



Siretta

Enabling Industrial IoT



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

Hardware User Manual

Rev 2.2



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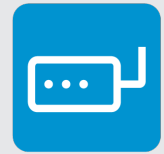
Introduction

This document is intended to provide guidance when adding a modem from the ZETA series to your system.

The ZETA series of GPRS/UMTS/LTE M2M modems are an advanced range of high performance modems developed for easy integration into existing systems and for embedded application development.

The ZETA modem range is based on the Telit xE910 GPRS/UMTS/LTE module series and is available with or without GPS. The modem manages the module power up sequence and can be programmed to perform additional custom tasks.

This document discusses the modems states and modes of operation in addition to the electrical characteristics of the modems interfaces.



About Siretta

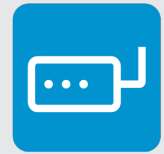
Siretta, located in Reading, United Kingdom have been manufacturing antennas, cable assemblies and cellular modems for over 10 years. We supply our products globally to many of the world's leading organisations.

Whether you require an off the shelf or custom solution, Siretta has a wide portfolio of antenna, RF cable assemblies and modems to fit your application.

Our extensive knowledge and experience in the wireless market allows us to support a wide range of customer applications, focusing on frequencies typically within the 75MHz - 5.8GHz range. These encompass the HF, VHF, ISM, GSM/GPRS/3G/4G and GPS frequencies as well as industrial WLAN and VHF/UHF antenna/Wi-Fi antenna solutions.

With a heavy emphasis on design, we have a team of dedicated Application Engineers and Product Managers, backed up by Field Sales Engineers, who specialise in wireless applications.

We have made significant investments in R&D facilities which boast GPS hardware development equipment and a cellular Pico Cell on site, as well as development software and a comprehensive suite of Industrial, Scientific and Medical band, and non ISM band frequency products. We have many technology partners enabling us to keep at the forefront of the communications industry and offer class leading wireless solutions.



General Description

The ZETA range of GPRS/UMTS/LTE modems are amongst the most versatile modem series available today. The ZETA series offers a range of interface options including USB and RS232 serial port communication, 2 x general purpose inputs, 1 x general purpose output, 2 x general purpose input/outputs as well as 1 x ADC input.

In addition to this, the ZETA series provides a 3.3V reference power supply output to use with external equipment and can be configured to offer 2 independent serial ports into the modem.

The Siretta ZETA series of modems contain a powerful C development environment which reduces redundancy and optimizes the architecture of your solution and lowers system component costs. In a typical integration project, IoT device developers employ a microcontroller to manage the modem functionality and other device peripherals. The Siretta ZETA series integrates Telit IoT AppZone which eliminates the requirement for an external controller, reducing cost and complexity, embedding application code right in the module.

The Siretta ZETA series includes a comprehensive set of high-level enabling functions allowing you to focus on the market-differentiating value-added features of your application software. Reduces time to market and project costs; and when you complete your development, reuse it across different products and technologies to expand your markets and opportunities.

Create a proof of concept in record time and with minimal investment. Leverage robust building blocks to shorten your development cycles through to mass deployment.



Specifications

Table 1. Specifications of the ZETA modem without GPS

	ZETA-N2-GPRS	ZETA-N-UMTS	ZETA-N-LTE
2G frequency band:	B8(900), B3(1800)	B8(900), B3(1800)	B8(900), B3(1800)
3G frequency band:	-	B8(900), B1(2100)	B8(900), B1(2100)
4G frequency band:	-	-	B1(2100), B3(1800), B7(2600), B8(900), B20(800)
Dimensions:	93 x 67 x 28mm	93 x 67 x 28mm	93 x 67 x 28mm
Weight:	104g	104g	104g
Supply voltage:	5 - 42V	5 - 42V	5 - 42V
Operating temperature:	-30 to +80°C	-30 to +80 °C	-40 - +85 °C
Cellular antenna connector:	SMA Female	SMA Female	SMA Female

Table 2. Specifications of the ZETA modem with GPS

	ZETA-G-GPRS	ZETA-G-UMTS	ZETA-G-LTE
2G frequency band:	B8(900), B3(1800)	B8(900), B3(1800)	B8(900), B3(1800)
3G frequency band:	-	B8(900), B1(2100)	B8(900), B1(2100)
4G frequency band:	-	-	B1(2100), B3(1800), B7(2600), B8(900), B20(800)
GPS support:	GPS, Glonass, Galileo	GPS	GPS
Dimensions:	93 x 67 x 28mm	93 x 67 x 28mm	93 x 67 x 28mm
Weight:	107g	107g	107g
Supply voltage:	5 - 42V	5 - 42V	5 - 42V
Operating temperature:	-30 to +80°C	-30 to +80 °C	-40 - +85 °C
Cellular antenna connector:	SMA Female	SMA Female	SMA Female
GPS antenna connector:	SMA Female	SMA Female	SMA Female



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

Table 3. Modem data transfer speeds

Model	Region	Cellular Coverage	GPS Coverage	Max Download	Max Upload
ZETA-N2-GPRS		Global		236.8Kbps	59.2Kbps
ZETA-G-GPRS		Global	Global	236.8Kbps	59.2Kbps
ZETA-N-UMTS		Global		21Mbps	5.76Mbps
ZETA-G-UMTS		Global	Global	21Mbps	5.76Mbps
ZETA-N-UMTS	(EU)	(Europe)		7.2Mbps	5.76Mbps
ZETA-G-UMTS	(EU)	(Europe)	Global	7.2Mbps	5.76Mbps
ZETA-N-LTE	(EU)	(Europe)		100Mbps	50Mbps
ZETA-G-LTE	(EU)	(Europe)	Global	100Mbps	50Mbps

NOTE - For part numbering and ordering information see [page 14](#)



AT Commands

The ZETA range of wireless modems has a cellular engine at its heart which can be controlled via the serial interface using standard AT commands.

The AT command is an ATTENTION command and is used as a prefix to other parameters in a formatted string. The AT command combined with other parameters can be sent to the modem with your preferred terminal emulator package (TMSTerm/TeraTerm/HyperTerminal) and typed in manually as a command line instruction.

The wireless module is compliant with the following AT command formats:

- 1) Hayes standard AT command set, in order to maintain the compatibility with existing SW programs.
- 2) 3GPP 27.007 specific AT command and GPRS specific commands.
- 3) 3GPP 27.005 specific AT commands for SMS (Short Message Service) and CBS (Cell Broadcast Service)
- 4) FAX Class 1 compatible commands
- 5) Proprietary command set, the module family also supports a proprietary set of AT commands for special purposes outside of the standard AT specification.

To obtain the latest AT command reference guide* with a full list of supported AT commands, please contact your Siretta representative or alternatively visit:

www.siretta.com

NOTE - This following document refers to useful AT commands throughout and offers descriptions of how to use the AT commands with the ZETA wireless modems.

*For GPRS modems refer to the GPRS AT Command Manual, for UMTS modems refer to the UMTS AT Command Manual, for LTE modes refer to the LTE AT Command Manual.



ZETA Interface

Standard Hardware Interfaces

The ZETA series modem comes with the following interfaces:

- » 1 x RS232 serial port interface for direct serial connection to module
- » 1 x RJ12 power connection with 2 power lines (5 - 42V) and 4 input interfaces
- » 1 x SMA female cellular antenna connector
- » 1 x SIM card reader (push-push)
- » 3 x external LED status indicators (Blue, Red, Green)
- » 10-Way connector
 - 1 x wired (10-way) RS232 debug port for direct serial connection to module
 - 1 x wired (10-way) 3.3V power supply output interface
 - 1 x wired (10-way) 12-bit ADC interfaces (42V tolerant)
 - 2 x wired (10-way) general purpose input interfaces
 - 1 x wired (10-way) general purpose output interface
 - 2 x wired (10-way) general purpose input/output interfaces



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

Optional Modem Features*

Optional Hardware

The ZETA series modems have the following optional hardware features:

- » 1 x SMA female GPS/GNSS antenna connector

Optional Technologies

The ZETA series modems have the following optional technologies available:

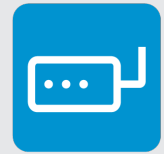
- » GPRS (2G)
- » UMTS (3G)
- » LTE (4G)

Optional Coverage

The ZETA series modems have the following coverage options available:

- » (EU) European Union
- » (NA) North America
- » (GL) Global

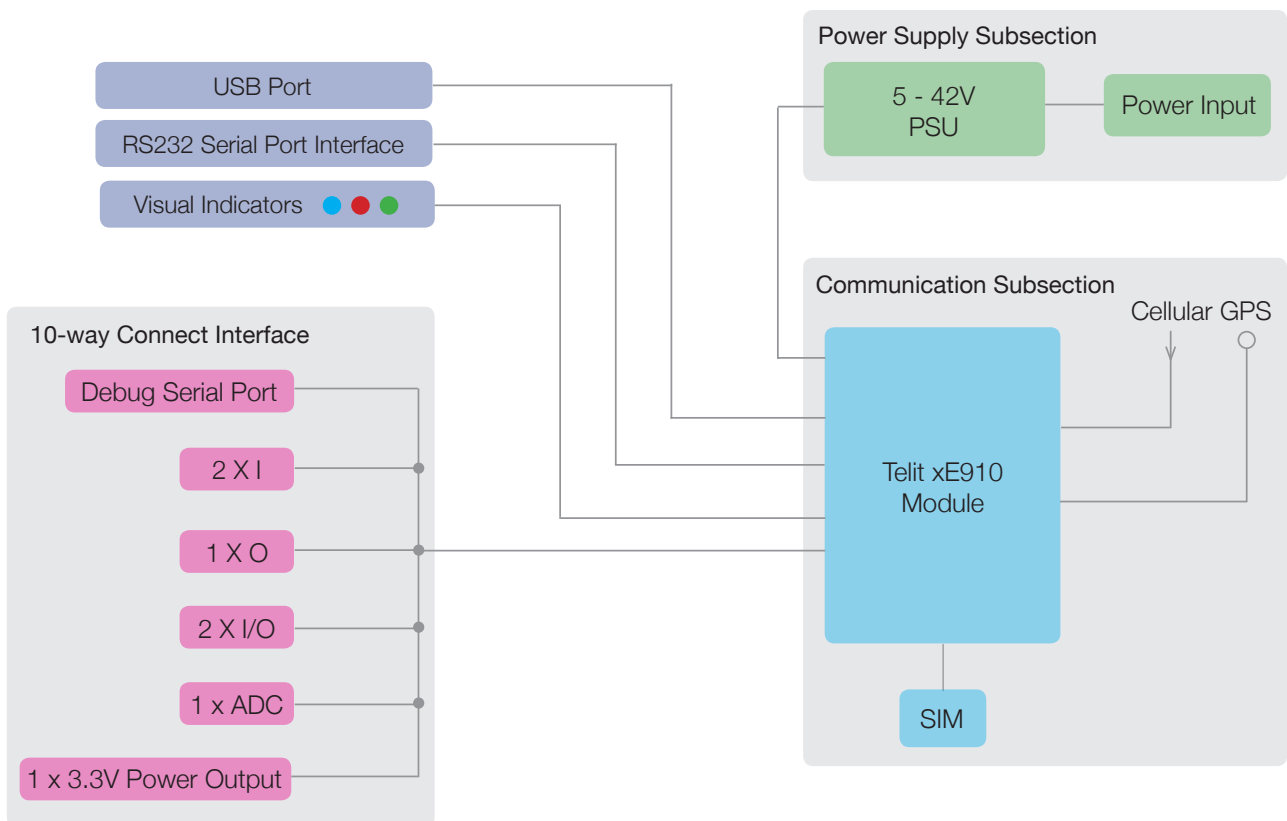
*To add optional features on your modem, see ordering Information on [page 14](#)



System Diagram

The ZETA series is a versatile range of modems offering multiple communication channels and interfaces to connect into other systems. The system diagram below gives a visual representation of the ZETA interfaces available to the user and shows the various subsections which make up the complete ZETA modem.

Figure 1. ZETA system diagram





System Overview

This ZETA can be used in a number of applications, some examples are shown below:

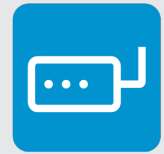
- » GPIO Monitor (Monitor/Set and report on GPIO status)
- » Standard RS232 modem attached to existing equipment (PC/MAC/Server etc.)

Typically connected devices are:

- » PC/MAC/Linux platforms for use as modem
- » Embedded (connected directly to remote equipment without a PC attached)

Operating System Connected Modem

- » Internet enable a remote device with RS232 connectivity over 2.5G/3G/4G. Internet connectivity can be retrofitted to end equipment without changing the software or configuration of the remote device.
- » Used in countries or places where broadband and WiFi is a less common method to connect to the internet or where services are unavailable. The ZETA modem can overcome this restriction by providing a mobile internet solution over the GPRS/UMTS/LTE network.



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

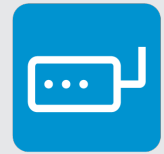
Examples:

- » Vending machine where the head office would poll for drinks remaining/money taken etc. This would be an on-demand pull to obtain results in real time.
- » Monitoring AMR/temperature/equipment in a home, i.e. Interrogate lights etc.
- » Monitoring GPIO, i.e. Open doors/windows
- » Remote entry system, i.e. Send a message to the modem to open a gate/door to allow access.
- » Streaming live data from remote system to a central location
- » Remote printing applications (remotely print over the GPRS network)
- » Polling remote devices for information to prevent an engineer callout

Modes of Operation

USB Interface

This is a USB standard Communication Device Class (CDC) device. A device driver is available for Windows OS. Linux uses standard CDC ACM drivers. Please contact your siretta representative for more information.



Ordering Information

ZETA - XX - XXXX (XX)

Modem Identifier

ZETA = Siretta Modem with GPIO

Module Type

N = Revision 1 without GPS
 N2 = Revision 2 without GPS
 G = Revision 1 with GPS

Product Module Version

GPRS = GPRS Technology
 UMTS = UMTS Technology
 LTE = LTE Technology

Coverage Options

(EU) = European Coverage
 (NA) = North American
 (GL) = Global Coverage

Part Numbering Examples

- » ZETA-N2-GPRS = GPRS Modem with GPIO, without GPS
- » ZETA-G-UMTS (GL) = Global Coverage UMTS and GPS Modem with GPIO
- » ZETA-G-LTE (EU) = EU Coverage LTE and GPS Modem with GPIO

Dimensions

All dimensions are shown in mm. The mounting holes are suitable for a M3 fixing screwing. These drawings are relevant for the entire ZETA series modems.

Figure 2. ZETA modem GPIO 10-way connector, SIM holder and LED indicator view - dimensions

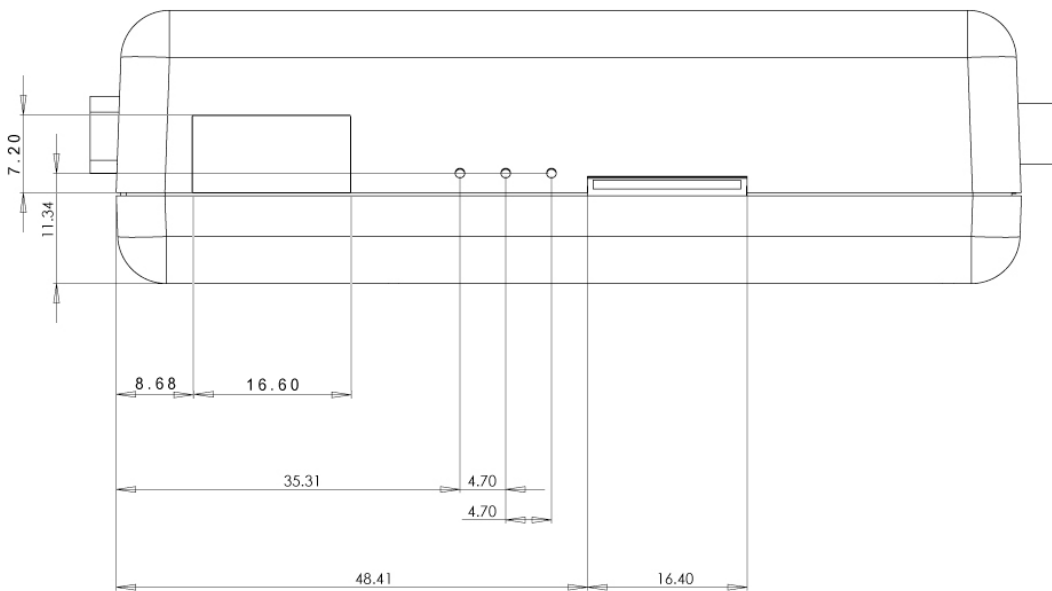
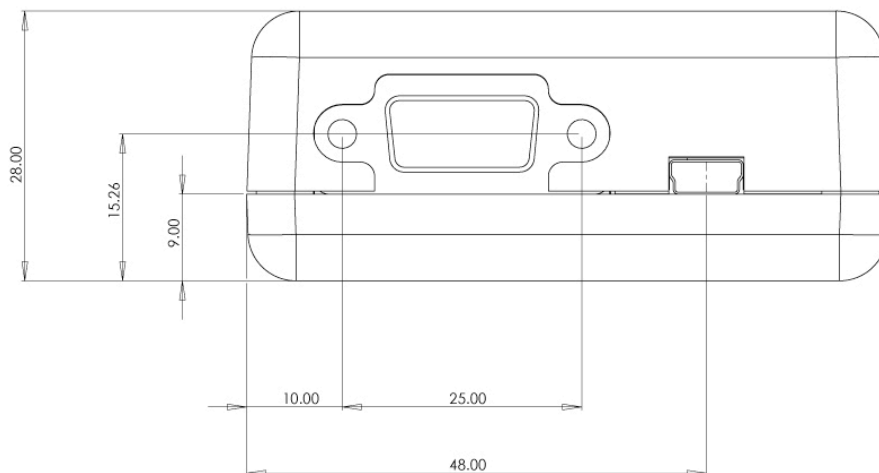


Figure 3. ZETA modem serial connector view - dimensions



ZETA-N Modems

All dimensions are shown in mm. The mounting holes are suitable for a M3 fixing screwing. These drawings are relevant for the ZETA-N modems.

Figure 4. ZETA-N modem top view - dimensions

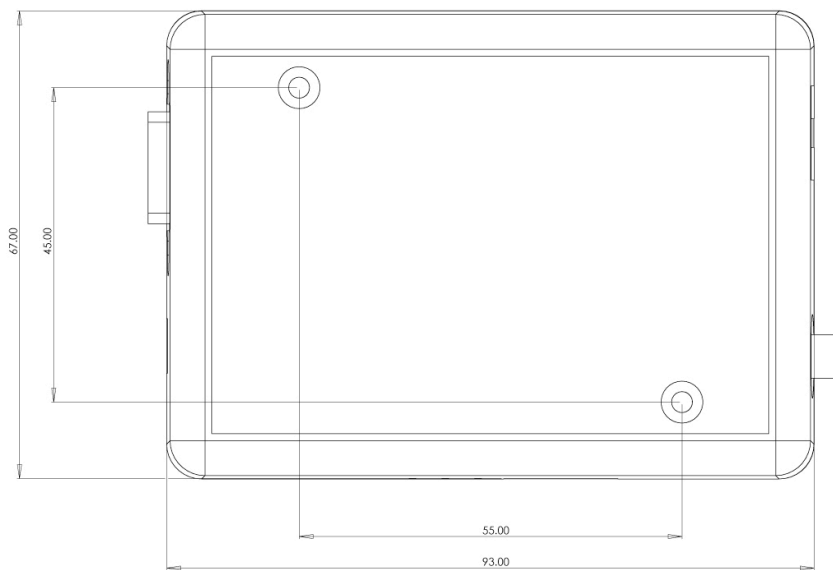
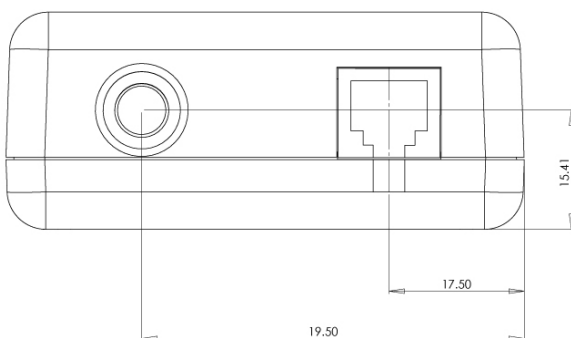


Figure 5. ZETA-N modem antenna and power view - dimensions



ZETA-G

All dimensions are shown in mm. The mounting holes are suitable for a M3 fixing screwing. These drawings are relevant for the ZETA-G modems.

Figure 6. ZETA-G modem top view - dimensions

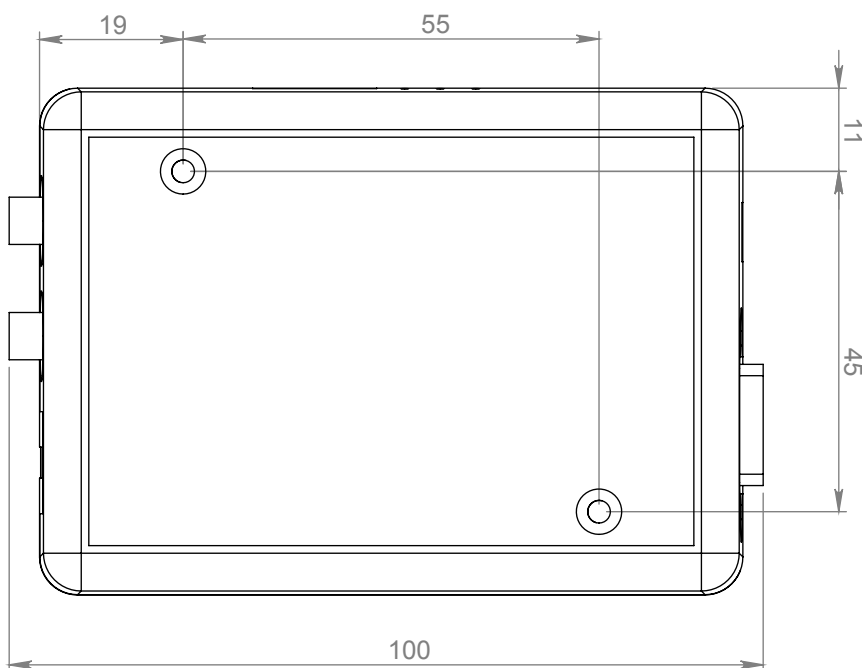
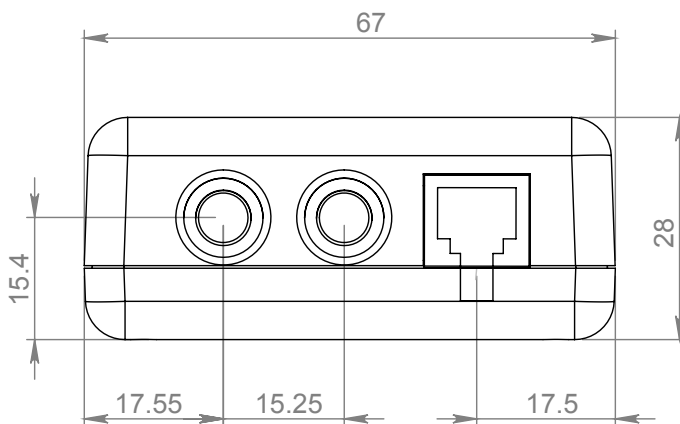


Figure 7. ZETA-G modem antenna and power view - dimensions





ZETA Series Images

Figure 8. ZETA-N variant



Figure 9. ZETA-G variant



Figure 10. 3D view of the ZETA



LED Indicators

There are 3 LED outputs on the ZETA modem coloured green, red and blue. By default, these show the functional/operational state of the modem. However, these may also be configured using software control by the user for other indication purposes. **Table 4** describes the functions of the LEDs.

Figure 11. LEDs

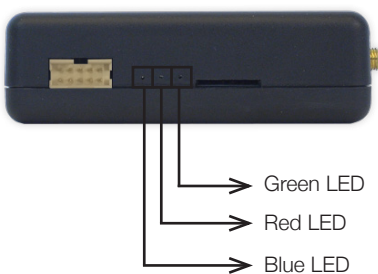
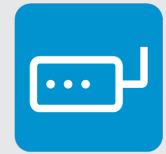


Table 4. LEDs

LED	At power up or PWRON_IN / PWROFF_IN control	After power up
Blue	Rapid blink during power on, otherwise off	Off / User defined
Red	Undefined state	Network registration state / call indication
Green	Rapid blink during power off, otherwise off	Off / User defined

Power Up LED States

On initial application of power, all LEDs will briefly illuminate. During power up, the green and blue LEDs are controlled directly by the ZETA, and the red LED is controlled by the embedded modem module. While the ZETA is in the power up state the blue LED will flash rapidly (300mS on, 300mS off) and the green LED will be off until the power up process is complete. After the power on process has completed, the blue and green LEDs become user configurable outputs.



Red LED Network Registration State / Call Indication

The red LED behaves slightly differently dependant on the ZETA version. **Table 5** describes the behaviour.

Table 5. Red LED Behaviour

ZETA Version	Not Registered	Registered	Call in Progress
GPRS (2G)	Fast blink (0.5s on, 0.5s off)	Slow blink (0.3s on, 2.7s off)	On
UMTS (3G)	On	Blink (1s on, 2s off)	On
LTE (4G)	On	Blink (1s on, 2s off)	On

NOTE: Updating the embedded modem module firmware will change the way in which red LED behaves as default settings will be restored. Customer AT commands that control GPIO1 will also affect the behaviour of the red LED. Siretta factory default settings for the red LED can be restored using the following AT commands in **table 6** below.

Table 6. AT commands to set default red LED behaviour

ZETA	AT Command(s) to restore defaults
GPRS (2G)	AT#SLED=2 followed by AT#SLEDSAV
UMTS (3G)	AT#GPIO=1,0,2
LTE (4G)	AT#GPIO=1,0,2

Green and Blue LED User Control

The green LED is connected to GPIO3 of the module and the blue to GPIO2. Both LEDs may be independently controlled as outputs using AT commands. The default setting is that these LEDs are off. **Table 7** shows the commands for changing the LED states. These settings are volatile and are lost when power fails. More recent firmware releases have options to allow this setting to be made permanent. Please read about the AT#GPIO command in the AT Commands Reference Guide for more information.

Table 7. Green and blue LED AT commands

LED	On	Off
Green	AT#GPIO=3,1,1	AT#GPIO=3,1,0
Blue	AT#GPIO=2,1,1	AT#GPIO=2,1,0



PWRON_IN Power On Procedure LED Indicators

PWRON_IN is the power on signal (pin 4 of the RJ12 power connector). Taking PWRON_IN high will turn the ZETA on (assuming there is power applied, but that the unit has been turned off using PWROFF_IN pin or AT#SHDN command).

During power up, the green and blue LEDs are controlled directly by the ZETA, and the red LED is controlled by the embedded modem module. While the ZETA is in the powering up, the blue LED will flash rapidly (300mS on, 300mS off) and the green LED will be off until the power up process is complete. After the power on process has completed, the blue and green LEDs become user configurable outputs.

PWROFF_IN Power Off Procedure LED Indications

PWROFF_IN is the power off signal on pin 3 of the RJ12 power connector. Taking PWROFF_IN high will turn a powered ZETA off.

During power off, the green and blue LEDs are controlled directly by the ZETA, and the red LED is controlled by the embedded modem module. While the ZETA is transitioning through the power off state the green LED will flash rapidly (300mS on, 300mS off) and the blue LED will be off until the power off process is complete when all LEDs will be off. In this state, PWRON_IN may be used to turn the unit on again.

Interfaces

RS232 Serial Port Interface

This connector provides a serial RS232 communication between the ZETA modem and the connected equipment. The modem can be configured via the RS232 connection using AT commands as specified in the AT command manual.

Figure 12. RS232 serial port



Figure 13. Pin numbering

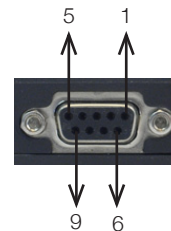
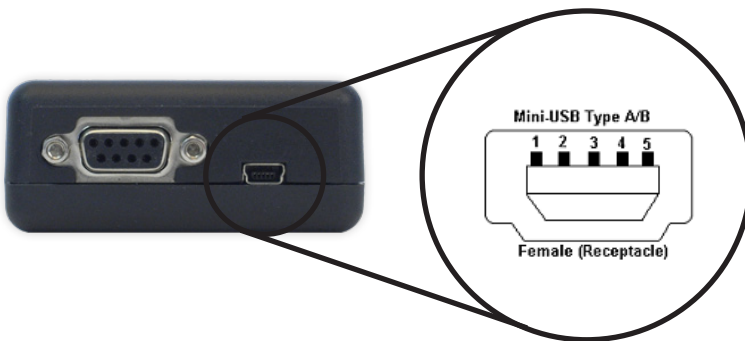


Table 8. Pin usage

Pin	Name	Usage	Status	Direction
1	DCD	Output from UART that indicates the carrier is present	Not Connected	OUT
2	RXD	Output transmit line of UART	Connected	OUT
3	TXD	Input receive line of UART	Connected	IN
4	DTR	Input to UART and controls DTE ready condition	Not Connected	IN
5	GND	Ground	Connected	IN
6	DSR	Output from UART that indicates the module is ready	Not Connected	OUT
7	RTS	Request to Send - Input line of UART that controls hardware flow control	Connected	IN
8	CTS	Clear to Send - Output line of UART that controls hardware flow control	Connected	OUT
9	RI	Ring Indicator - Output line of UART that indicates the incoming call condition	Not Connected	OUT

USB Serial Port Interface

Figure 16. ZETA USB Connector



A mini USB type B connector is provided for USB serial connection. ESD protection to +/-4KV contact discharge and +/-8KV air discharge is provided. Pins on this connector are shown in **table 9** below.

Table 9. Mini USB Connectors

Pin	Name	Direction	Description	Low Level	Nominal	High Level
1	VBUS	Input	USB Power VBUS	4.75V	5V	5.25V
2	D-	Differential	Data Minus	4.75V	5V	5.25V
3	D+	Differential	Data Plus	4.75V	5V	5.25V
4	-	-	-	-	-	-
5	GND	Input	Signal Ground	-	0V	-



USB Interface Drivers

The ZETA series modems support a standard USB 2.0 device interface compatible with USB 2.0 specifications and supporting the USB low-speed [1.5 Mb/s] and full-Speed (12 Mb/s) modes. The USB port can be used to send AT-commands, reprogram the modems and view debug output. The maximum baud rate available to communicate with the ZETA series modems is up to 12 Mbit/s.

Drivers are required on Windows OS to install the USB port and these are available for all recent versions of Windows OS. Linux/Unix/MAC OS runs the USB port using the native CDC ACM driver. Please contact Siretta for more information.

In HSDPA (High Speed Downlink Packet Access) mode, the downlink data speed rates can be up to 7.2Mbps. To achieve this network data rate using the ZETA, integrators need to interface the ZETA to their applications in full-speed (12 Mb/s) mode.

The USB device driver creates a number of virtual COM ports on the system for access to the module. Up to 6 ports can be created (depending on the model used) and these ports will be created using the next available COM ports on the system. Using the AT command AT#PORTCFG these ports can be configured for use as general purpose AT command communication ports, GPS NMEA communication ports and trace debug ports. The AT#PORTCFG command configures the modems internal MUX to direct the dedicated internal ports to physical external ports on the USB interface.*

USB0 → Configurable port
USB1 → Configurable port
USB2 → Configurable port
USB3 → Configurable port
USB4 → Configurable port
USB5 → Configurable port

The ZETA series modems do not support autobauding. Integrators have to set the correct speed for serial communication before device initialization. If the right speed is set, the device responds with OK. The default baudrate is 115200.

To change the baudrate:

- » Send command AT+IPR=<rate><cr>
- » Wait for 'OK' response

*Please see the following command 'AT#PORTCFG' in the AT command reference manual for more information on configuring these ports on your modem.

Supported baudrates

- » 2400
- » 4800
- » 9600
- » 19200
- » 38400
- » 57600
- » 115200
- » 230400

GPIO 10-Way Connector

This connector provides a general purpose multi-way interface for the user to access additional functionality within the ZETA modem. This convenient interface allows connections to be made to the modems peripheral connections such as the trace /debug TTL RS232 serial port, GPIO interface and ADC. Recommended mating connector: FCI 89947-710LF Receptacle Connector - IDC 2mm 2 x 5 - 10way.

Figure 18. 10-way connector



Figure 19. Pin numbering

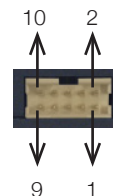


Figure 20. FCI 89947-710LF



Table 10. 10-way connector

Pin	Name	Direction	Description	Low Level	Nominal	High Level
1	GND	Input	Signal Ground	-	0V	-
2	Output 1	Output	General Purpose Output 1	0 - 0.5V	3.3V	3.3V
3	Debug RX	Input	Debug Serial Receive (TTL)	-	3.3V	-
4*	GPIO2	Input	General Purpose Input/Output 2	0 - 0.5V	12V	42V
4*	GPIO2	Output	General Purpose Input/Output 2	0 - 0.5V	3.3V	3.3V
5	Debug TX	Output	Debug Serial Transmit (TTL)	-	3.3V	-
6*	GPIO1	Input	General Purpose Input/Output 1	0 - 0.5V	12V	42V
6*	GPIO1	Output	General Purpose Input/Output 1	0 - 0.5V	3.3V	3.3V
7	3.3V	Output	Low Voltage Power Supply	-	3.3V	-
8	Input 2	Input	General Purpose Input 2	0 - 0.5V	12V	42V
9	ADC 1	Input	Analogue to Digital Converter 1	0 - 0.5V	12V	42V
10	Input 1	Input	General Purpose Input 1	0 - 0.5V	12V	42V

*General purpose Input / Output on pin 4 and pin 6 of the function header can be set in software using standard AT commands to operate as either an input or an output. Please see 'Digital Functions' section on page 27 which describes how to configure the port to be an input or an output.

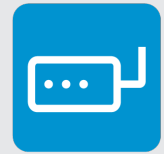


The ZETA maximum current drive on the outputs and current consumption on the inputs at different voltages are shown below in **table 11**.

Table 11. Input/output voltages

Signal Name	Parameter	Voltage Level	Current Drive
Output1 (GPO1)	Current drive	3.3V	24mA
Input/Output (GPIO1/2)	Current drive	3.3V	20mA
Input/Output (GPIO1/2)*	Input current	42V	1.68mA
Input/Output (GPIO1/2)*	Input current	12V	0.31mA
Input/Output (GPIO1/2)*	Input current	6V	45µA
Input/Output (GPIO1/2)*	Input current	3V	120µA
Input 1/2 (GPI1/2)	Input current	42V	4.2mA
Input 1/2 (GPI1/2)	Input current	12V	1.2mA
Input 1/2 (GPI1/2)	Input current	6V	0.6mA
Input 1/2 (GPI1/2)	Input current	3V	0.3mA
3.3V Output	Power supply	3.3V	100mA

*Values taken when Input/Output type set to Input.



Digital Functions

Digital Output

- » Switch voltage is 3.3V high side switch
- » See **table 11** above (**page 26**) for maximum output current
- » Under full control of AT command/embedded application

The following command can be used to initialise and to set the digital input/output functionality:

AT#GPIO=4,1,1 (switch general purpose output 3 on – Set Pin 6 GPIO function to Output)

AT#GPIO=4,0,1 (switch general purpose output 3 off – Set Pin 6 GPIO function to Input)

AT#GPIO=5,1,1 (switch general purpose output 4 on – Set Pin 4 GPIO function to Output)

AT#GPIO=5,0,1 (switch general purpose output 4 off – Set Pin 4 GPIO function to Input)

The following command can be used to initialise and to set the status of GPIO1 when set to output:

AT#GPIO=6,1,1 (switch general purpose input/output 1 on, Pin 6 on function header)

AT#GPIO=6,0,1 (switch general purpose input/output 1 off, Pin 6 on function header)

The following command can be used to initialise and to set the status of GPIO2 when set to output:

AT#GPIO=7,1,1 (switch general purpose input/output 2 on, Pin 4 on function header)

AT#GPIO=7,0,1 (switch general purpose input/output 2 off, Pin 4 on function header)

The following command can be used to initialise and to set the digital output functionality:

AT#GPIO=8,1,1 (switch general purpose output 1 on, Pin 2 on function header)

AT#GPIO=8,0,1 (switch general purpose output 1 off, Pin 2 on function header)



Digital Input

» Under full control of embedded application

The following AT commands can be used to initialise and to read the status of the general purpose inputs:

AT#GPIO=9,2,0 (read general purpose input 1, Pin 10 on function header)

AT#GPIO=10,2,0 (read general purpose input 2, Pin 8 on function header)

The following AT command can be used to read the status of GPIO1 when set to input:

AT#GPIO=6,2,0 (read general purpose input/output 1, Pin 6 on function header)

The following AT command can be used to read the status of GPIO2 when set to input:

AT#GPIO=7,2,0 (read general purpose input/output 2, Pin 4 on function header)

SIM Socket

The ZETA modem supports fixed SIMs locked to a network and roaming SIMs which can operate on more than one network within the home country. This allows for least cost routing for roaming mobile data and machine to machine applications where signal strength is variable in any given area and network selection is required.

The ZETA also supports global roaming SIMs which will work with any network it can detect, at home or abroad and can be chosen for best performance.

Figure 21. SIM holder



SIM Requirements

1.8V/3.3V Mini SIM (2FF) supported on the ZETA modem.

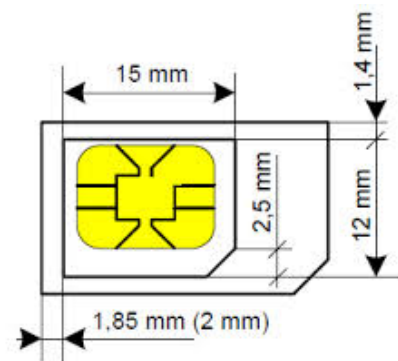
SIM services available for the ZETA GPRS series include:

- » 2G GSM: B8(900), B3(1800)
- » SMS
- » GPRS
- » CSD

SIM services available for the ZETA UMTS/LTE series include:

- » 2G GSM: B8(900), B3(1800)
- » 3G UMTS: B8(900), B1(2100)
- » 4G LTE: B1(2100), B3(1800), B7(2600), B8(900), B20(800)
- » SMS
- » GPRS
- » CSD

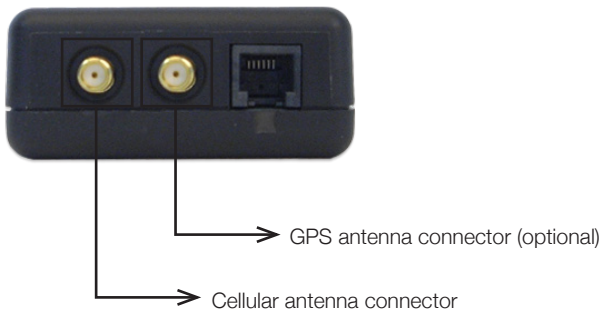
Figure 22. SIM card dimensions



NOTE - 3G only SIM will not be supported on 2G GSM only modem. Please ensure SIM is 2G (GSM), 3G (UMTS) and 4G (LTE) capable for greatest compatibility.

Antenna Connectors

Figure 23. Antenna connector



Antenna Placement

When in service the antenna should be placed away from electronic devices or other antennas. The recommended minimum distance between adjacent antennas, operating on a similar radio band, is at least 50cm.

Antenna Connection Cable

If a cable is used to connect the modem to the antenna this cable must be a high quality low loss cable. The cable and any connectors used should have 50 ohms impedance.



Cellular Antenna Connector

A female SMA connector is provided to allow connection of a passive antenna. For optimum performance the antenna assembly connected to this modem is required to have the following characteristics:

- » For 2G GSM operation specified operation in the following bands:
B8(900), B3(1800)
- » For 3G UMTS operation specified operation in the following bands:
B8(900), B1(2100)
- » For 4G LTE operation specified operation in the following bands:
B1(2100), B3(1800), B7(2600), B8(900), B20(800)
- » The characteristic impedance on any antenna or cable assembly attached to this modem should be 50 ohms
- » The antenna must be capable of handling a minimum of 2W output power
- » The VSWR should be less than 3:1 to avoid damage to the modem



GPS Antenna Connector (Optional)

GPS Antenna Polarization

The GPS signal as broadcast is a right hand circularly polarized signal. The best antenna to receive the GPS signal is a right hand circularly (RHCP) polarized antenna.

GPS Antenna Gain

Antenna gain is defined as the extra signal power from the antenna as compared to a theoretical isotropic antenna (equally sensitive in all directions).

It is important to note that GPS antenna gain is not the same thing as external LNA gain. Most antenna vendors will specify these numbers separately, but some combine them into a single number. It is important to know both numbers when designing and evaluating the front end of a GPS receiver.

An antenna with higher gain will generally outperform an antenna with lower gain. Once the signals are above about -130 dBm for a particular satellite, no improvement in performance would be gained. However, for those satellites that are below about -125 dBm, a higher gain antenna would improve the gain and improve the performance of the GPS receiver. In the case of really weak signals, a good antenna could mean the difference between being able to use a particular satellite signal or not.

As the GPS antenna needs to be located away from the ZETA series Modem then an active antenna will be required to obtain the best system performance. The active antenna has its own built in low noise amplifier to overcome RF trace or cable losses after the active antenna. The active antenna has a low noise amplifier (LNA) with associated gain and noise figure.



GPS

ZETA-G-GPRS Modem

The ZETA-G-GPRS modem is a cutting edge GPS receiver that can simultaneously search and track satellite signals from multiple satellite constellations. This multi-GNSS receiver uses the entire spectrum of Global Navigation Satellite Systems available: GPS, Glonass, Galileo and QZSS.

The ZETA-G-GPRS modem features an advanced real time hardware correlation engine for enhanced sensitivity navigation (PVT), Fast Acquisition giving rapid Time-to-First-Fix (TTFF), low power consumption, 32 track verification channels, stand Alone and Assisted mode and Satellite Based Augmentation Systems (SBAS): WAAS, EGNOS, and MSAS.

ZETA-G-UMTS and ZETA-G-LTE Modem

The ZETA-G-UMTS and ZETA-G-LTE modems feature a high performance GPS receiver which provides fast Time-To-First-Fix (TTFF), low power consumption and Satellite Based Augmentation Systems (SBAS): WAAS, EGNOS, and MSAS. The receiver can be used in both autonomous and assisted mode and supports advanced digital signal processing to achieve GPS sensitivity better than -165 dBm which enable indoor tracking applications.

The ZETA-G-UMTS and ZETA-G-LTE modems also support advanced real time hardware correlation engine and offers the capability to monitor up to 28 channels simultaneously in stand alone or assisted mode.

GPS Performance (ZETA-G Variants)

- » Advanced real time hardware correlation engine for enhanced sensitivity (better than -165dBm for A-GPS)
- » Fast Acquisition giving rapid Time-to-First-Fix (TTFF)
- » Capability to monitor up to 28 channel
- » Stand Alone and Assisted mode
- » Integrated LNA



GPS Characteristics

Table 12. Main characteristics of GPS

Characteristic	Typical Values
GPS RX Sensitivity	-164dBm
GPS Cold Start Autonomous	-147dBm
GPS Hot Start Autonomous	-161dBm
GPS Tracking Mode	-166dBm
GPS Accuracy	3m
TTFB from Cold Start	42 secs
TTFB from Warm Start	30 secs
TTFB from Hot Start	1.8 secs

GPS Power Supply

GPS antenna power supply is generated internally by the ZETA modem and is a stable high accuracy low dropout supply designed to give very good GPS performance.

Table 13. GPS power consumption

Characteristic	Typical Values
Power Consumption in Acquisition	46.4mA
Power Consumption in Tracking	37.8 mA
Power Consumption in Low Power Tracking	25.7mA

GPS Output Power

Table 14. GPS antenna connection output characteristics

	Min	Nom	Max
Output enabled	2.8V	3.0V	3.3V
Output disabled	-	0.0V	0.2V
Output current	0mA	20mA	28mA

NOTE: Power supply is enabled when GPS engine is powered with the following AT command:

AT\$GPSP=1 - will turn the GPS engine on

AT\$GPSP=0 - will turn the GPS engine off

To output NMEA data, please refer to AT\$GPSNMUN command in the AT command reference guide.

Power

RJ12 Power Connector

This connector is used for supplying DC power and power ON/OFF signals for the modem.

Figure 26. RJ12 power connector

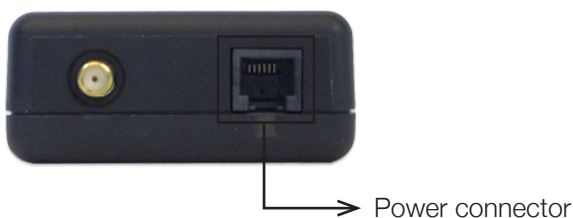


Figure 27. Pin numbering

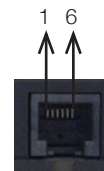


Table 15. Pin usage

Pin	Name	Direction	Description	Low Level	Nominal	High Level
1	Vin	Input	Input power	5V	12V	42V
2	-	-	-	-	-	-
3	PWROFF_IN	Input	Power off signal	5V	12V	42V
4	PWRON_IN	Input	Power on signal	5V	12V	42V
5	-	-	-	-	-	-
6	GND	Input	Signal ground	-	0V	-

Each pin of type Input is activated when the voltage on the pin is in the range of Vin DC (5V to +42V). The maximum output drive voltage is fixed at TTL level 3.3V.

The modem ON/OFF state is activated by the power OFF and power ON signal inputs.

The modem ON/OFF states are shown above in **table 15**. The initial state of the modem on power-up is ON.



Power Supply Requirements

A DC power supply must be connected to the power input.

Table 16. Characteristics of power input

	ZETA Series
DC input voltage	5 to 42V
Recommended input voltage	12V DC
Supply current @ 12V:	
Peak (20ms at registration)	2A
Average standby	25mA
Call in progress	250mA
Ringing	250mA

The ZETA modem has a wide operating voltage and can be powered from 5V to 42V.

Powering the modem can be done in 2 different ways:

- » Modem Power Supply - Standard multi region power supply provides constant 12V at 2A
- » Power Cable - Provide a power source between 5V to 42V from the supply of the equipment connected

The ZETA modem has the following input power supply protection:

- » On board voltage reverse polarity protection
- » Over voltage spike protection to 70V for 1mS.
- » ESD protection to +/-4KV contact discharge and +/-8KV air discharge.

NOTE - The current requirements of the ZETA modem will scale with input voltage. The higher the input voltage the lower the current consumption, the power consumption will remain constant. Recommended input voltage is 12V.



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

Table 17. ZETA modem states

ZETA State	Pin-4 (ON)	Pin-3 (OFF)	Modem ON/OFF
OFF	ACTIVE	ACTIVE	OFF
ON	ACTIVE	ACTIVE	ON
ON	NOT-ACTIVE	ACTIVE	Switches OFF
OFF	NOT-ACTIVE	ACTIVE	OFF
OFF	ACTIVE	NOT-ACTIVE	Switches ON
ON	ACTIVE	NOT-ACTIVE	ON



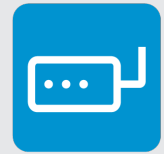
Current Consumption

The measurement was taken with 2 Voltages (5V, 12V).

The modem was connected via RS232 to a PC in order to send/receive AT commands. The temperature was maintained in a temperature chamber. The voice call with power level 5 in GSM 900 was established with a GSM signal generator test set.

Table 18. ZETA modem current consumption

	7V	12V	42V
Modem Off	305.90nA	308.42nA	312.0nA
Modem On (Not registered)	31.38mA	21.78mA	10.97mA
Modem On (Registered 2G network)	31.57mA	22.00mA	11.14mA
Modem On (Registered with IP address)	31.62mA	21.96mA	11.19mA
Modem On (Registered with socket connected)	32.37mA	22.75mA	12.44mA
Modem On (Registered 3G network)	32.49mA	21.96mA	11.21mA
Modem On (Registered with IP address)	31.87mA	22.56mA	11.03mA
Modem On (Registered with socket connected)	34.57mA	24.96mA	15.08mA
Modem On (Registered 4G network)	36.32mA	24.00mA	14.21mA
Modem On (Registered with IP address)	34.74mA	25.30mA	11.93mA
Modem On (Registered with socket connected)	43.50mA	31.22mA	15.51mA



Switching the Modem ON/OFF

Power on the ZETA

The ZETA modems have several options to power on. The 2 main options are shown below:

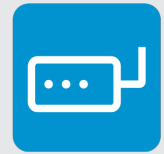
- 1) Auto power up using the built in CPLD power controller. This process is controlled by default within the modem to control the modem functionality and allows for automatic power up when power is supplied. The auto power on control will automatically power up the modem as required and manage its status whilst it is online.
- 2) Manually power up the modem using the PWRON_IN pin on the RJ12 power connector (Pin 4). When this pin is connected to logic high (0.5-42V) for >0.5 seconds the modem will power up.

NOTE - The modem is fully operational after it has powered on and able to send AT commands. This may take anything from 2 to 20 seconds depending on the startup procedure. Once the modem is powered up it will automatically attempt to logon to the cellular network and may take anything from 10 seconds to 4 minutes depending on the network. This is outside the control of the modem and is network and frequency dependant.

Power off the ZETA

The ZETA modems have several options to power off. The 2 main options are shown below:

- 1) Manually power down the modem using the PWROFF_IN pin on the RJ12 power connector (Pin 3). When this pin is connected to logic high (0.5-42V) for >0.5 seconds the modem will power off.
- 2) Manually power down the modem using the AT command AT#SHDN. This command will safely disconnect from the network and power down the module.



Considerations when manually powering the ZETA on and off

The PWRON_IN and PWROFF_IN signals 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) up to Vcc (max 42V), or at least a large fraction of that voltage range (>0.5V). Very slow transitions (significantly slower than many milliseconds) or very small transitions (e.g. only a few millivolts instead of 0V to 0.5V) will not turn on the modem (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, under the following condition special design care has to be taken:

- » Large capacitors in your power supply which will lead to slow leading and falling edges

The case above might prevent the modem from recognizing 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.

If you are in doubt, please use the following recommendations:

- » Use the Vcc power supply signal from the main supply to test the power on signal function.
- » Make sure that your signal and system design adheres to the recommendations mentioned above
- » Consult our support team and we will be more than happy to assist you.

Disaster recovery power down reset procedure

The ZETA modems do not have any special power down reset functionality for disaster recovery.

In the event of the standard power down functions failing using the PWROFF_IN pin or the software shutdown AT command then power must be removed completely from the modem.

Wait for a minimum of 10 seconds and then apply mains power to put the modem in to the startup state.

NOTE - Powering down the the modem without following the correct procedure using the shutdown command or the hardware PWROFF_IN pin can result in improper functioning of the modem. It will also not detach safely from the cellular network and may cause the terminal to become blacklisted.



Embedded Software Support

When developing your application you may decide to use an external micro controller to manage your applications functionality. Depending on your exact requirements you may need to have the added flexibility of using an external microprocessor to manage power constraints or enable high performance functionality. You also have the option to use the embedded software development environment included within the cellular engine on the Siretta ZETA family of modems. All the modules used within the ZETA modem family support the Telit IoT AppZone embedded development environment which is available for use out-of-the-box and can be developed to suit your exact application requirements.

NOTE - Contact your Siretta representative for information about the IoT embedded development environment.

Telit AppZone

Telit AppZone is a high-level optimized standard C development environment that has been developed as an integrated platform to run within the cellular module and provides an advantageous “all-in-one” solution. This allows you to save time and money because the M2M module can perform all the key tasks normally associated with an external microprocessor.

The development environment offers a flexible platform whether you are planning on developing a new tracking application, an innovative healthcare device, a trend-setting Automatic Meter Reading component or any other M2M application. The Telit AppZone could meet your needs whilst minimizing your development effort and design costs. The end result is a much faster TTM (Time to Market).

Some of the key distinguishing features of AppZone include:

- » Fast Interrupt Latency (130µsec)
- » AT command tunneling
- » Multi-tasking with IPC feature and application priority
- » Over-The-Air (OTA) updates
- » Low power consumption (Deep Sleep mode 75µA)
- » File System and memory (FS NVM, Flash and RAM)



Telit AppZone - Lightweight, fast and efficient

AppZone lets you take full advantage of the hardware features and capabilities of your Siretta modem, enabling software development across product families. The AppZone IDE is the reference workbench and development tool for all Telit based products, supporting the multiple programming environments available for different modules and technologies.

AppZone C is the flagship application framework for cellular products. It is lightweight, runs on RTOS and delivers optimized performances and fast response. The framework includes a full set of APIs programmable in C language, enabling access to the modem, hardware, peripherals, operating system and other services. Ease of integration of 3rd party libraries, protocol stacks and peripherals. Available across all cellular technologies and form factors.

IoT AppZone supports Python for Telit legacy modules.



Installation

Considerations for Installations Incorporating the ZETA

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

Environmental conditions: The modem must be installed so that the environmental conditions stated such as temperature, humidity and vibration are satisfied. Additionally, the electrical specifications must not be exceeded.

Cellular signal strength: The modem/antenna has to be placed in a position that ensures sufficient cellular signal strength. To improve signal strength, the antenna can be moved to a more elevated position. Signal strength usually depends on how close the modem is to cellular 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.

When the application is operational, you can verify signal strength by issuing the AT command:

AT+CSQ

See “AT+CSQ Signal Strength” in the AT command manual

*Tip: Before installing the modem you can use an ordinary mobile telephone to check the signal strength in each possible installation location. Siretta can also provide a cellular signal tester which provides a full breakdown of the cellular signal received.**

When considering the location for the modem and antenna placement, you must consider received signal strength as well as cable length as long cable runs can attenuate the received signal strength.

Connections of components to ZETA Series modems: The system integrator is responsible for the final system solution. If external components are incorrectly designed or installed it may cause radiation limits to be exceeded. For instance, improper cable connections or incorrectly installed antennas can disturb the network and lead to modem malfunction.

*Please contact your Siretta representative for more information



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

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 subscription.
- » Consider the choice of the supplementary services such as GPRS and CSD.

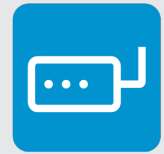
Power Supply Installations

- » Use a high-quality power supply with short leads. This ensures that the voltages at the connector pins are within the specified range, especially during the maximum peak current of approximately 2A.
- » When the modem 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 from damage.

Securing the Modem

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

- » Where access is restricted, it may be easier to connect all the cables to the modem prior to placing it in the application on the headers.
- » Securely attach the ZETA modem to the host application using 4 M3 3mm diameter pan-head screws.



Safety and Product Care

Please read the information on this page and **page 43** 'Installation' before you begin your system integration.

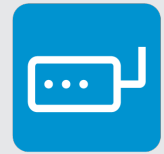
General Precautions

- » The ZETA series modems are a standalone item designed for indoor use only. For use outside it must be installed in a weatherproof enclosure.
- » Do not exceed the environmental and electrical limits as specified.
- » Avoid exposing the modem to lit cigarettes, naked flames or to extreme hot or cold temperatures.
- » Never try to dismantle the modem. 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 ZETA series modems must not be installed or located where the surface temperature of the enclosure may exceed 85°C.
- » All cables connected to the ZETA series modems must be secured or clamped, immediately adjacent to the modems connectors, to provide strain relief and to avoid transmitting excessive vibration to the modem in the installation.
- » To protect power supply and to meet the fire safety requirements when the modem 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 ZETA series modem.

SIM Card Precautions

Before handling the SIM card in your application, ensure that you have discharged any static electricity. Use standard precautions to avoid electrostatic discharges.

- » When designing a ZETA series modem into your application, the accessibility of the SIM card should be taken into account so that it can be removed or changed.



Antenna Precautions

If the antenna is to be mounted outside, always consider the risk of a lightning strike. Follow the instructions provided by the antenna manufacturer. In addition please observe the following:

- » 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.
- » With all mobile station equipment, the antenna of the modem emits radio frequency energy. To avoid EMI (electromagnetic interference) you must determine if the application 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 external signal cables.
- » The modem and antenna may be damaged if either come into contact with ground potentials other than the ground potential used in your application. Beware, ground potentials can vary significantly between hardware platforms.

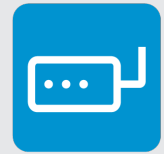
Exposure to RF Energy

There has been some public concern about possible health effects of using cellular equipment in close proximity to a person or body. Although research on health effects from RF energy has focused for many years on the current RF technology, research research has been carried out on newer radio technologies. After existing research had been reviewed, and after compliance to all applicable safety standards has been tested, it has been concluded that the ZETA series modem is fit for use.

If you are concerned about exposure to RF energy, there are a number of things you can do to minimize exposure. Obviously, limiting the duration of time near a device will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your modem efficiently by adhering to the following guidelines:

Electronic devices: Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However, RF energy may affect some malfunctioning or improperly shielded electronic equipment.

Vehicle electronic equipment: Check your vehicle manufacturer's representative to determine if any on board electronic equipment is adequately shielded from external RF energy.



ZETA Series

GPRS/UMTS/LTE Modem with GPIO

Aircraft: Turn your modem OFF before boarding any aircraft. To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crewmember to use your modem equipment whilst the plane is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem whilst in the air.

Blasting areas: To avoid interfering with blasting operations, turn your modem OFF when in a “blasting area” or in areas posted: “turn off two-way radio“. Construction crew often uses remote control RF devices to set off explosives.

Potentially explosive atmospheres: Turn your modem OFF when in any area with a potentially explosive atmosphere. It is rare, but your modems or their accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations, below deck on boats, fuel or chemical transfer or storage facilities and areas where the air contains chemicals or particles, such as grain, dust or metal powders. Do not transport or store flammable gas, liquid or explosives, in the compartment of your vehicle, which contains your modem or accessories. Before using your modem in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.



Safety Recommendations

PLEASE READ CAREFULLY

Be sure the use of this product is allowed in the country intended and the environment required. The use of this product may be dangerous and has to be used with caution in the following areas:

- » Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc
- » Where there is risk of explosion such as gasoline stations, oil refineries, gas works etc

It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product, any mark of tampering will compromise the warranty.

We recommend following the instructions of this hardware user guide for the correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to conform to the security and fire prevention regulations.

The product has to be handled with care, avoid any direct contact with the pins because electrostatic discharge may damage the product. The same precautions have to be observed for the SIM card installation. Do not insert or remove the SIM when the product is in power saving mode. (AT+CFUN=5).

The system integrator is responsible for the complete functionality of the final product. Therefore, care has to be taken with the external components used with the module, as well as any installation issue.

Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a suitable antenna with characteristics which match the product requirements.

The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation EN 50360.



Conformity Assessment

The ZETA series of modems conform to the R&TTE Directive for use as a stand-alone product. If the modem is installed in compliance with the telecoms installation instructions then no further evaluation is required under Article 3.2 of the R&TTE Directive and no further involvement of an R&TTE Directive Notified Body is required for the final application.

The ZETA series of modems conform to the following European Union Directives:

- » R&TTE Directive 1999/5/EC (Radio Equipment & Telecommunications Terminal Equipment)
- » LVD (Low Voltage Directive) 73/23/EEC and product safety
- » Directive 89/336/EEC for conformity for EMC

In order to satisfy the essential requisite of the R&TTE 99/5/EC directive, the ZETA series modems are compliant with the following standards:

- » GSM (Radio Spectrum). Standard: EN 301 511 and 3GPP 51.010-1
- » EMC (Electromagnetic Compatibility). Standards: EN 301 489-1 and EN 301 489-7
- » Include stand-alone spurious emissions to Clause 8.2 of EN 301 489-1.
- » LVD (Low Voltage Directive) Standards: EN 60 950



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Definitions

Term	Definition
2G	2nd Generation Mobile Telecommunications
3G	3rd Generation Mobile Telecommunications
ADC	Analog to Digital Converter
AMR	Automatic Meter Reading
AT	Attention
CBS	Cell Broadcasting Service
CPLD	Complex Programmable Logic Device
CSD	Circuit Switched Data
EGNOS	European Geostationary Navigation Overlay Service
GND	Ground
GPI	General Purpose Input
GPIO	General Purpose Input Output
GPO	General Purpose Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
I/O	Input/Output
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LTE	Long Term Evolution
M2M	Machine to Machine
MSAS	Multi-functional Satellite Augmentation System
RF	Radio Frequency
RS232	Radio Sector
RX	Receive Signal
RXD	Receive Signal
SIM	Subscriber Identity Module
SMA	Sub Miniature Version A
SMS	Short Message Service
TTFB	Time To First Fix
TTL	Transistor - Transistor Logic
TX	Transmit Signal
TXD	Transmit Signal
UART	Universal Asynchronous Receiver/Transmitter
UMTS	Universal Mobile Telecommunications System (Same as 3G)
USB	Universal Serial Bus
WAAS	Wide Area Augmentation System
Vcc	Positive Power Supply
Vin	Input voltage



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