
6.3.2	Antenna type.....	30
6.3.3	Antenna placement.....	30
6.3.4	The antenna cable.....	30
6.3.5	Possible communications disturbances	31

Table Overview

Table 1: Abbreviation.....	7
Table 2: Documentation Change Log.....	8
Table 3: Feature Overview.....	13
Table 4: Accessories List.....	15
Table 5: RJ11 Pin and Signals Description.....	20
Table 6: Electrical characteristics of the serial port signals.....	21
Table 3: Sample values on the Analog Input.....	22
Table 7: Operating states of the green LED.....	27
Table 8: Power consumption (in mA) in off, idle and low power modes and during active calls.....	28

Figure Overview

Figure 1: Connector on rear side of the Terminal.....	9
Figure 2: Connectors on front side of the Terminal.....	10
Figure 3: Drawing of the Terminal's Housing.....	11
Figure 4: RJ11 Pin Connector.....	19
Figure 5: Mini USB Type A/B connector for HT910 E and HT910 E USB Powered.....	22
Figure 6: Looping the DSR with DTR pins to permanently deactivate low-power mode.....	25

1 General Information

This User Manual consists of the following chapters:

Chapter	Description
1	General Information provides basic information such as the conventions for the warning levels, applicable related documentations, used abbreviations, a revision history and contact information.
2	Product Description provides a brief overview about the mechanical specification of the product (including size and weight) as well as an overview of the functions and features of the device as well as the available accessories.
3	Safety and Product Care addresses the audience for this manual, the intended use of this device and safety-related information important to read before using the device.
4	Electrical Description describes the electrical characteristics and pin allocation of the device's connectors.
5	Operation provides details relating to the commissioning of the device, including details on activating special features such as the low power mode.
6	Installation of the modem provides important instructions about how to install the device for the M2M application.

1.1 Contact for Support

Please submit your request to TELIC AG customer support using the following online form:

<http://www.telic.de/en/support/support-request>

Information about Telic AG, products and accessories, including FAQs, are available from the following web site: <http://www.telic.de>.

1.2 Conventions Used in this Manual

The following conventions for warning levels are used in this manual:

Warning



Warnings against hazards that may result directly in **serious injuries or death** in case of non-observance.

Caution



Warnings against hazards that may result in **injuries** in case of non-observance.

NOTICE

Warnings against hazards that may result in **material damage** in case of non-observance.

	Indicates that the device can be damaged by electrostatic discharge.
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	This note contains helpful suggestions or references to material not covered in the document.
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1.3 Related Documentation

Please consult the download zone of the Telic AG website for additional documents related to , such as AT command manuals. Note that such type of documents can be accessed online only after you have registered on our website and agreed with our terms of use. Please follow this link to register for a user account:

<http://www.telic.de/en/nda-reg-form>

Use the following link to login if you already have a valid user account:

<http://www.telic.de/en/en-login>

1.4 Abbreviations

Abbreviation	Explanations
CSD	Circuit Switched Data
DCE	Data Circuit Terminating Equipment
DTE	Data Terminal Equipment
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
HR	Half Rate
ME	Mobile Equipment
MT	Mobile Terminated
PDU	Protocol Data Unit
RF	Radio Frequency
SIM	Subscriber Identity Module
SMS	Short Message Service
TA	Terminal Adapter
TE	Terminal Equipment

Table 1: Abbreviation

1.5 Revision History

Revision	Date	Changes
Rev 1.0	1.07.2013	Initial Version
Rev. 1.2	21.03.2014	Update Document Layout
Rev. 1.3	20.01.2015	Addition of section 4.4.1
Rev. 1.4	23.06.2015	Modified section 3.3, added sections 3.4 & 3.6. Safety chapter moved to section 4.
Rev. 1.5	04.07.2016	Updated Table of Contents
Rev. 1.6	07.12.2016	Updated section 1.1
Rev. 1.7	06.02.2017	Updated section 3.6 Power Consumption
Rev 2.0	28.03.2017	Updated structure and layout of the document. Updated content of low power mode and power consumption sections. Note: This document only applies to HT910 E terminal with serial number starting with 06301.

Table 2: Documentation Change Log

2 Product Description

NOTICE

Please notice that the content of this User Manual only applies to the HT910 E terminal starting with serial number 06301.

2.1 Overview

The pictures below shows the mechanical design of the HT910 E terminal along with the positions of the different connectors and mounting holes. The HT910 E terminal case is made of durable PC/ABS plastic.

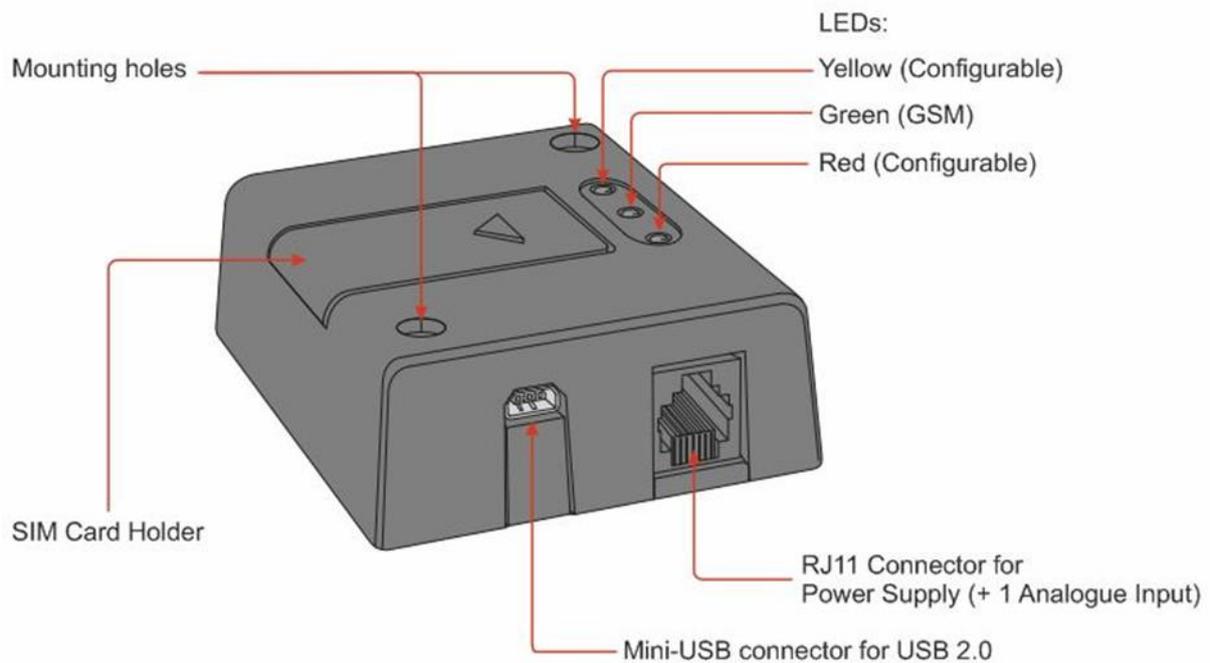


Figure 1: Connector on rear side of the Terminal

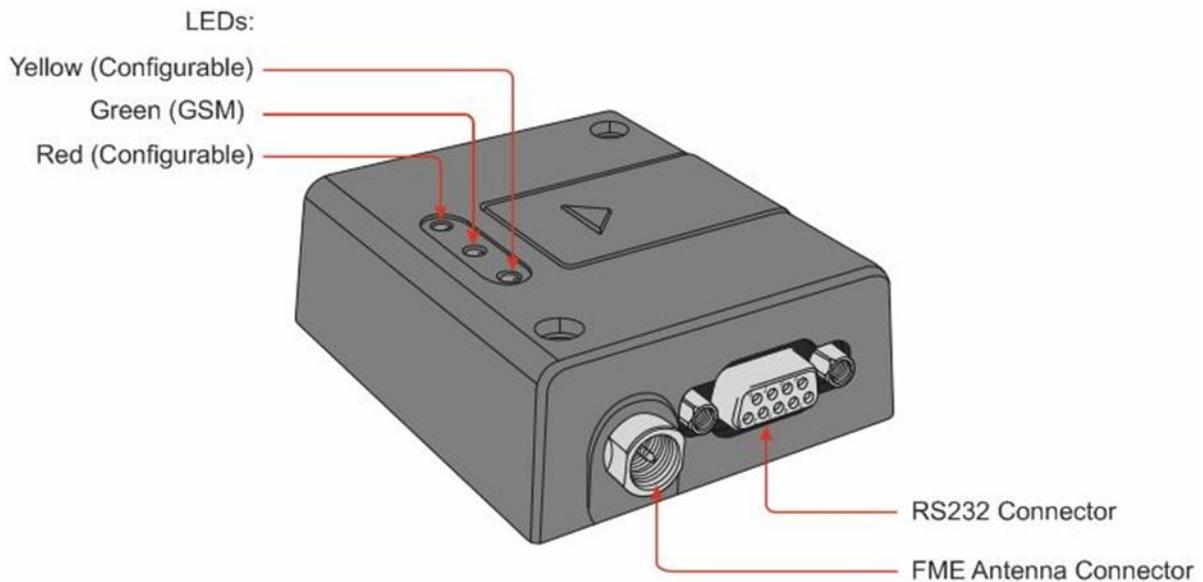


Figure 2: Connectors on front side of the Terminal

Please note the following:

- The terminal can be securely fitted into your application by using the mounting holes positioned at the two corners of the device.
- The SIM card can be inserted into the modem without the need for any tools.
- Section 4 Electrical Description“2. Electrical Description” describes the pins and electrical characteristics or of the modem’s terminal’s various connectors are described in
- Section 4.2 Antenna Connector“2.3 Antenna Connector” provides information about the antenna connector is found in “2.3 Antenna Connector”



Special DIN Rail Mounting Brackets (Art-nr. 12304 or Art-nr. 12305) is available as an accessory item which allows installation of the modem in industrial environments using DIN Rails. For more details of our accessories please check chapter [2.5 Telic Certified Accessories.](#)

2.2 Identification

On the bottom of the device, you will find the type label.



Label	Description
S/N	Serial number ¹
	Serial number
IMEI	International Mobile Equipment Identity
FW	firmware version
HW-Rev.	Hardware Revision Number + Production date
Input	Supply Voltage Range
	CE conformity mark
	Disposal in accordance with European Directive 2002/96/CE

2.3 Physical Dimensions and Weight

Overall dimensions: 77 x 67 x 26 mm
Weight: 91g

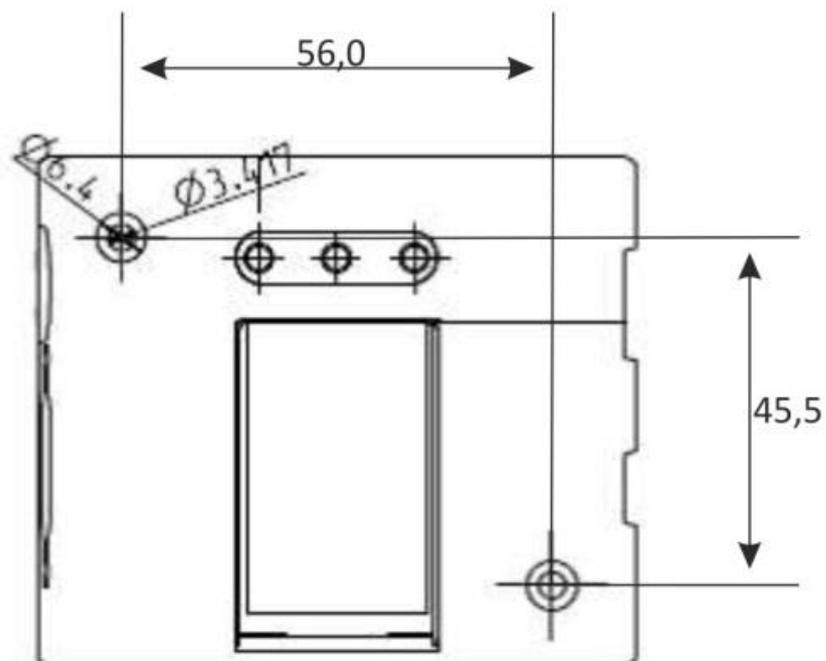


Figure 3: Drawing of the Terminal's Housing

¹ Note that the serial number consists of a 4-digit product ID followed by the device's IMEI.

2.4 Product Features and Technical Data

NOTICE

Telic AG may, at any time and without notice, make changes or improvements to the products and services offered and / or cease producing or commercializing them.

NOTICE – Optional Features

Features identified as “Optional” in this document **are not assembled** by default. Please contact our Sales Team at <http://www.telic.de/en/contact-us> to clarify the details of ordering terminal variants.

Category	Features	Details
Module Name:	Telit UE910-EUD	
Air Interface	GSM Frequency Bands UMTS Frequency Bands	900 / 1800 MHz 900 / 2100 MHz
	Data	<ul style="list-style-type: none"> ▪ GPRS Class 33 ▪ EDGE Class 33 <ul style="list-style-type: none"> – Max 236.8 kbit/s uplink – Max 296 kbit/s downlink ▪ UMTS 384 kbits uplink/downlink ▪ HSPA category 6 in uplink and up to category 14 in downlink <ul style="list-style-type: none"> – Uplink HSUPA 5.76Mbit/s – Downlink Up to 7.2 Mbit/s
	Output Power	Class 4 (2W) for GSM900 Class 1 (1W) for GSM1800 Class E2 (0.5 W, 27 dBm) for EDGE 900 Class E2 (0.4W, 26 dBm) EDGE 1800 Class 3 (0.25W, 24 dBm) for UMTS
	SMS	Point-to Point mobile originated and mobile terminated SMS Concatenated SMS supported SMS cell broadcast Text and PDU mode
	CSD	Non-transparent circuit switched data: up to 9,6 kbps
Hardware Features	Memory	2 MB RAM / 5MB Flash
	SIM Card Holder	1x (1,8/3 Volt)
	LEDs	1 GSM / UMTS status + 2 configurable
	Type Approvals	CE
Connectors	D-Sub (9-pin)	1x Female (RS232)
	USB	1x Mini-USB (USB 2.0) Also the power connector for USB powered variant.
	RJ11	6-way (power/IO connector) – Not connected for USB powered variant
Interfaces / Connectors	Antenna	1x (FME Male)
	RS232	1x (Sub-D9 Female)
	USB 2.0	1x (Mini-USB)

Category	Features	Details
	Analog Inputs	1x (RJ11 connector)
	Outputs	1x (RJ11 connector, optional)
Software	AT Command Set	AT Command Set: Hayes Compliant, TS 27.005, 27.007 and Telit custom AT
	Programming Language	Python
	SIM Application Toolkit	SAT Release 99
	TCP/IP Stack	TCP, UDP, ICMP, HTTP, DNS, FTP, SSL, SMTP
	SW Update	Serial / USB / FOTA
Power Management	Voltage Range	5V - 32V
Hardware Characteristics	Operating Temperature	-30°C to +80°C
	Dimensions	77x66x26 mm
	Weight	91g

Table 3: Feature Overview

2.5 Telic Certified Accessories

NOTICE

The pentaband antennas listed in this section are suitable both for use with GSM and UMTS networks. Please check, though, which frequency bands your mobile network service provider supports specifically for UMTS Cat-1. Eventually, you might need to purchase a dedicated antenna to cover the 2600 MHz band. Please contact us if you require specific recommendations on suitable antennas to use.

Art-Nr.	Description	
Antennas		
12020	Patch Antenna; FME female connector, self-adhesive, waterproof, GSM: 900, 1800, 1900 MHz; UMTS: 2100 MHz	
12021	Magnetic Antenna; FME female connector, GSM: 900, 1800 MHz, UMTS: 2100 MHz	
12019	Stub Antenna; FME female, GSM: 900, 1800 MHz; UMTS 2100 MHz	
12016	Rectangular Antenna; FME female, GSM: 900, 1800 MHz; UMTS: 2100 MHz	
12006	Roof-mount antenna; FME female waterproof, 900, 1800, 1900, 2100, 2400 MHz	
Others		

Art-Nr.	Description	
12004	RS232 cable (V.24 compliant); 1.5m for PC connection	
12304	Mounting Bracket for DIN Rail; Terminal Mounting bracket for DIN Rail (rectangular)	
12305	Mounting Bracket for DIN Rail; Terminal Mounting bracket for DIN Rail (straight)	
12002	Power supply 230V AC / 12 VPC; 6pin RJ11 connector	
12003	Power cable; 6pin RJ11 connector with open ends; 1.5 m	
12301	Mini USB cable ~ 0.6 m	
12302	USB-A to Mini USB cable ; 1.0 m	

Table 4: Accessories List

Please contact your distributor or Telic AG for availability or check Telic's webpage <http://www.telic.de>.

3 Safety and Product Care

This device has been designed in accordance with industrial standards, manufactured with utmost care using high-quality materials, and thoroughly tested. Nevertheless, its use may constitute a risk to persons or cause material damage.

The following safety instructions must be followed to ensure the safety of users and of the device.

NOTICE

If these instructions are ignored, Telic AG will not assume responsibility for any damages that are incurred. Telic AG may refuse warranty claims where evidence of product misuse is found.

Please read the information in this section and the information in Section 6 Installation of the modem before starting your integration work!

3.1 Audience and Intended Use

This terminal product is targeted towards system integrators who need to add a wireless communications link to their M2M / IoT application to capture data from the application as well as to remotely control that application. Any other use is not intended.

3.2 Safety instructions

PLEASE READ THESE SAFETY INSTRUCTIONS AND KEEP A COPY OF THEM.

The HT910 E terminal contains highly integrated components which can be damaged by electrostatic discharge if the user would open the housing.



Therefore, only touch the HT910 E terminal on the housing or connectors and avoid touching the components on the board.

- Always ensure that the use of the modem is permitted. The modem may present a hazard if used in the proximity of personal medical electronic devices. As a rule, the modem must not be used in hospitals, airports or planes.
- Never use the modem at a gas station, refueling point, blasting area or in any other environment where explosives may be present.
- Operating the modem close to other electronic devices, such as antennas, television sets, and radios may cause electromagnetic interference.
- This product is intended to be used with the antenna or other radiating element at least 20 cm away from any part of the human body. In applications where this rule cannot be applied, the application designer is responsible for providing the SAR measurement test report and declaration.
- You are responsible for observing your country's safety standards, and where applicable, the relevant wiring rules.

Warning



When using products which are exposed to electric voltage the valid regulations have to be observed.

Always make sure that the device is disconnected from the power supply before opening it.

You should only use tools on components, modules or devices if they are disconnected from the power supply and the electric charge, which may still be stored in some components inside the device, has been discharged.

All cables and wires which are energized and connected to the device, the module or components must be checked regularly for any damage of the isolation shield or fractures of the cables. If the supply cables are visibly damaged the device must be taken out of operation immediately until the faulty cable has been replaced.

When using components or modules, the specification given in the corresponding description of these components must strictly be observed. The device shall be operated only by appropriately qualified personnel.

This device shall only be used for its intended purpose.

Please note that we are not responsible for any errors in usage of wireless connections. Therefore, we cannot accept any responsibility for consequential loss.

In case measurements with the opened housing are necessary, an isolating-transformer must be integrated for safety reasons. Alternatively, the voltage can be supplied by an appropriate power supply which complies with the safety regulations. All wiring work must be done in a voltage free state only.

3.3 General precautions

The HT910 E terminal as a stand-alone item is designed for indoor use only. To use outside it must be integrated into a weatherproof enclosure. Do not exceed the environmental and electrical limits as specified in Section 2.4 Product Features and Technical Data.

- Avoid exposing the modem to lighted cigarettes, naked flames or to extreme hot or cold temperatures.
- Never try to dismantle the modem yourself. There are no components inside the modem that can be serviced by the user. If you attempt to dismantle the modem, you will invalidate the warranty.
- The HT910 E terminal must not be installed or located where the surface temperature of the plastic case may exceed 80°C.
- All cables connected to the HT910 E terminal must be secured or clamped, immediately adjacent to the modem's connectors, to provide strain relief and to avoid transmitting excessive vibration to the modem in the installation.
- Ensure the cables, supplying power, and input cable to the HT910 E terminal do not exceed 3 meters.
- To protect power supply cables and meet the fire safety requirements when the unit is powered from a battery or a high current supply, connect a fast 1.25A fuse in line with the positive supply.
- Do not connect any incompatible component or product to the HT910 E terminal.

3.4 SIM card precautions

Before handling the SIM card in your application, ensure that you are not charged with static electricity. Use proper precautions to avoid electrostatic discharges.

When the SIM card hatch is opened, the SIM card connectors lie exposed under the SIM card holder.



Caution! Do not touch these connectors! If you do, you may release an electrical discharge that could damage the modem or the SIM card.

When designing your application, the SIM card's accessibility should be considered. We always recommend that you have the SIM card protected by a PIN code. This will ensure that the SIM card cannot be used by an unauthorized person.

3.5 Antenna precautions

Consider the risk of lightning in case the antenna is to be mounted outside. Follow the instructions provided by the antenna manufacturer.

NOTICE

Please note that this UMTS device is designed for use with one single antenna only. It does not support antenna diversity.

- Never connect more than one modem to a single antenna. The modem can be damaged by radio frequency energy from the transmitter of another modem.
- Like any mobile station, the antenna of the modem emits radio frequency energy. To avoid EMI (electromagnetic interference), you must determine whether the application itself, or equipment in the application's proximity, needs further protection against radio emission and the disturbances it might cause. Protection is secured either by shielding the surrounding electronics or by moving the antenna away from the electronics and the external signals cable.
- The modem and antenna may be damaged if either come into contact with ground potentials other than the one in your application. Beware, ground potential is not always what it appears to be.

3.6 Storage Conditions

The following environmental limits must be maintained in order to safely store the terminal and ensure that it remains functional until a maximum of 12 months:

- Storage temperature: from 5°C to 35°C
- Humidity: <75% relative humidity.

4 Electrical Description

The modem uses the following standard connectors:

- RJ11:
 - Power: 5 – 32 Volt / DC (ADC)
 - 1 analogue Input
 - 1 digital Output (optional)
- Mini USB Interface
- SIM card reader: 3V interface
- FME male coaxial jack (antenna connector)
- Sub-D female socket, 9 pin (RS232 serial port)

4.1 Power Connector

An RJ11 6-way connector, as shown and described below, serves as a means of supplying and controlling DC power to the modem. The use of an external power supply is necessary as the USB port is not intended to be used as power source.²

The supply voltage VCC required by the modem is 5V - 32V DC. Please note that applying the supply voltage does not switch the modem on. To do so an additional active-high control signal, TO_IN, must be applied for > 1 second.

Please see chapter 5.1 Switch ON the modem for further important details about TO_IN and power supply requirements, especially if TO_IN is applied in parallel to VCC.



VCC and GND are reverse-polarity and over-voltage protected as long as the antenna interface and the user's application are not used or connected to separate grounds.

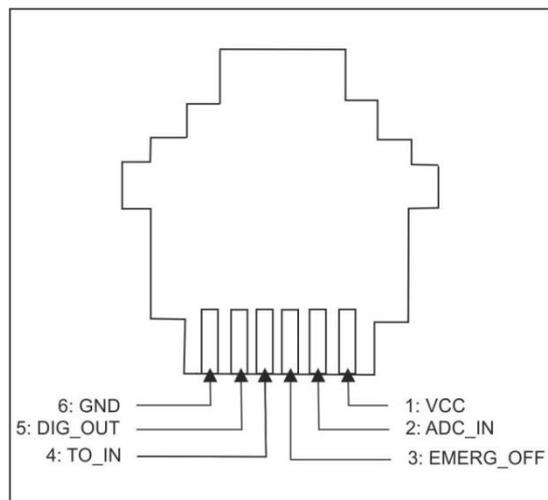


Figure 4: RJ11 Pin Connector

PIN	Signal	Direction	Limits	Description
1	VCC	Input	5 – 32V	Positive power input, DC

² This Statement does not apply to the USB Host Powered version of the HT910 E.

PIN	Signal	Direction	Limits	Description
2	ADC_IN not connected	Input	0-32V	Analogue Input
3	HR_IN	Input	5 – 32V	Active high control line used to switch off the terminal $V_{IH} > 5V$, $V_{IL} < .5V$ Power off: $t > 5s$
4	TO_IN	Input	5 – 32V	Positive edge triggered signal; used to switch on the modem $V_{IH} > 5V$, $V_{IL} < 0.5V$ Power on: $t > 1s$ after VCC available V_{IH} = Voltage Input high V_{IL} = Voltage Input low
5	DIG_OUT	Output	5 - VCC	(Optional) Digital Output VCC, max. 400 mA
6	GND	Input	-	Negative power (ground) input and return path for TO_IN and HR_IN

Table 5: RJ11 Pin and Signals Description

4.2 Antenna Connector

The antenna connector on the modem is assembled with an FME male coaxial jack. The customer-selected antenna should fulfil the following requirements:

- Frequency range: Depending on the frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s)
- Bandwidth:
 - 80 MHz in GSM / 900 MHz
 - 170 MHz in DCS / 1800 MHz
 - 250 MHz in UMTS Band 1 / 2100 MHz
 - 80 MHz in UMTS Band 8 / 900 MHz
- Impedance: 50 Ohm
- Antenna Gain: > 1.5 dBi
- Input Power:
 - 33dBm(2 W) peak power in GSM
 - 24dBm Average power in UMTS
- VSWR absolute max.: $\leq 10:1$ (limit to avoid permanent damage)
- VSWR recommended $\leq 2:1$ (limit to fulfill all regulatory requirements)
- Length of the antenna cable: <3m

4.3 SIM card reader

The terminal is fitted with a SIM card reader designed for 1.8V and for 3V SIM cards. It is the flip-up type which is lockable in the horizontal position and is accessed through a removable panel.

4.4 RS232 Serial Port

The modem supports a standard RS232 serial interface via its 9 pin Sub-D connector, shown below. In line with serial communication terminology the terminal should be considered as the data circuit-terminating equipment (DCE) and the external application or computer as the data terminating equipment (DTE). The maximum baud rate to communicate with the HT910 E terminal is 921,6 kbit/s.

PIN	Signal	Direction	Limits	Description
1	DCD	Output	> + 4V < - 4 V	Data carrier detect
2	RD	Output	> + 4V < - 4 V	Received data
3	TD	Input	> + 2,4V < 0.8 V	Transmitted data
4	DTR	Input	> + 4V < 0.8 V	Data terminal ready
5	GND	-	0 V	Ground connection
6	DSR	Output	> + 4V < - 4 V	Data set ready
7	RTS	Input	> + 2,4V < 0.8 V	Request to send
8	CTS	Output	> + 4V < - 4 V	Clear to send
9	RI	Output	> + 4V < - 4 V	Ring indicator

Table 6: Electrical characteristics of the serial port signals

4.4.1 Serial Data

The modem supports the standard data character format of

- Programmable baud rate
- Auto-configuration mode with auto-baud.

4.5 Mini USB Connector

Figure 5: Mini USB Type A/B connector gives an overview about the PIN Assignment of the Mini USB connector from the Standard HT910 E terminal and also of the USB Powered version (host powered). The Pin Assignment of the two versions is the same.

The modem supports a standard USB 2.0 Full Speed slave interface to receive AT-commands as well as data transmissions.

Drivers for Windows Desktop, Windows CE Embedded and instructions for Linux are available for download from the Telic AG website (for registered users only).

HT910 E

The HT910 E uses the USB connector for data communication but requires the use of the power connector to power the device.

HT910 USB Powered

The HT910-USB powered variant is powered directly from the USB connector via a standard 5V USB interface.

You will find the version of your HT910 on the label at the bottom of the device.

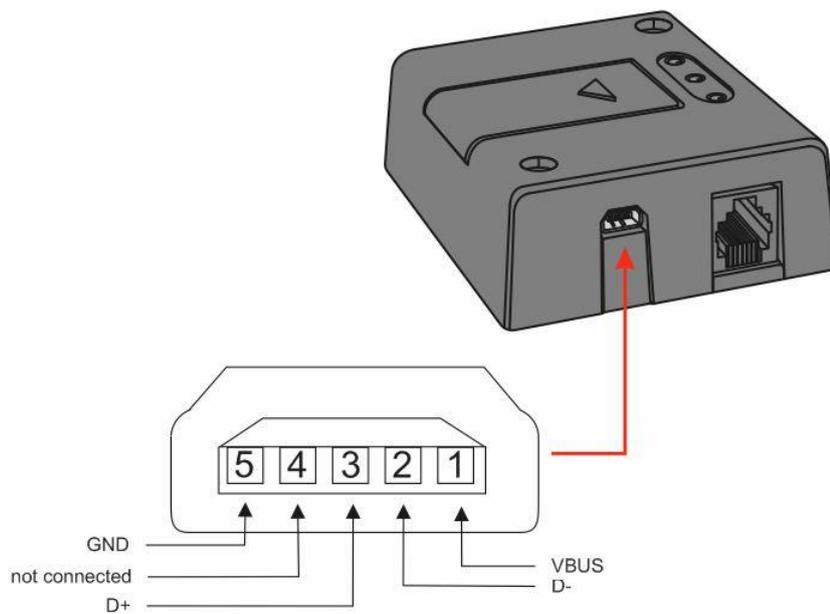


Figure 5: Mini USB Type A/B connector for HT910 E and HT910 E USB Powered

4.5.1 Analog Input

The following command must be used to initialise and to read the status of the analogue input:

AT#ADC=1,2,0 or AT#ADC=1,2

Response:

#ADC: <digital value> e.g. #ADC: 119

$ADC_IN \approx 0,033333V \times \text{digital value}$

ADC_IN [V]	5V	12V	24V	32V
digital value	150	360	720	960

Table 7: Sample values on the Analog Input

4.5.3 Digital Output (Optional)

- switched voltage is VIN; high side switch
- max. Output 400mA
- short circuit protected
- ESD protected
- under full control of the external embedded application

The following command has to be used to initialize and to set the digital output:

AT#GPIO=6,1,1 output switched on

AT#GPIO=6,0,1 output switched off

5 Operation

5.1 Switch ON the modem

NOTICE

To ensure correct operation of the terminal, please ensure that a SIM Card has been inserted into the terminal prior to switching it on.

Do not insert a SIM card into the device while it is switched on. If you find out that the device is switched on but missing a SIM card, first switch off the modem and then insert the SIM card. Note that the device does not have a SIM card detect feature.

There are two ways to switch on the modem, once power is applied:

- assert TO_IN to high level for > 5s
- activate the RS232 control line DTR for >0.2s

The modem is fully operational after 4 seconds. Logging onto a network may take longer than this and is outside the control of the modem. The modem can be configured to start up at the time power is applied by permanently tying power connector signals TO_IN (pin 4) and VCC (pin 1) together.



DTR must be cycled from low to high.



The TO_IN signal requires a positive “edge” (a sharp” signal transition from low to high) to turn the modem on. This transition should be a rising signal from 0V (GND) to VCC, or at least a large fraction of that voltage range, and must be applied at the same time as VCC or after it.

Very slow transitions (significantly slower than many milliseconds) or very small transitions (e.g. only few volts instead of 0V to VCC) will not turn on the module (since they are not considered to be a “positive edge”).

Although this will not be an issue in almost all typical applications of the modem, there are a few cases in which the modem might not recognize the power up signal. This is no failure of the modem itself, the same would apply to almost any electronic device that provides a separate “power on” or “reset” signal.

Possible cases are the following:

- Large capacitors in your power supply which will lead to slow leading and falling edges (issue does not apply with modern stabilized switching regulator power-adaptors) AND TO_IN tied in parallel to VCC (instead of separate dedicated digital signal)
- Slow analogue signals used to assert TO_IN
- TO_IN signal not before VCC

If you are in doubt, please

- Use the mains power adapter that is provided by your distributor and is known to work properly with your modem.
- Make sure that your signal and system design is according to the above.
- Consult our support team that will be more than happy to assist you.

5.2 Switching OFF the modem

There are two ways to switch off (power down) the modem as described below:

- use the AT#SHDN command; DTR permanently to low (0,8V)
- HR_IN to high level for $t > 5s$

A delay of up to 10s is experienced as the modem logs off the network

5.3 Configuration of the bit rate on the serial interface

Please note that the module used in the terminal does not support autobauding. The configured data rate is 115200 baud.

5.4 Power cycle the modem

There are two ways to switch off (power down) the modem as described below:

- EMERG_OFF to high level for $t > 1s$ on the RJ11 connector
- Turn off, or disconnect the power supply.

5.5 Using low power mode of the modem

The HT910 E terminal supports a special ultra-low power mode which can be activated or deactivated by sending dedicated AT commands, which are described further below in this section. Please refer to Section **Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden.** for detailed power consumption values.

Activating the low power mode can also deactivate the RS232 Transceiver, which helps further reduce the power consumption. In some scenarios, however, this may not be desirable, as it may lead to data loss. Therefore, the following preconditions for using the low power mode need to be considered:

- There are no special precautions required when using a serial interface that is fully compliant with the RS232 specification (V.24) both on the DTE and DCE. You can proceed as described in the following sub-sections.
- If the DTR line is not available on the DTE (the M2M application), and you do not need to use the low power mode, then the DSR pin on DCE side should be looped with the DTR pin, as shown in the figure below. With this approach, the ultra-low-power mode will be permanently disabled.

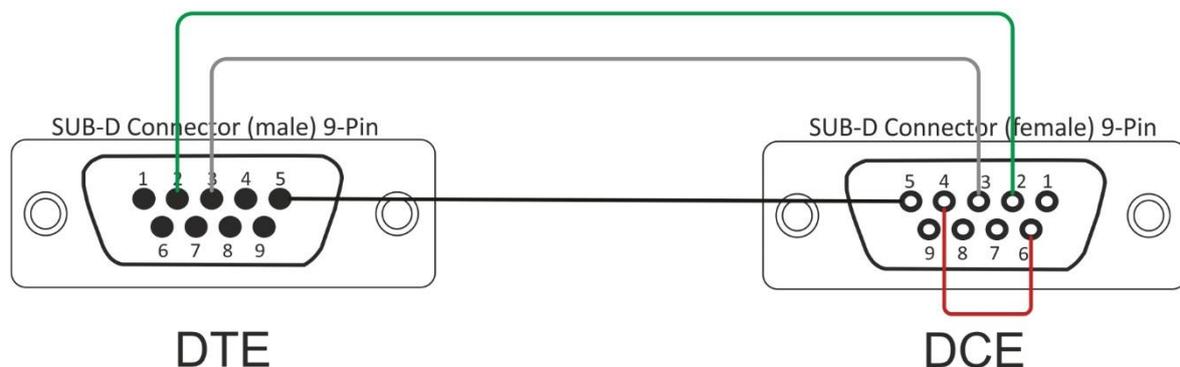


Figure 6: Looping the DSR with DTR pins to permanently deactivate low-power mode.

5.5.1 Enabling the low power mode

- Wait until the GSM/UMTS module is logged onto the GSM/UMTS network
- Send the AT command AT+CFUN=5 (section 5.1.4.4.2 of the AT command manual)

- Set the DTR control line from High level to Low level
- When the DTR line is Low, the user application is not ready to operate and the module enters power saving mode

NOTICE

Enabling low power mode as described herein also deactivates the RS232 transceiver!

5.5.2 Disabling the low power mode by user

- Set the DTR control line from Low to High.
- Low-power mode should be exited automatically. After sending DTR from Low to High, the module doesn't save power, but the module is saving power again after setting DTR from High to Low.
- The RS232 transceiver is activated immediately.
- AT channel is available immediately after changing DTR from Low to High.
- Send AT command "AT+CFUN=1" to remain in normal mode.

5.5.3 Disabling the low power mode upon receiving GSM activity

- Pre-requisite: the RING line must be connected between DTE and DCE for this function to work. The RING pin is used to indicate incoming SMS or calls.
- The DTR control line is still at a low level.
- GSM module is called or receives an SMS.
- Low-power mode should be exited automatically, if calling or sending an SMS to the GSM module.

NOTICE

The user must set DTR line to high in order to activate the RS232 transceiver, this is not done automatically.

5.6 Operating states / green LED

The modem has a green power up LED, as depicted below, which is used to indicate various operating states. These states are described in following table.

Default setting:

- Set alternate GPIO function: at#gpio=1,0,2
- Set alternate Timings: at#sled=4
- Safe configuration: at#sledsav

SLED = 2,50 Operating state of Terminal	green LED state
Device off	Permanently off
Net search / not registered	Fast blinking (period=1s, LED _{on} =0,5s)
Registered full service	Slow blinking (period=3s, LED _{on} =0,3s)
Not registered	Permanently on
Low power mode activated	Permanently off

Table 8: Operating states of the green LED

5.7 Status LEDs (one yellow, one red)

The red and yellow Status LEDs are under control of GPIO1 and GPIO2 of the HT910 modem inside the Terminal. They can be controlled via AT commands. The default status of these two LEDs is off. The following commands must be used to initialize and to configure the GPIOs to control the two LEDs:

Switching on red LED at#gpio=2,1,1
 Switching off red LED at#gpio=2,0,1
 Switching on yellow LED at#gpio=3,1,1
 Switching off yellow LED at#gpio=3,0,1

These LEDs can be controlled e.g. by an external microcontroller via AT commands issued to the terminal via the RS232 interface. They can be used to signal any useful status of the external application such as:

- error indication
- status of communication (UMTS, GPRS, SMS, CSD, etc.)
- status of network (to simulate network LED)
- quality of service

5.8 Power Consumption

The following table shows you the power consumption of the Terminal in different modes. Please note the following points:

- The power consumption measurements listed in the table below have been performed over an average of 1 min.
- The LED is active only during active data transmission, i.e. during an active call. It is deactivated while in idle or low power mode. Presumably, there are no active calls in these modes.
- Measurements during active calls have been performed with data transmission over Traffic Channel #62 (TCH=62).
- DTR=open means that the serial interface is not used.
- PL refers to the Power Level used. PL=05 corresponds to maximum transmit power.

Device State	USB connected	DTR	@ 5V	@ 12V	@ 24V	@ 32V
Off (no TO-IN)	No	low	0,1	0,2	0,3	0,4
Idle mode (creg=1)	No	low	25,8	12,1	8,4	7,2
	Yes	open	33,0	15,3	12,0	9,4

Device State	USB connected	DTR	@ 5V	@ 12V	@ 24V	@ 32V
	Yes	low	46,1	21,2	14,6	12,4
Low power mode (cfun=5)	No	low	3,3	1,8	1,6	1,5
	Yes	open	30,0	13,9	11,0	8,7
Active call PL=05	No	high	225	92	49	39
	Yes	open	234	96	53	41
Active call PL=12	No	high	75	33	21	18
	Yes	open	83	36	24	20
Active call PL=19	No	high	55	25	17	15
	Yes	open	64	29	21	17

Table 9: Power consumption (in mA) in off, idle and low power modes and during active calls

5.9 Additional Software Configuration

5.9.1 Deactivating Antenna Diversity in the Terminal

Antenna diversity is a feature which allows the terminal to receive data streams through two separate antennas. This feature is de-activated by default, since the HT910 E terminal supports only one antenna. Please use the following commands to de-activate this feature if it should happen to be activated:

What do you want to do	Send the AT command	Device Response
Check the current setting	AT#RXDIV?	
Antenna Diversity is de-activated		#RXDIV: 0,0
Antenna Diversity is activated		#RXDIV: 1,3
De-Activate Antenna Diversity	AT#RXDIV=0,0	

6 Installation of the modem

This chapter gives you advice and helpful hints on how to integrate the HT910 E terminal into your application from a hardware perspective. Please read the information given in Section 2 Product Description and then read the information in this section before starting your integration work.

6.1 Where to install the modem

There are several conditions which need to be taken into consideration when designing your application as they might affect the modem and its function. They are:

6.1.1 Environmental conditions

The modem must be installed so that the environmental conditions stated in Section 2.4 Product Features and Technical Data, such as temperature, humidity and vibration are satisfied. Additionally, the electrical specifications in Section 2.4 Product Features and Technical Data must not be exceeded.

6.1.2 GSM Signal strength

The modem has to be placed in a way that ensures sufficient GSM signal strength. To improve signal strength, the antenna can be moved to another position. Signal strength may depend on how close the modem is to a radio base station. You must ensure that the location at which you intend to use the modem is within the network coverage area. Degradation in signal strength can be the result of a disturbance from another source, for example an electronic device in the immediate vicinity. More information about possible communication disturbances can be found in section 5.3.5.

When an application is completed, you can verify signal strength by issuing the AT command AT+CSQ. See “AT + CSQ Signal Strength”.



Before installing the modem, use an ordinary mobile telephone to check a possible location for it. In determining the location for the modem and antenna, you should consider signal strength as well as cable length

6.1.3 Connection of components to the Terminal

The integrator is responsible for the final integrated system. Incorrectly designed or installed external components may cause radiation limits to be exceeded. For instance, improperly made connections or improperly installed antennas can disturb the network and lead to malfunctions in the modem or equipment.

6.1.4 Network and Subscription

Before your application is used, you must ensure that your chosen network provides the necessary telecommunication services. Contact your service provider to obtain the necessary information.

- If you intend to use SMS in the application, ensure this is included in your (voice) subscription.
- Consider the choice of the supplementary services

6.2 How to install the modem

6.2.1 Power supply

- Use a high-quality power supply cable with low resistance. This ensures that the voltages at the connector pins are within the allowed range, even during the maximum peak current.
- When the unit is powered from a battery or a high current supply, connect a fast 1.25A fuse in line with the positive supply. This protects the power cabling and modem.

6.2.2 Securing the modem

Before securing the modem take into account the amount of additional space required for the mating connectors and cables that will be used in the application.

- Where access is restricted, it may be easier to connect all the cables to the modem prior to securing it in the application.
- Securely attach the HT910 E terminal modem to the host application using two 3mm diameter pan-head screws.

6.3 Antenna

6.3.1 General

The antenna is the component in your system that maintains the radio link between the network and the modem. Since the antenna transmits and receives electromagnetic energy, its efficient function will depend on:

- the type of antenna (for example, circular or directional);
- the placement of the antenna;
- Communication disturbances in the vicinity of the antenna.

The following sections address issues concerning antenna type, antenna placement, antenna cable, and possible communication disturbances. In any event, you should contact your antenna manufacturer for additional information concerning antenna type, cables, connectors, antenna placement, and the surrounding area. You should also determine whether the antenna needs to be grounded or not. Your antenna manufacturer might be able to design a special antenna suitable for the application.

6.3.2 Antenna type

Make sure that the selected antenna meets the requirements specified in Section 4.2 (“Antenna Connector”).

6.3.3 Antenna placement

The antenna should be placed away from electronic devices or other antennas. The recommended minimum distance between adjacent antennas, operating in a similar radio frequency band, is at least 50cm. If signal strength is weak, it is useful to face a directional antenna at the closest radio base station. This can increase the strength of the signal received by the modem. The modem’s peak output power can reach 2W. RF field strength varies with antenna type and distance. At 10cm from the antenna the field strength may be up to 70V/m and at 1m it will have reduced to 7V/m. In general, CE-marked products for residential and commercial areas, and light industry can withstand a minimum of 3V/m.

6.3.4 The antenna cable

Use 50Ω impedance low-loss cable and high-quality 50Ω impedance connectors (frequency range up to 2GHz) to avoid RF losses. Ensure that the antenna cable is as short as possible. The Voltage Standing-Wave Ratio (VSWR) may depend on the effectiveness of the antenna, cable and connectors. In addition, if you use an adapter between the antenna cable and the antenna connector, it is crucial that the antenna cable is a high-quality, low-loss cable. Minimize the use of extension cables, connectors and adapters. Each additional cable, connector or adapter causes a loss of signal power.

6.3.5 Possible communications disturbances

Possible communication disturbances include the following:

- **Noise** can be caused by electronic devices and radio transmitters.
- **Path-loss** occurs as the strength of the received signal steadily decreases in proportion to the distance from the transmitter.
- **Shadowing** is a form of environmental attenuation of radio signals caused by hills, buildings, trees or even vehicles. This can be a particular problem inside buildings, especially if the walls are thick and reinforced.
- **Multi-path fading** is a sudden decrease or increase in the signal strength. This is the result of interference caused when direct and reflected signals reach the antenna simultaneously. Surfaces such as buildings, streets, vehicles, etc., can reflect signals.
- **Hand-over** occurs as you move from one cell to another in the GSM network. Your mobile application call is transferred from one cell to the next. Hand-over can briefly interfere with communication and may cause a delay, or at worst, a disruption.