Siretta

Enabling Industrial IoT


# Zeta-xxP Series

Ultra Low Power Modem

*Applicable models:*
LTE Cat 1 / LTE Cat 4 / LTE Cat M1 / LTE Cat NB1 / UMTS / GSM

## Hardware Manual

**Rev 3.1**

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Enabling Industrial IoT

**ZETA-xxP Series**
Hardware Manual

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# Introduction

This hardware manual serves as a comprehensive guide to the ZETA-xxP modem series, offering detailed recommendations for seamlessly integrating these devices in to your system. The content of the document covers essential information, including the modem's interface specifications, electrical characteristics, and operational modes. For simplicity, the term "ZETA" will be used throughout to collectively refer to all ZETA-xxP models unless otherwise indicated.

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# General Product Description

The ZETA-xxP series comprises a versatile lineup of modems supporting LTE, LTE-M, LTE Cat NB1, UMTS, and GSM technologies. Designed for easy integration in to existing systems and embedded application development these modems are built upon the reliable Telit xE910 GPRS/UMTS/LTE module series. Their low-power design makes them an excellent choice for power-sensitive applications.

ZETA modems are future-ready, ensuring compatibility with emerging LTE-M and NB-IoT networks while maintaining GSM as a fallback option. Each unit is equipped with a range of interface options, including USB and RS232 serial port communication, enabling connection to both legacy equipment and USB interfaces. With the LTE Cat 4 and LTE Cat 1 variants, ZETA modems can cater to high-speed applications with ease and efficiency."

The ZETA features an advanced C dev environment designed to streamline development, minimize redundancy, and optimize your solution's architecture while lowering system component costs.

In most IoT integration projects, developers typically use a microcontroller to handle modem functions and manage other device peripherals. However, the ZETA incorporates Telit IoT AppZone, eliminating the need for an external controller. This reduces both cost and complexity by allowing application code to be embedded directly within the module.

# Specifications

## Mechanical

Table 1. *Zeta-xxP Series Mechanical Specifications*

| Parameter | Description |
|---|---|
| Dimensions | 93 x 67 x 28 mm |
| Weight | |
| ZETA-NLP/NSP | 92.5 g |
| ZETA-NEP | 92.8 g |
| ZETA-GEP | 97.2 g |
| Case | Black ABS plastic |
| Operating Temperature | -40 to +85 °C |
| Antenna Connector(s) | SMA Female |
| USB Connector | Mini USB type B |
| RS232 Connector | Female 9-pin D-type with locknuts |
| Power Connector | RJ12 |
| GPIO Connector (Enhanced order option) | 10 way (2x5), 2 mm pitch |

## Interface

Table 2. *Zeta-xxP Series Interface*

| Parameter | Description |
|---|---|
| Dimensions | 7 to 42 V |
| Antenna Impedance | 50 Ohm |
| USB Speed | USB 2.0<br>(High speed 480/Mbit/s and full speed 12Mbit/s) |
| RS232 Signals | TX, RX, DCD, DTR, DSR, CTS, RTS and RI |
| RS232 Baud Rates | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 |
| RS232 Connector | Female 9-Pin D-type with locknuts |
| Power Connector | RJ12 |

# Ordering Information

### Modem Identifier
ZETA = Siretta Low Power Modem

### Module Type
N = Without GNSS
G = With GNSS (GPS, Glonass, Beidou, Galileo, QZSS)
LP = Ultra Low Power
SP = Low Power
EP = Enhanced Low Power with RS232 Debug Port
TP = Enhanced Low Power with TTL Debug Port
SD = Low Power with Diversity
ED = Enhanced Low Power with Diversity
TD = Enhanced Low Power with TTL Debug Port and Diversity

### Product Module Version
LTE1 = LTE Cat 1 Technology
LTE4 = LTE Cat 4 Technology
LTEM = LTE Cat M1 / LTE Cat NB1 Technology

### Coverage Options
(EU) = European Coverage of 2G / GSM, 3G / UMTS and 4G / LTE
(USA) = North America Coverage of 3G / UMTS and 4G / LTE
(GL) = Global Coverage of 2G / GSM and 4G / LTE
(AP) = Asia Pacific Coverage of 3G / UMTS and 4G / LTE

### Part Numbering Examples
ZETA-NLP-LTEM (GL) = Ultra Low Power Global Coverage LTE Cat M1 / LTE Cat NB1 Modem ZETA-NSP-LTE1 (EU) = Low Power European Coverage LTE Cat 1 Modem ZETA-GEP-LTE4 (EU) = Low Power European Coverage LTE Cat 4 Modem with GPIO and GNSS

### Accessories
60942 - 12V, 1A mains power supply adapter
61064 - RJ12 to open end cable, 1m, to connect to DC power
34777 – 10 Way GPIO cable, 0.5m

## GPIO Connector (Enhanced order option)

The optional IO connector on the enhanced ZETA supports the following functions:

- 1x 3-wire RS232 debug port connected directly to the cellular module
- 1x output voltage (to be used to power external interfaces and as a reference for the GPIO)
- 1x 12-bit ADC (42 V tolerant)
- 3x General purpose inputs (42 V tolerant)
- 2x General purpose open collector outputs (Capable of sinking 1 A @ 42 V)

## Diversity (Order option)

The ZETA may be ordered with a second antenna connection to improve radio sensitivity.

The function is called Antenna Diversity. Diversity improves the input sensitivity by up to 2 dB, which could aid operation in low signal strength areas. Channel aggregation is not supported by this option. Diversity is mutually exclusive with the GNSS option.

## GNSS (Order option)

GNSS is mutually exclusive with the diversity option, meaning both cannot be ordered on the same unit. The characteristics of the GNSS receiver are:

Table 3. *GNSS Receiver Specifications*

| Parameter | Typical Measurement | Notes |
|---|---|---|
| Sensitivity | | |
| Standalone or MS Based | -160.0 dBm | |
| Tracking Sensitivity Acquisition | -147.0 dBm | |
| Cold Stat Sensitivity | -145.0 dBm | |
| TTFF | | |
| Hot | 1.1 s | GPS + Glonass Stimulator Test |
| Warm | 22.1 s | GPS + Glonass Stimulator Test |
| Cold | 24.9 s | GPS + Glonass Stimulator Test |
| **Parameter** | **Typical Measurement** | **Notes** |
| Accuracy | 0.8m | GPS + Glonass Stimulator Test |
| Min Navigation Update Rate | 1 Hz | |
| Dynamics | 2 g | |
| Operation Limits | 515 m/sec | |
| A-GPS | Supported | |

Values within the table represent a ZETA operating under standard environmental conditions. Device-to-device variation is within 2 dB of the specified sensitivity.

# ZETA Models & Interfaces

The ZETA-xxP modems feature different interfaces depending on the model variant.

The **ZETA-NLP** and **ZETA-NSP** series have the following interfaces and features:

» 1 x RS232 serial port interface for direct serial connection to module (9 wire interface)
» 1 x RJ12 power connection with 2 power lines (7- 42 V) and 4 input interfaces
» 1 x SMA female cellular antenna connector
» 1 x SIM card reader (push-push)
» 3 x external LED status indicators (Red, Green, Blue)
» 1 x FS USB port

The **ZETA-NEP** series have the following interfaces and features:

» 1 x RS232 serial port interface for direct serial connection to module (9 wire interface)
» 1 x RJ12 power connection with 2 power lines (7- 42 V) and 4 input interfaces
» 1 x SMA female cellular antenna connector
» 1 x SIM card reader (push-push)
» 3 x external LED status indicators (Red, Green, Blue)
» 1 x FS USB port
» 10-Way GPIO connector

The **ZETA-GEP** series have the following interfaces and features:

» 1 x RS232 serial port interface for direct serial connection to module
» 1 x RJ12 power connection with 2 power lines (7- 42 V) and 4 input interfaces
» 1 x SMA female cellular antenna connector
» 1 x SMA female GNSS antenna connector
» 1 x SIM card reader (push-push)
» 3 x external LED status indicators (Red, Green, Blue)
» 1 x FS USB port
» 10-Way connector

Table 4. *ZETA Interfaces*

| ZETA Model | Ultra Low Power | Low Power | RS232 Serial Port | Mini USB Type B | RJ12 Power Port | SMA Cellular (Female) | SMA GNSS (Female) | SIM Reader | 10 Way GPIO |
|---|---|---|---|---|---|---|---|---|---|
| NLP | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | x |
| NSP | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | x |
| NEP | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | ✓ |
| GEP | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

# Network Support

EU = European Union
AP = Asia Pacific
USA = United States of America

Table 5. Support for ZETA-xxP Series

| ZETA Version | GSM | UMTS | LTE Cat 1 | LTE Cat 4 | LTEM | NB-IoT |
|---|---|---|---|---|---|---|
| LTE 1 (EU) | ✓ | ✓ | ✓ | | | |
| LTE 1 (USA) | | ✓ | ✓ | | | |
| LTE 1 (AP) | | ✓ | ✓ | ✓ | | |
| LTE 4 (EU) | ✓ | ✓ | ✓ | ✓ | | |
| LTE 4 (USA) | | ✓ | ✓ | ✓ | | |
| LTE 4 (AP) | | ✓ | ✓ | ✓ | | |
| LTEM (GL) | ✓ | | | | ✓ | ✓ |

## Frequency Band Support

Table 6. GSM frequency band Support

| GSM Band | Frequency | Common Name | LTE (EU) | LTE (USA) | LTE (AP) | LTEM (GL) |
|---|---|---|---|---|---|---|
| B2 | 1900 MHz | PCS | | | | ✓ |
| B3 | 1800 MHz | DCS | ✓ | | | ✓ |
| B5 | 850 MHz | Cellular | | | | ✓ |
| B8 | 900 MHz | Extended GSM | ✓ | | | ✓ |

Table 7. UMTS frequency band Support

| UMTS Band | Frequency | Common Name | LTE (EU) | LTE (USA) | LTE (AP) | LTEM (GL) |
|---|---|---|---|---|---|---|
| B1 | 2100 MHz | IMT | ✓ | | | |
| B2 | 1900MHz | PCS | | ✓ | | |
| B3 | 1800 MHz | DCS | ✓ | | | |
| B4 | 1700 MHz | AWS-1 | | ✓ | | |
| B5 | 850 MHz | Cellular | | ✓ | ✓ | |
| B6 | 800MHz | UMTS 800 | | | ✓ | |
| B8 | 900 MHz | Extended GSM | ✓ | | ✓ | |
| B19 | 850 MHz | Upper 800 (Japan) | | | ✓ | |

Table 8. LTE frequency band Support

| LTE Band | Frequency | Common Name | LTE (EU) | LTE (USA) | LTE (AP) | LTEM (GL) |
|---|---|---|---|---|---|---|
| B1 | 2100 MHz | IMT | | | ✓ | ✓ |
| B2 | 1900MHz | PCS | | ✓ | | ✓ |
| B3 | 1800 MHz | DCS | ✓ | | ✓ | ✓ |
| B4 | 1700 MHz | AWS-1 | | ✓ | | ✓ |
| B5 | 850 MHz | Cellular | | ✓ | ✓ | ✓ |
| B7 | 2600MHz | IMT-E | ✓ | | | |
| B8 | 900 MHz | Extended GSM | ✓ | | ✓ | ✓ |
| B9* | 1800 MHz | DCS | | | ✓ | |
| B12 | 700 MHz | Lower SMH | | ✓ | | ✓ |
| B13 | 700 MHz | Upper SMH | | ✓ | | ✓ |
| B14 | 700 MHz | Upper SMH | | ✓ | | |
| B18 | 850 MHz | Lower 800 (Japan) | | | ✓ | ✓ |
| B19 | 850 MHz | Upper 800 (Japan) | | ✓ | ✓ | ✓ |
| B20 | 800 MHz | Digital Dividend | ✓ | | ✓ | ✓ |
| B26 | 850 MHz | Extended Cellular | | | ✓ | ✓ |
| B28 | 700 MHz | APT | | | ✓ | ✓ |
| B28A** | 700 MHz | APT | ✓ | | | |
| B66 | 1700 MHz | Extended AWS | | ✓ | | |
| B71 | 600 MHz | Digital Dividend (US) | | ✓ | | |

* B9 was intended for use in Japan, but not deployed.

B28A is a subset of B28 using the lower duplexer frequencies:(Tx: 703-733 MHz/ Rx: 758-788 MHz)

## Data Transfer Rates

Table 9. Data transfer rates

| Technology | Upload | Download |
|---|---|---|
| 2G / GSM-EDGE* | 236 kbps | 296 kbps |
| 3G / UMTS | 5.76 Mbps (ZETA LTE1) | 7.2 Mbps (ZETA LTE1) |
| 3G / UMTS** | 11.5 Mbps (ZETA LTE4) | 42 Mbps (ZETA LTE4) |
| LTE Cat 1 | 5 Mbps | 10 Mbps |
| LTE Cat 4 | 50 Mbps | 150 Mbps |
| LTE Cat M1 | 375 kbps | 300 kbps |
| LTE Cat NB1 | 62.5 kbps | 21 kbps |

* The ZETA supports EDGE. This is an enhanced (but backwards compatible) version of GPRS, sometimes referred to as 2.75G. Not all networks can be assumed to support this, in which case the GPRS data rates will apply.

** DC-HSPA+ is also supported.

**Note:** These are the data transfer rates supported by the ZETA. To achieve the advertised speeds, good network reception and a cell tower capable of supporting the rates are required. For the fastest connection speeds, use the USB interface.

# Power Consumption

All power consumption figures are recorded with the unit powered by the recommended 12V, 1A power supply, with the modem at default settings and operating via the RS232 interface unless otherwise.

Table 10. Power consumption of ZETA-LTE in ultra-low power

| Ultra-Low Power Mode | Typical Consumption |
|---|---|
| Switched off (using PWROFF_IN on the RJ12 connector) | 0.9 mA |
| On, registered, no call in progress, AT+CFUN=1 | 11.1 mA |
| On, not registered, flight mode, AT+CFUN=4 | 10.7 mA |
| On, registered on LTE, no call in progress, 2.56 sec DRx cycle, AT+CFUN=5 | 1.5 mA |
| On, registered on LTE, no call in progress, 1.28 sec DRx cycle, AT+CFUN=5 | 1.6 mA |
| On, registered on UMTS, no call in progress, DRx8, AT+CFUN=5 | 1.4 mA |
| On, registered on UMTS, no call in progress, DRx7, AT+CFUN=5 | 1.5 mA |
| On, registered on GSM , no call in progress, DRx5, AT+CFUN=5 | 1.5 mA |
| On, registered on GSM , no call in progress, DRx2, AT+CFUN=5 | 1.7 mA |
| Operating on LTE, maximum transmit power | 318 mA |
| Operating on LTE, minimum transmit power | 112 mA |
| Operating on UMTS, maximum transmit power | 231 mA |
| Operating on UMTS, minimum transmit power | 84.6 mA |
| Operating on GSM, 900 MHz, maximum power | 185 mA |
| Operating on GSM, 1800 MHz, minimum power | 126 mA |
| GNSS active, Cellular connection idle | 20.1 mA |

Table 11. Power consumption of ZETA-LTE in low power

| Low Power Mode | Typical Consumption |
|---|---|
| Switched off (using PWROFF_IN on the RJ12 connector) | 0.9 mA |
| On, registered, no call in progress, AT+CFUN=1 | 11.6 mA |
| On, not registered, flight mode, AT+CFUN=4 | 11.2 mA |
| On, registered on LTE, no call in progress, 2.56 sec DRx cycle, AT+CFUN=5 | 7.1 mA |
| On, registered on LTE, no call in progress, 1.28 sec DRx cycle, AT+CFUN=5 | 7.2 mA |
| On, registered on UMTS, no call in progress, DRx8, AT+CFUN=5 | 7.0 mA |
| On, registered on UMTS, no call in progress, DRx7, AT+CFUN=5 | 7.1 mA |
| On, registered on GSM , no call in progress, DRx5, AT+CFUN=5 | 7.1 mA |
| On, registered on GSM , no call in progress, DRx2, AT+CFUN=5 | 7.3 mA |
| Operating on LTE, maximum transmit power | 319 mA |
| Operating on LTE, minimum transmit power | 113 mA |
| Operating on UMTS, maximum transmit power | 231 mA |
| Operating on UMTS, minimum transmit power | 85.1 mA |
| Operating on GSM, 900 MHz, maximum power | 185 mA |
| Operating on GSM, 1800 MHz, minimum power | 127 mA |
| GNSS active, Cellular connection idle | 20.5 mA |

Table 12. Power consumption of ZETA-LTEM in ultra-low power

| Ultra-Low Power Mode | Typical Consumption |
|---|---|
| Switched off (using PWROFF_IN on the RJ12 connector) | 0.9 mA |
| On, registered, no call in progress, AT+CFUN=1 | 10.1 mA |
| On, not registered, flight mode, AT+CFUN=4 | 9.7 mA |
| On, registered on LTE, no call in progress, 2.56 sec DRx cycle, AT+CFUN=5 | 1.0 mA |
| On, registered on LTE, no call in progress, 1.28 sec DRx cycle, AT+CFUN=5 | 1.1 mA |
| On, registered on LTE, no call in progress, 0.64 sec DRx cycle, AT+CFUN=5 | 1.6 mA |
| Operating on LTE Cat M1, maximum transmit power | 73.8 mA |
| Operating on LTE Cat M1, minimum transmit power | 46.3 mA |
| Operating on LTE Cat NB1, maximum transmit power | 23.7 mA |
| Operating on LTE Cat NB1, minimum transmit power | 16.4 mA |
| Operating on GSM, 900 MHz GPRS, maximum power | 91.8 mA |
| Operating on GSM, 900 MHz GPRS, minimum power | 46.3 mA |
| Operating on GSM, 900 MHz EDGE, maximum power | 188.3 mA |
| Operating on GSM, 900 MHz EDGE, minimum power | 52.8 mA |
| GNSS active, Cellular connection idle | 16.4 mA |
| GNSS active, Cellular connection idle | 20.5 mA |

Table 13. Power consumption of ZETA-LTEM in low power

| Low Power Mode | Typical Consumption |
|---|---|
| Switched off (using PWROFF_IN on the RJ12 connector) | 0.9 mA |
| On, registered, no call in progress, AT+CFUN=1 | 10.6 mA |
| On, not registered, flight mode, AT+CFUN=4 | 10.2 mA |
| On, registered on LTE, no call in progress, 2.56 sec DRx cycle, AT+CFUN=5 | 6.7 mA |
| On, registered on LTE, no call in progress, 1.28 sec DRx cycle, AT+CFUN=5 | 6.8 mA |
| On, registered on LTE, no call in progress, 0.64 sec DRx cycle, AT+CFUN=5 | 7.2 mA |
| Operating on LTE Cat M1, maximum transmit power | 74.3 mA |
| Operating on LTE Cat M1, minimum transmit power | 46.8 mA |
| Operating on LTE Cat NB1, maximum transmit power | 24.2 mA |
| Operating on LTE Cat NB1, minimum transmit power | 16.9 mA |
| Operating on GSM, 900 MHz GPRS, maximum power | 92.3 mA |
| Operating on GSM, 900 MHz GPRS, minimum power | 46.8 mA |
| Operating on GSM, 900 MHz EDGE, maximum power | 188.8 mA |
| Operating on GSM, 900 MHz EDGE, minimum power | 53.3 mA |
| GNSS active, Cellular connection idle | 16.9 mA |
| GNSS active, Cellular connection idle | 20.5 mA |

**Note:**

- An additional 0.5 mA of power is required for ZETA units with the GPIO connector (Enhanced order option), regardless of power state, excluding current drawn by external devices connected to the IO port. I.e. If you connect anything to the IO port, its current requirements will be separate from this baseline value.
- Power consumption is influenced by network conditions beyond the control of the ZETA or application in use. Consequently, actual power consumption may vary, and both higher and lower values than those shown here may be observed.
- ‘Operating’ is defined as connected to the network and sending data at the maximum data rate through the USB interface.
- The transmit power level will normally be set automatically by the modem depending on network conditions. Maximum power will occur at low received signal strengths and minimum power at high received signal strengths.
- GNSS power consumption figures do not account for any additional power required to operate an active GNSS antenna.

# System Overview

The ZETA is a versatile device, as such it can be applied in a number of applications, including but not limited to:

» Serving as a power efficient cellular communication interface.

» Upgrading your estate with a low power solution that operates seamlessly on the existing cellular network.

» Future-proofing applications by installing a 4G/LTE compatible solution with 2G/GSM fall back.

» Integration as a standard cellular modem with existing equipment.

**Important:** This device adheres to the USB standard Communication Device Class (CDC) specification.

Ensure that the appropriate Telit USB driver is installed when connecting to the modem via USB. Device drivers can be downloaded from: https://www.siretta.com/usb-drivers.

Similarly, if using a USB to RS232 cable, the corresponding driver should be installed. These drivers can be downloaded from: https://www.siretta.com/serialdrivers.

## Operating System Connected Modem

» Internet enabled remote device with RS232 and/or USB connectivity over 2G/ GPRS, 3G/UMTS, LTE-M, LTE Cat NB1, LTE Cat 1, LTE Cat 4. 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 Wi-Fi is a less common method to connect to the internet or where services are unavailable. The ZETA can overcome this restriction by providing a mobile internet solution over the cellular network.

## Examples

» Vending machine integration, allowing the head office to poll for real-time data on remaining stock, money collected, and other metrics through an on-demand system.

» Monitoring AMR/temperature/equipment in a home, i.e. Interrogate lights etc.

» 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 cellular network).

» Polling remote devices for information to prevent an engineer callout.

# ZETA-xxP Images

*Figure 1. ZETA-NLP, NSP and NEP*


*Figure 2. ZETA-GEP*

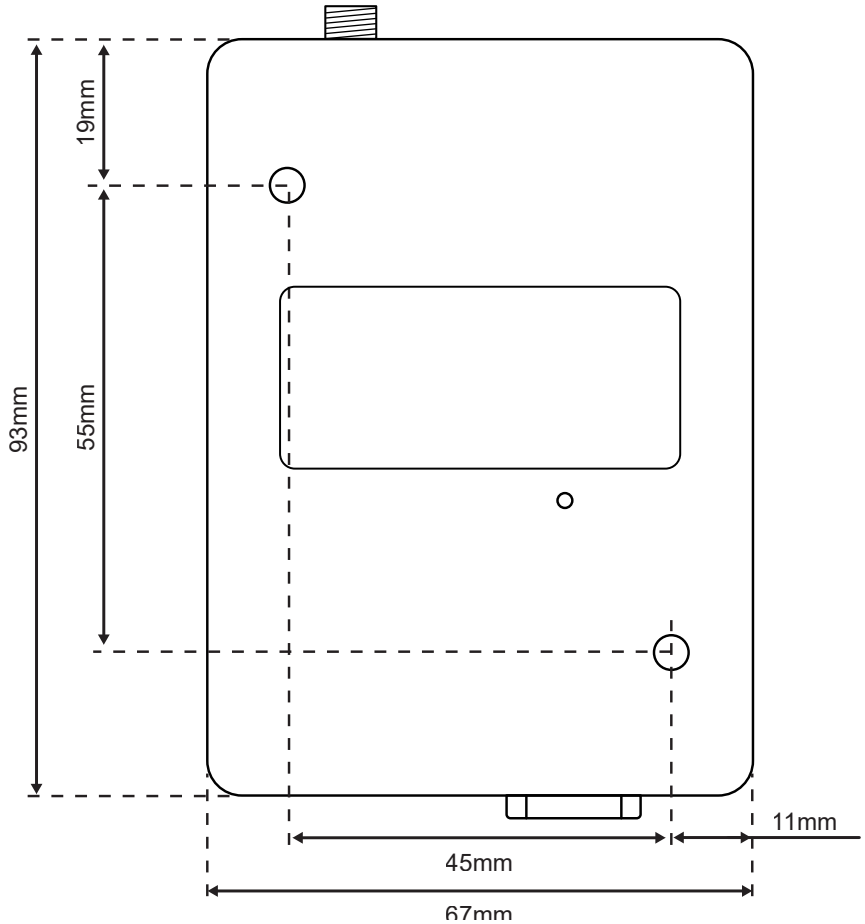

*Figure 3. 3D view of the ZETA-NLP and ZETA-NSP*


*Figure 4. 3D view of the ZETA-NEP and ZETA-GEP*

# Dimensions

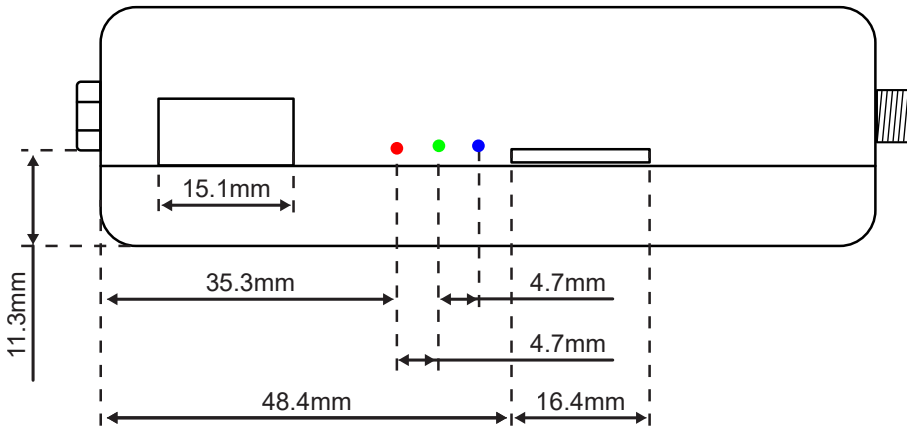
All measurements are specified in millimetres (mm).

**Bottom View** *Figure 5. Mounting points*



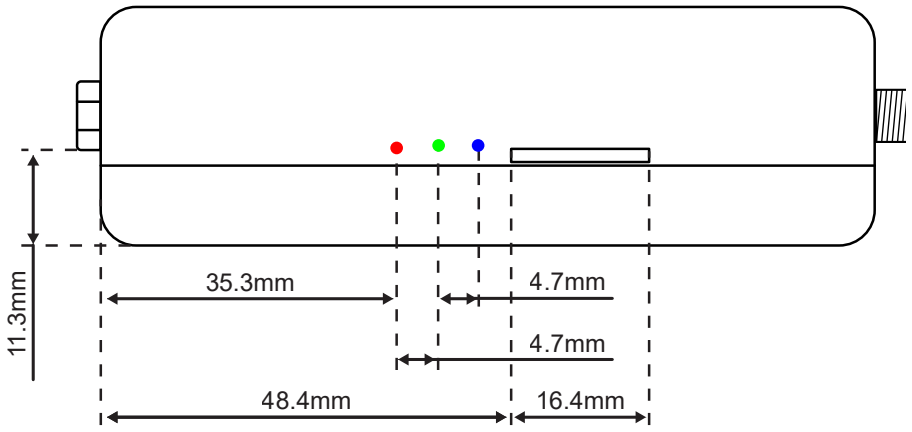
### Side View: ZETA-GEP & ZETA-NEP

*Figure 6. 10-Way GPIO Header, LED indicators and SIM card slot*



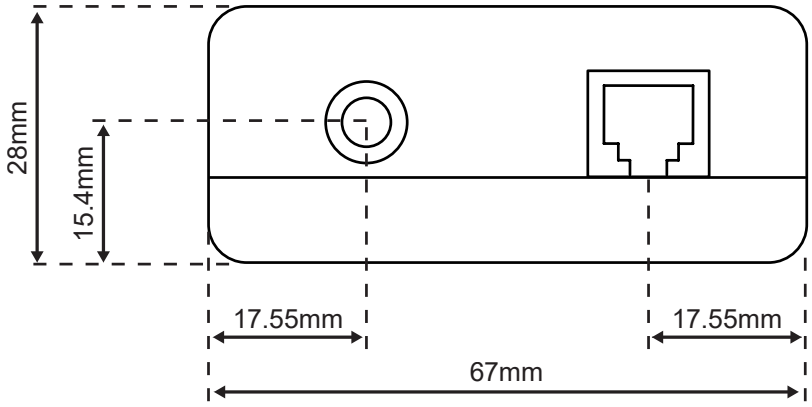

### Side View: ZETA-NLP & ZETA-NSP

*Figure 7. LED indicators and SIM card slot*



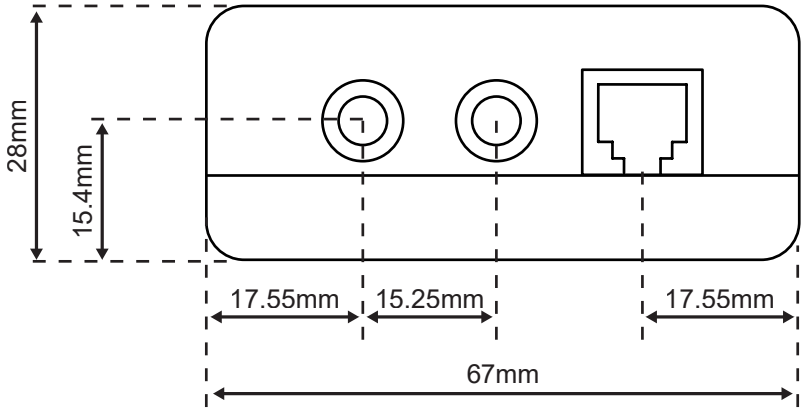
### End View: ZETA-NLP & ZETA-NSP

*Figure 8. Antenna and power connectors*



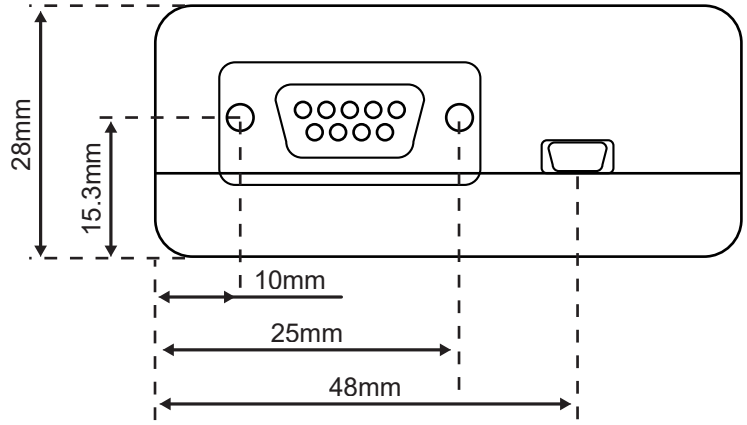

### End View: ZETA-GxP

*Figure 9. Antennae and power connector*




### End View

*Figure 10. RS232 and Mini-B connectors.*



# AT Commands

ZETA modems are powered by a cellular engine that can be controlled via the serial interface using standard AT commands. AT (Attention) commands serve as a prefix to additional parameters within a structured string. AT commands, combined with the necessary parameters can be sent to the modem through the preferred terminal emulator such as Teraterm or HyperTerminal, and executed 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 AT command set for User Equipment (UE).
3. 3GPP 27.005 Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS).
4. Proprietary command set, the module family also supports a proprietary set of AT commands for special purposes outside of the standard AT specification.

Visit the Siretta document library: https://www.siretta.com/document-library/ for the most up-to-date AT command reference guide which includes a comprehensive list of supported commands, and descriptions on their usage.

## Ultra Low Power Options

The ultra-low power feature enables a ZETA model with this capability to enter an ultra-low power state while remaining connected to the cellular network. The device will automatically wake from this state if any incoming cellular network activity is detected, ensuring no network traffic is lost. This mode of operation is executed using the AT Command: **AT+CFUN=5**.

Once this command has been issued the modem is ready to enter ultra low power mode. To activate ultra-low power, sending the modem in to a dormant state, the DTR line must be de-asserted on the serial port. This can be done using a terminal emulator like RealTerm. The modem will respond by de-asserting the CTS line, indicating it has successfully entered ultra-low power mode. This allows the modem to consume very little current whilst not in use, but be quickly available for local use by re-asserting the DTR line.

Once the modem enters ultra-low power mode, the serial port is deactivated, and the modem will no longer respond to AT commands, effectively appearing off. To resume the normal operation and begin communication you will need to reassert the DTR line.
For ZETA variants without the ultra-low power option, the **AT+CFUN=5** command can still be used to reduce power consumption, though the savings will be less significant compared to the ultra-low power mode.

## Ultra Power Mode Receiving Data

In the ultra low power state, special configurations are needed to enable data being received from a connected socket to be output over the serial port.

The serial port must be configured in the following ways:

1. Enable hardware flow control with **AT&K3**.
2. Enable low power mode by issuing **AT+CFUN=5**.
3. Setup a socket and establish an active connection.
4. Enter ultra low power state by de-asserting DTR control line.
5. De-assert RTS line.
6. Wait for specified timeout to check for incoming data.

When the timeout has expired, check for data over the connected socket:

1. Assert DTR line to disable low power state and activate full serial port.
2. Assert RTS line to receive full buffered data over serial port and wait for all data to be received.
3. When all data has been received de-assert RTS line.
4. De-assert DTR line to re-enter low power state and wait for the specified time-out to receive further data.

**Important:** When no data is pending reception from the cellular network, the modem operates at the published low power consumption figures. However, if there is data pending from the cellular network, the power consumption increases to approximately 5 mA at 12 V until the data transfer process has completed and low power state is re-entered.

The modem does not automatically enter the full power state while there is pending cellular network data, so the connected application is required to periodically poll the cellular network. If there is pending data, this will immediately start to be received over the serial connection. Once the data transfer is complete, the modem can be put back in to the low power state where it will meet the published power consumption figures.

The shorter the check interval, the less time will be potentially spent at the higher 5mA current consumption. Choose this check interval to match the requirements of your system.

# Interfaces

## System Diagram

The system diagrams below visually illustrate the ZETA interfaces and highlight the key subsections that comprise the modem.

*Figure 11. ZETA-NLP/ ZETA-NSP Block diagram*

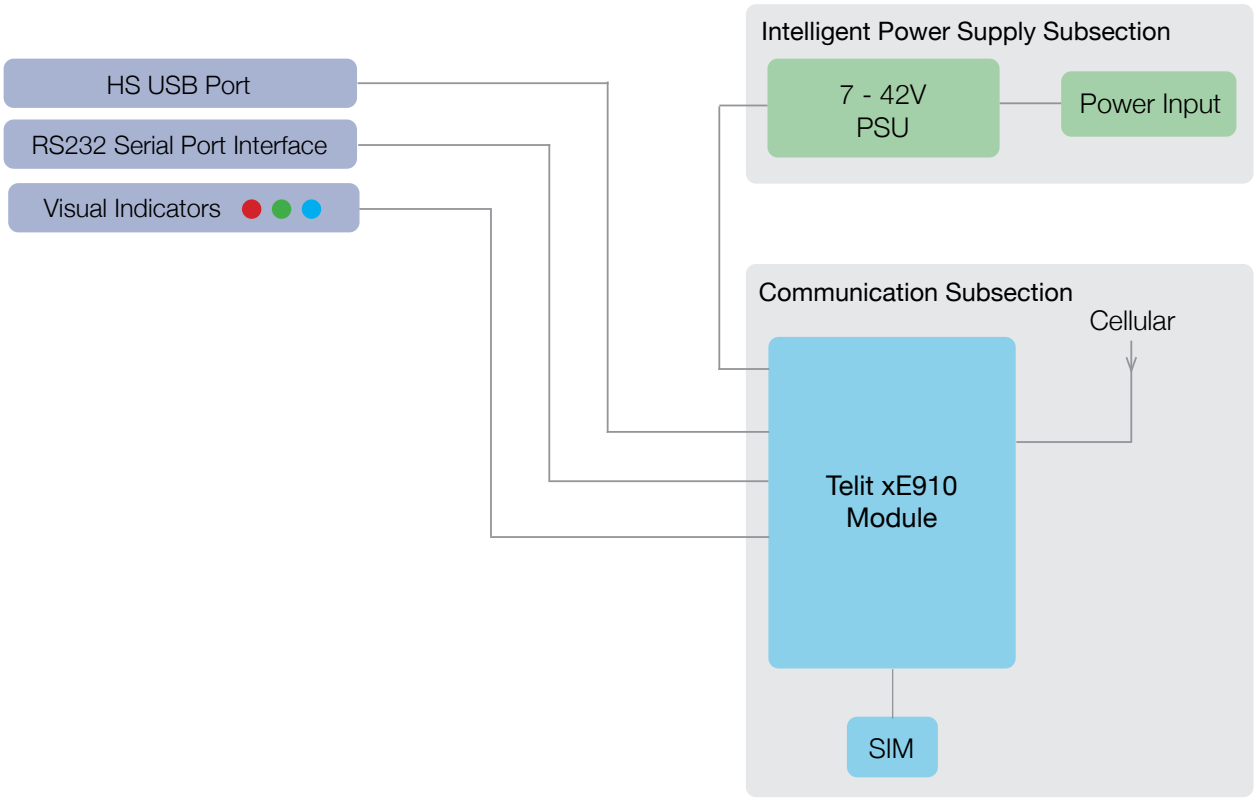


*Figure 12. ZETA-NEP Block diagram*

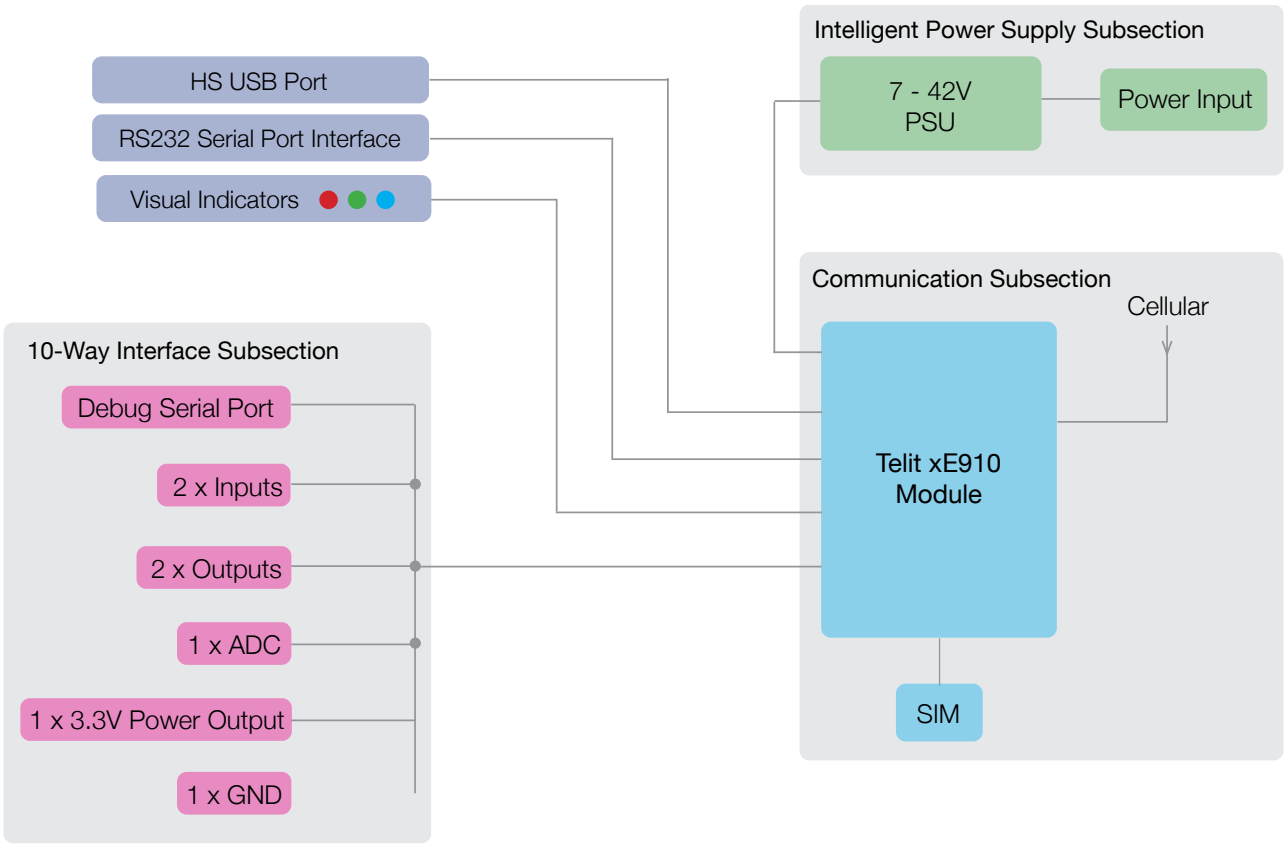
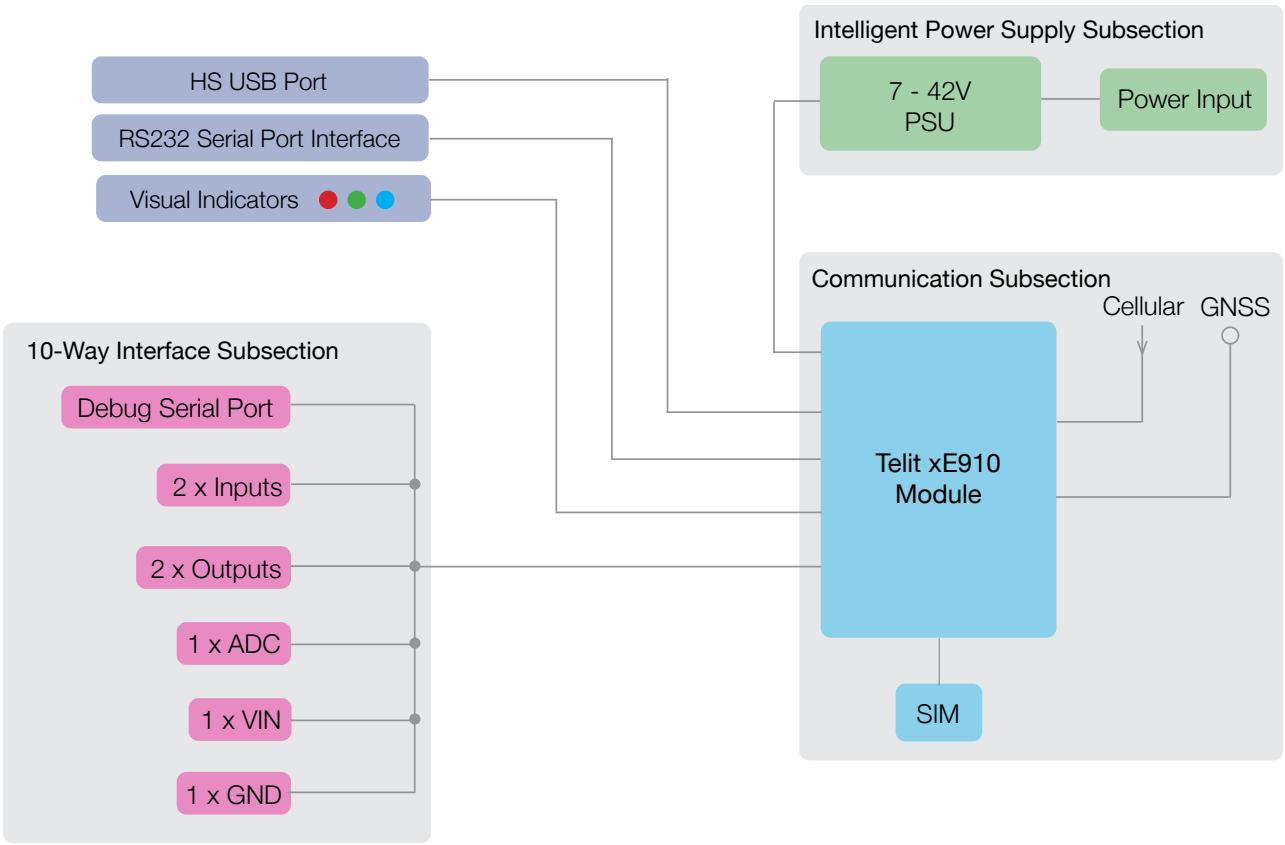


*Figure 13. ZETA-GEP Block diagram*



## RS232 Serial Port

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 reference guide. The ZETA modem is a DCE device (Data terminating). All pins in the 9-way D type connector are electrically connected inside the modem.

*Figure 14. RS232 ports*

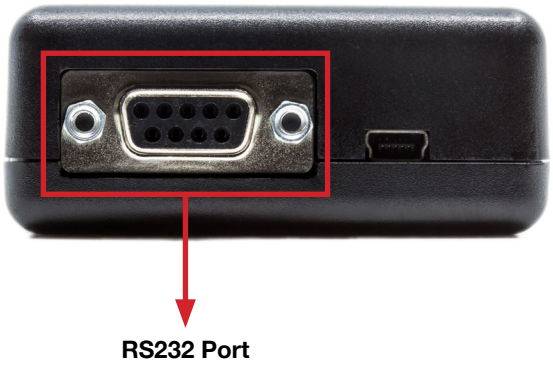



*Figure 15. Pin numbering*

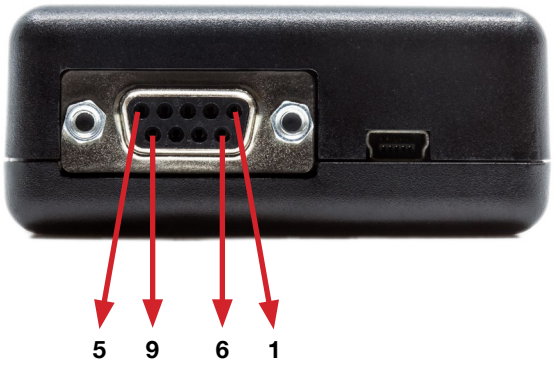



Table 14. RS232 Pin Numbering

| Pin | Name | Usage | Direction |
|---|---|---|---|
| 1 | DCD | Output from UART that indicates the carrier is present | OUT |
| 2 | RXD | Output transmit line of UART | OUT |
| 3 | TXD | Input receive line of UART | IN |
| 4 | DTR | Input to UART and controls DTE ready condition | IN |
| 5 | GND | Ground | IN |
| 6 | DSR | Output from UART that indicates the module is ready | OUT |
| 7 | RTS | Request to Send – Input line of UART that controls hardware flow control | IN |
| 8 | CTS | Clear to Send – Output line of UART that controls hardware flow control | OUT |
| 9 | RI | Ring Indicator – Output line of UART that indicates the incoming call condition | OUT |

Table 15. Baud Rates

| Supported Baud Rates | Name |
|---|---|
| 2400 | 38400 |
| 4800 | 57600 |
| 9600 | 115200 |
| 19200 | 230400 |

**Note:** The ZETA-NLP has an ultra-low power mode of operation, which when enabled by de-asserting DTR will force all the RS232 output pins to be high impedance and not be driven. Only when DTR is asserted will the RS232 port be enabled.

9-Way RS232 connector compliant with TIA-232-F with all signals connected. Maximum data rate 230.4 kbps (with a load of 3k Ω, 1000 pF). All characteristics are over the operating temperature range of -40 to +85 °C unless stated otherwise.

Table 16. RS232 transmitter electrical characteristics

| Transmitter Parameter | Conditions | Min | Typ | Max |
|---|---|---|---|---|
| Output voltage swing | 3k Ω load to ground | ±5.0 V | ±5.4 V | |
| Output short circuit current | | | ±35 mA | ±60 mA |

Table 17. RS232 receiver electrical characteristics

| Transmitter Parameter | Conditions | Min | Typ | Max |
|---|---|---|---|---|
| Voltage range | | -25 V | | 25 V |
| Threshold low | | 0.6 V | 1.2 V | |
| Threshold high | | | 1.8 V | 2.4 V |
| Hysteresis | | | 0.3 V | |
| Resistance | +25 °C | 3k Ω | 5k Ω | 7k Ω |

# Mini-USB Port

*Figure 18. ZETA USB Connenctor*


The mini USB Type B connector is used for USB serial connections and features ESD protection of up to ±4 kV for contact discharge and ±8 kV for air discharge. The pin configuration for this connector is described in table 18.

Table 18. Mini-USB Connectors

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

# USB Interface Drivers

ZETA 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 modem and view the debug output. ZETA modems support a maximum communication baud rate of 12 Mbit/s. To use the USB port, appropriate drivers are required, which are available for various operating systems, including Windows and Linux.

In high speed LTE modes, downlink data speed rates can be exceed the maximum RS232 serial data rate. To achieve this network data rate using the ZETA-xxP, integrators should interface the ZETA-xxP to their applications in full-speed (12 Mb/s) mode.

The device driver creates up to 6 virtual COM ports on the system for access to the module. Up to 4 of these ports can be configured for use as general purpose AT command communication ports.

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

Search for: **AT#PORTCFG** within the AT reference guide for more detailed information on configuring the ports.

ZETA modems do not support automatic baud rate detection. Therefore, the correct baud rate must be configured for serial communication before initializing the device. Once the correct speed is set, the device will respond with “OK” to any valid AT command. The default baudrate is 115200. To change the baudrate:

» Send command: AT+IPR=<rate>
» Wait for ‘OK’ response

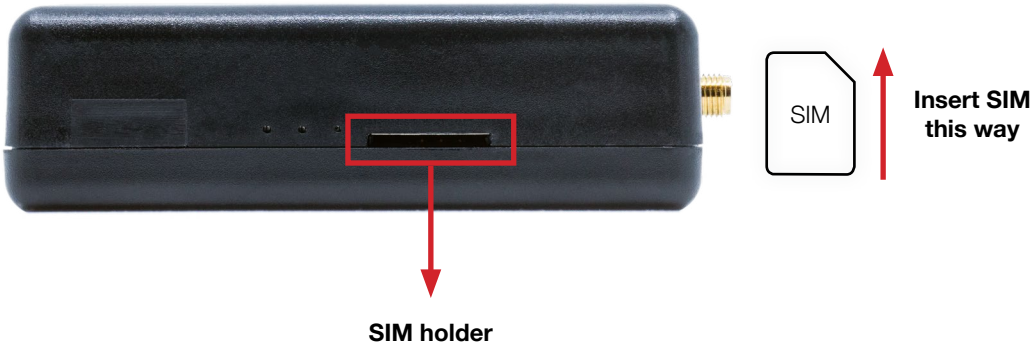
Table 19. USB Baud Rates

| Supported Baud Rates | Name |
|---|---|
| 300 | 115200 |
| 600 | 230400 |
| 1200 | 460800 |
| 2400 | 921600 |
| 4800 | 2900000 |
| 9600 | 3200000 |
| 19200 | 3686400 |
| 38400 | 4000000 |
| 57600 | |

## SIM Socket

ZETA modems support both fixed SIMs, limited to a single network, and roaming SIMs (global roaming included) that can operate on multiple networks. This enables least-cost routing for mobile data and M2M applications, ensuring reliable connectivity in areas with varying signal strength where network selection is essential.

*Figure 17. SIM Slot*



# LED Indicators

The ZETA  features three LED indicators in red, green, and blue. By default, these LEDs display the modem's operational status. However, users can customise their functionality for other purposes through software. The table below outlines the roles of each LED.

*Figure 18. ZETA-NLP & NSP LEDs*

*Figure 19. ZETA-NEP & GEP LEDs*

Table 20. LEDs

| LED | At power up or PWRON_IN/PWROFF_IN control | After power up |
|---|---|---|
| Red | Undefined state | Network registration state / call indication<br>Blinking = Network registered.<br>Solid = Unregistered, searching. |
| Green | Rapid blink during power on, otherwise off | Off / User defined |
| Blue | Rapid blink during power off, otherwise off | Off / User defined |

## Power up LED States

The green and blue LEDs are managed by the ZETA's power management controller, while the red LED is controlled by the embedded modem module. Upon initial power, the blue LED will remain off and the green LED will blink rapidly (500 ms on, 500 ms off) until the embedded module is initialised. The red LED will then light up. If the ZETA successfully registers to the network, the red LED will blink (1000ms on, 2000ms off). Otherwise, it will remain solid until registered.

## ZETA-NLP Variants

After the power on process is complete, all LED's are disabled to conserve power. However, the green LED will briefly flash once every 30 seconds to show that that the modem is still active.

## ZETA-NSP, ZETA-NEP and ZETA-GEP Variants

After the power on process is complete the red, green and blue LED's are controlled directly by the module using the standard set of AT commands seen in as shown in tables 21 (Red LED) and 22 (Green and Blue LEDs).

## Red LED User Control (Not applicable to ZETA-NLP variant)

Table 21. Red LED AT Commands

| | AT Commands | | |
|---|---|---|---|
| LED | Set network registration status | Turn on LED permanently | Turn off LED permanently |
| Red | AT#GPIO=1,0,2 | AT#GPIO=1,1,1 | AT#GPIO=1,0,0 |

## Blue and Green LED User Control (Not applicable to ZETA-NLP variant)

The green LED is connected to GPIO2 of the module, and the blue to GPIO3. Both LEDs can be independently controlled as outputs using AT commands, with the default state being off.

Table 22 provides the commands for changing the LED states.

**Note:** These settings are volatile and will be lost when power is cycled. However, certain firmware releases provide the option to make this setting permanent.

Table 22. Green and Blue LED AT Command

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

Refer to the AT Commands Reference Guide for more information on the **AT#GPIO** command.

## PWRON_IN Power On Procedure LED Indicators

PWRON_IN is the power-on signal (pin 4 of the RJ12 power connector). Bringing PWRON_IN high will power on a ZETA.

## PWRON_IN Power Off Procedure LED Indicators

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

During power off, the green and blue LEDs are controlled directly by the ZETA, the red LED is controlled by the embedded modem module. While the ZETA is transitioning through the power off state the Blue LED will flash rapidly (500 mS on, 500 mS off) before all LEDs turn off.

# GPIO 10-Way Connector

This connector provides a versatile multi-way interface, giving users access to additional features within the ZETA modem. It enables connections to key peripheral components, including the ADC, trace/debug RS232 serial port, and the GPIO interface. The connector can also supply power. If used for this purpose, the current drawn by connected devices must be considered. Since the included power supply is rated at only 1A, it may not be sufficient for additional devices, so a higher-rated power supply should be considered.

The GPIO pins offer flexible functionality, configurable as inputs to read signals from sources such as temperature sensors or motion detectors. As outputs, they can drive relays to control higher-power devices such as motors, lights, or alarms.  For seamless integration, the recommended mating connector is the FCI 89947-710LF Receptacle Connector (IDC 2mm, 2x5, 10-way), which can be purchased directly through Siretta .

*Figure 20. 10-way connector*

*Figure 21. Pin numbering*

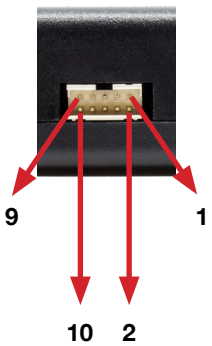



*Figure 22. FCI 89947-710LF*

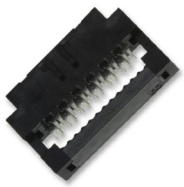


Table 23. GPIO Pin Numbering

| Pin | Name | Direction | Description | Low Level | High Level |
|---|---|---|---|---|---|
| 1 | Input 1 | Input | General Purpose Input 1 | - | - |
| 2 | ADC 1 | Input | Analogue to Digital Converter 1 | 0 – 0.05 V | 42V |
| 3 | Input 2 | Input | General Purpose Input 2 | - | - |
| 4 | VIN_OUT | Output | Power Supply Voltage Output* | - | - |
| 5 | Input 3 | Input | General Purpose Input 3 | - | - |
| 6 | Debug TX | Output | Debug Serial Transmit (TTL) 115200 Baud Rate | -5 V | 5 V |
| 7 | Output 1 | Output | General Purpose Open Collector Output 1 | - | - |
| 8 | Debug RX | Input | Debug Serial Receive (TTL) | -25 V | 25 V |
| 9 | Output 2 | Output | General Purpose Open Collector Output 2 | - | - |
| 10 | GND | Input | Signal Ground | - | - |

**Note:**

» Devices with batch code 44055 or greater → Pin 4 outputs VIN.

» Devices with batch code less than 44055 → Pin 4 outputs 3.3V.

The batch code is printed on the silver label on the rear of the modem.

## General Purpose Inputs (GPI)

Table 24. Input pin

| Pin | Name | Direction | Description | Low Level | High Level |
|---|---|---|---|---|---|
| 1 | Input 1 | Input | General Purpose Input 1 | 0 – 0.35 V | 1 – 42 V |
| 3 | Input 2 | Input | General Purpose Input 2 | 0 – 0.35 V | 1 – 42 V |
| 5 | Input 3 | Input | General Purpose Input 3 | 0 – 0.35 V | 1 – 42 V |

Table 25. Input command

### AT Commands for Reading Inputs

| Pin | Commands |
|---|---|
| 1 | AT#GPIO=6,2,0 |
| 3 | AT#GPIO=7,2,0 |
| 5 | AT#GPIO=8,2,0 |

**Note:** The commands use GPIO 6, 7, an 8 as opposed to 1, 3, and 5 because these are the internal mappings assigned to the respective pins.

## General Purpose Outputs (GPO)

Table 26. Output pins

| Pin | Name | Direction | Description | On | Off |
|---|---|---|---|---|---|
| 7 | Output 1 | Output | General Purpose Output 1 | 11 mΩ | 50 MΩ |
| 9 | Output 2 | Output | General Purpose Output 2 | 11 mΩ | 50 MΩ |

**Note:** The digital outputs are fully controlled via AT commands. The following commands can be used to initialise and set the digital output functionality.

Table 27. Output commands

| | AT Commands for Controlling Outputs | | | |
|---|---|---|---|---|
| Pin | GPO 1 ON | GPIO 1 OFF | GPIO 2 ON | GPIO 2 OFF |
| 7 | AT#GPIO=4,1,1 | AT#GPIO=4,0,1 | | |
| 9 | | | AT#GPIO=5,1,1 | AT#GPIO=5,0,1 |

# Digital Functions

The maximum input current consumption and output current drive for the respective GPIO pins are listed in table 28.

Table 28. Input/Output Voltages

| Signal Name | Parameter | Voltage level | Current source / Sink |
|---|---|---|---|
| Input 1 | Input current | VCC | 0.31 mA |
| Input 2 | Input current | VCC | 0.31 mA |
| Input 3 | Input current | VCC | 0.31 mA |
| Output 1 | Current sink | VCC | 1.0 mA |
| Output 2 | Current sink | VCC | 1.0 mA |
| ADC | Input current | VCC | 4.2 mA |
| VIN Output or 3.3V Output* | Power supply | VIN or 3.3 V* | 100 mA |

**Note:**

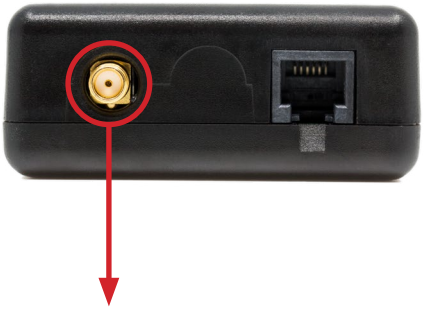
» Devices with batch code 44055 or greater → Pin 4 outputs VIN.

» Devices with batch code less than 44055 → Pin 4 outputs 3.3V.

The batch code is printed on the silver label on the rear of the modem.

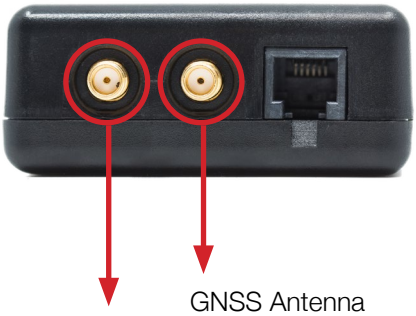
# SMA Antenna Connectors

*Figure 23. ZETA-NxP Antenna connector*



Cellular Antenna Connector

*Figure 24. ZETA-GEP Antenna connectors*



Cellular Antenna Connector

GNSS Antenna Connector (ZETA-GEP)

## 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 50 cm. The antenna should not be placed inside a metal box.

Please read the antenna manufacturers installation instructions carefully - some antennas require a ground plane.

If experiencing poor reception, try installing the antenna at a higher elevation. Raising the antenna is typically the most effective method to enhance signal strength.

## 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

For correct operation of the ZETA, to fulfil all regulatory requirements and prevent damage, the antenna connected must meet the following requirements:

- Frequency range: An antenna that covers all the frequency bands supported by the ZETA (version dependant).
- Gain absolute maximum: 3 dBi
- Gain recommended: < 2 dBi
- Impedance: 50 Ohm
- Input Power: > 33 dBm (2W) peak power in GSM
  > 24 dBm average power in UMTS & LTE
- VSWR absolute maximum: <= 10:1 (to prevent damage)
- VSWR recommended: <= 2:1 (to fulfil regulatory requirements)

# GNSS

## ZETA-GEP Modem

The ZETA-GEP modem has a cutting edge GNSS receiver that can simultaneously search and track satellite signals from multiple satellite constellations. By leveraging the full spectrum of Global Navigation Satellite Systems, it supports:

- GPS
- GLONASS
- BeiDou
- Galileo
- QZSS

### Key Features of the ZETA-GEP GNSS Receiver

- Advanced real-time hardware correlation engine for enhanced sensitivity navigation (PVT)
- Fast Acquisition giving rapid Time-to-First-Fix (TTFF)
- Low power consumption for energy efficiency
- 32 tracking verification channels
- Stand alone and assisted tracking modes
- GNSS sensitivity (-157 dBm) enabling indoor tracking
- Support for Satellite-Based Augmentation Systems (SBAS)
- Wide Area Augmentation System (WAAS)
- European Geostationary Navigation Overlay Service (EGNOS)
- Multi-functional Satellite Augmentation System (MSAS)

This high-performance GNSS receiver ensures precise and reliable positioning, even in challenging environments.

# GNSS Antenna Connector (ZETA-GEP Models)

## GNSS Antenna Polarisation

The GNSS signal as broadcast is a right hand circularly polarised signal. The best antenna to receive the GNSS signal is a right hand circularly (RHCP) polarised patch antenna.

## GNSS Antenna Gain

Antenna gain is defined as the increase in signal power provided by an antenna in a specific direction, compared to an ideal isotropic antenna (which radiates equally in all directions). It is measured in dBi (decibels relative to an isotropic antenna. It is important to distinguish GNSS antenna gain from external Low Noise Amplifier (LNA) gain, they are not the same.

Most antenna manufacturers specify these values separately, but some may combine them into a single gain figure. When designing and evaluating the front-end of a GNSS receiver, understanding both antenna gain and LNA gain is crucial to ensure optimal signal reception and system performance.

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 -125 dBm, a higher gain antenna would improve the gain and improve the performance of the GNSS 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 GNSS antenna should ideally be placed away from the ZETA modem, an active antenna is recommended for optimal system performance. An active antenna includes a built-in Low Noise Amplifier (LNA), which helps compensate for RF trace and cable losses that occur after the antenna.

## GNSS Power Supply

The ZETA modem provides a stable, high-accuracy, low-dropout power supply to the GNSS antenna, ensuring optimal GNSS performance.

Table 29. GNSS Power Consumption

| Characteristics | Typical Values |
|---|---|
| Power consumption in acquisition | 16.4 mA |
| Power consumption in tracking | 12.8 mA |
| Power consumption in low power tracking | 5.7 mA |

## GNSS Output Power

The GNSS signal as broadcast is a right hand circularly polarised signal. The best antenna to receive the GNSS signal is a right hand circularly (RHCP) polarised patch antenna.

## GNSS Antenna Gain

The GNSS antenna power supply is only active when the GNSS engine is powered on.

» Turn the GNSS engine ON by sending the command **AT$GPSP=1**. This enables the GNSS antenna power supply.

» Turn the GNSS engine OFF by sending the command **AT$GPSP=0**. This disables the GNSS antenna power supply.

To enable the GNSS module to output NMEA data (the standard GPS data format), the **AT$GPSNMUN** command is used.

Table 30. GNSS Output Characteristics

GNSS Antenna Power Supply Output Characteristics

| Parameter | Min | Nominal | Max |
|---|---|---|---|
| Output enabled | 3.2 V | 3.3 V | 3.4 V |
| Output disabled | - | 0.0 V | 0.2 V |
| Output current | 0 mA | 20 mA | 100 mA |

# Power

## RJ12 Power Connector

This connector supplies DC power and transmits power ON/OFF signals to the modem.

*Figure 25. ZETA-xxP RJ12 Power Connector*

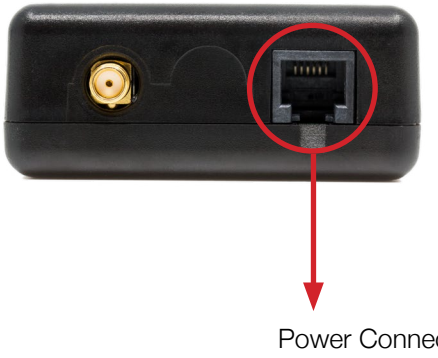



*Figure 26. Pin Numbering*


Table 31. RJ12 Pin numbering

| Pin | Name | Function | Description |
|---|---|---|---|
| 1 | V_IN | Power | Input power (7 V to 42 V; 12 V @ 1 A recommended)* |
| 2 | RESET_IN | Input | Hard System Reset |
| 3 | PWROFF_IN | Input | Power off signal |
| 4 | PWRON_IN | Input | Power on signal |
| 5 | Reserved | Input | Unused input |
| 6 | GND | Power | Ground |

* The included power supply can power external voltage-based systems connected to the GPO pins. However, if using the output pins in high-current applications, a separate power supply rated for the required load would be better suited as this could exceed the 1A rating.

Table 32. RJ12 Input Pin Parameters

| Name | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Maximum input voltage | | | | 42 | Volts |
| Input threshold low | | | | 0.25 | Volts |
| Input threshold high | | 1.75 | | | Volts |
| Input resistance | +25 °C | 23.5 | | 47 | kΩ |

All characteristics are within the operating temperature range of -40 to +85 °C unless stated otherwise.

All signal input pins have an internal 47K Ω pull down to ground, so it is acceptable to leave them disconnected if unused. This is their inactive (off) state.

The modem ON/OFF state is activated by the PWRON_IN and PWROFF_IN signal inputs respectively.

On power up the initial state of the modem is ON. The modem's ON/OFF states can be found in table 26.

Table 33. Modem States

| ZETA-xxP 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 |

# Power Supply Requirements

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

Table 34. Input Power Characteristics

| ZETA-xxP Series | |
|---|---|
| DC input voltage | 7 to 42 V |
| Recommended input voltage | 12 V DC |
| Supply current @ 12V: | |
| Peak (20ms at registration) | 1 A |
| Average standby | 11 mA |
| Call in progress | 200 mA |
| Ringing | 210 mA |
| GNSS enabled | 16 mA |

The ZETA's current consumption varies with input voltage, decreasing as the voltage increases. The recommended input voltage is 12V, though the modem supports a broad operating voltage range from 7V to 42V, allowing for flexibility in powering options. The ZETA can be powered in two ways:

» RJ12 Power Supply – A standard multi region power supply delivers a steady 12 V at 1 A. A suitable mains power supply is included with the starter kit, which can also be ordered separately if needed.

» Power Cable – An external DC power source that users can provide, operating within 7V to 42V. This allows flexibility to power the ZETA modem using batteries or custom power supplies.

A 1-meter cable terminated with an RJ12 connector is included with the ZETA starter kit. It can also be ordered separately under part number 61064.

The RJ12 connector used to apply power to the ZETA is polarised, meaning reverse voltage protection is not included. However, the power supply input does have ESD protection and is able to withstand a Human Body Model transient pulse of +/-2500 V, in accordance with JEDEC JESD22-A114 standards.

# Switching the Modem On/Off

## Powering in the ZETA

ZETA modems offer two methods for power on.

1. Auto power up - The modem features an integrated power controller that manages its functionality and enables automatic power-up when power is applied.
2. Manual power up - The modem can be powered on manually by using the PWRON_IN pin on the RJ12 power connector (Pin 4). Applying a voltage between 1.75V and 42V to this pin for more than 0.5 seconds will turn the modem on.

The modem becomes fully operational after powering on and is then able to send AT commands. The startup time varies depending on the startup procedure and may take up to 40 seconds.

## Shutting down the ZETA

The ZETA should only be powered down manually.

1. Manual shut down - The modem can be turned off using the PWROFF_IN pin on the RJ12 power connector (Pin 3). Applying a voltage between 1.75V and 42V for more than 0.5 seconds will initiate the shutdown procedure.

## Power-On and Power-Off Signal Requirements

The PWRON_IN and PWROFF_IN signals require a positive edge (a transition from low to high voltage) to power on the modem. This means the signal must rise from 0V (GND) to at least 1.75V. Slow transitions (longer than a few milliseconds) or minor voltage changes (only a few millivolts) will not trigger power-on, as they do not meet the requirements for a proper positive edge.

However, this is rarely an issue in typical modem applications. It may only occur in specific cases, such as when large capacitors are present in the power supply, causing slow-rising or falling signal edges.

# Recovery Boot Mode

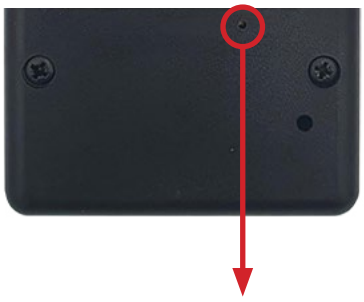
**Important:** This mode is not required for normal operation. Recovery boot should only be used when the modem is non-functional and cannot be recovered through the standard firmware update process.

To enter recovery mode, insert the pin tool into the small opening on the back of the modem. Press and hold the switch until the connected computer detects the device, typically it takes about10 seconds. Once recognised, a new device named 'QDLoader' will appear under 'Ports (COM & LPT)' in Windows Device Manager. The module will remain in this state until one of the following actions are taken:

» Device Reboot: Power down the module and reboot.

» Firmware Update: If the modem is in a non-working state then you may be able to recover it. Run the firmware update procedure in SirettaSPARK to reflash the firmware on the module. Allow the entire update procedure to complete before powering down the modem.

*Figure 27. Configuration Switch*



ZETA modem emergency boot configuration switch

*Figure 28. Function pin tool*

## Disaster recovery power down reset procedure

The GNSS signal as broadcast is a right hand circularly polarised signal. The best antenna to receive the GNSS signal is a right hand circularly (RHCP) polarised patch antenna.

If the standard power-down method fails or the unit becomes unresponsive, you can reset the modem by connecting the RESET_IN pin to a logic high voltage (1.75 V – 42 V) for at least 0.5 seconds.

Alternatively, fully disconnect power from the modem. Wait at least 10 seconds before restoring power to restart the device.

**Note:** Powering down the modem without following the correct procedure can result in improper functioning of the modem. Additionally, this will cause the device to not detach safely from the cellular network. If repeated frequently it could result in the modem being blacklisted from the network.

# Embedded Software Support

When developing your application, you may choose to integrate an external microcontroller to manage its functionality. Depending on your specific requirements, an external microprocessor can provide greater flexibility for handling power constraints or enabling high-performance features.

Alternatively, you can utilize the embedded software development environment within the cellular engine of the ZETA modems. All ZETA-xxP modules support the Telit IoT AppZone embedded development environment, which is ready to use out-of-the-box and can be customized to meet your exact application needs.

## Telit AppZone

Telit AppZone is a high-level, optimised C development environment designed as an integrated platform that runs within the cellular module, providing an “all-in-one” solution that saves time and money by allowing the M2M module to handle tasks typically managed by an external microprocessor. Whether you’re developing a new tracking application, an innovative healthcare device, or a cutting-edge Automatic Meter Reading component, the Telit AppZone offers a flexible platform to meet your needs while reducing development effort and design costs, resulting in a faster Time to Market (TTM).

AppZone allows you to fully leverage the hardware features and capabilities of your Siretta modem, enabling seamless software development across product families. The AppZone IDE serves as the reference workbench and development tool for all Telit-based products, supporting multiple programming environments. AppZone C, the flagship application framework for cellular products, is lightweight, runs on RTOS, and offers optimised performance with fast response times. It includes a full set of APIs programmable in C, providing access to the modem, hardware, peripherals, and operating system, and supports the integration of third-party libraries and protocol stacks across all cellular technologies and form factors.

Some of the key distinguishing features of AppZone include:

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

# Installation

## Installation considerations for ZETA-xxP Modems

When designing your application, several factors should be considered, as they may impact the ZETA and its functionality. These include:

### Installation considerations for ZETA-xxP Modems

When designing your application, several factors should be considered, as they may impact the ZETA and its functionality. These include:

### Environmental conditions

The modem must be installed in compliance with environmental conditions such as temperature, humidity, and vibration, while ensuring electrical specifications are not exceeded.

### Cellular signal strength

The modem/antenna should 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. Ensure the installation location of the modem is within the network coverage area. Degradation in signal strength can be the result of interference e.g. from nearby electronic devices or sources.
Signal strength can be verified by issuing the AT command:

» **AT+CSQ**

See “AT+CSQ Signal Strength” in the AT command guide.
Tip: Before installing the modem you can use an ordinary mobile telephone to check the signal strength in each potential installation location.
When choosing the location for the modem and antenna, keep in mind that long cable runs can reduce the received signal strength due to attenuation.

### Connections of components to ZETA-xxP 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.

### 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.

» Consider which network technologies are available in your region and the impact this will have on device connectivity. Each network technology operates differently, offering different advantages and disadvantages, and may be better suited for specific types of applications.

## 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 1 A.

» When the modem is powered from a battery or a high current supply, connect a fast 1.25 A fuse in line with the positive supply. This protects the power cabling and modem from damage.

## Securing the Modem

Before securing the modem, take in to 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 installing it.

» Securely attach the ZETA modem to the host application using 4 x M3 (3 mm diameter) pan-head screws.

Securely attach the ZETA modem using the optional ZETA Modem DIN Rail Adapter mounting bracket (Product sheet available here).

# Safety and Product Care

## General Precautions

» The ZETA-xxP 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-xxP 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-xxP 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 1.2 5A fuse in line with the positive supply.

» Do not connect any incompatible component or product to the ZETA-xxP 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-xxP series modem in to your application, the accessibility of the SIM card should be taken in to 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 in to 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 has begun on new radio technologies, such as LTE and 5G. After existing research had been reviewed, and after compliance to all applicable safety standards has been tested, it has been concluded that the ZETA-xxP 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.

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-xxP series of modems conform to the R&TTE Directive for use as a standalone 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-xxP 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-xxP 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

# Regulatory Approvals

Device ID 2AVL4ZETA-XXP

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

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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

» Re-orient or relocate the receiving antenna.

» Increase the separation between the equipment and receiver.

» Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

» Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

The product complies with the requirements of the following directives:

The Radio Equipment Directive 2014/53/EU

The RoHS Regulations 2011/65/EU

The product complies with the requirements of the following regulations:

The Radio Equipment Regulations 2017; UK SI 2017 no. 1206

The RoHS Regulations 2012; UK SI 2012 No 3032

Device ID 28712-ZETAXXP

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1) L'appareil ne doit pas produire de brouillage;

2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

Responsible Party – Contact Information

Declarations of Conformity are provided to all competent authorities by:

Siretta Limited
Basingstoke Road
Spencers Wood
Reading
Berkshire
RG7 1PW
+44 1189 769 000
support@siretta.com

The approvals mentioned are valid only if the appropriate marking has been affixed to the product. To find out which approvals have been granted to the product, please refer to the markings on the product label.

# Definitions

| Term | Definition |
|---|---|
| **2G** | 2nd Generation Mobile Telecommunications |
| **3G** | 3rd Generation Mobile Telecommunications |
| **4G** | 4th Generation Mobile Telecommunications |
| **5G** | 5th Generation Mobile Telecommunications |
| **ADC** | Analog to Digital Converter |
| **AMR** | Automatic Meter Reading |
| **AT** | Attention |
| **Cat 1** | LTE Category 1 Network |
| **Cat 4** | LTE Category 4 Network |
| **Cat M1** | LTE Category M Network |
| **Cat NB1** | LTE Narrow Band Internet of Things Network |
| **CBS** | Cell Broadcasting Service |
| **CSD** | Circuit Switched Data |
| **CTS** | Clear To Send |
| **DCD** | Data Carrier Detect |
| **DSR** | Data Set Ready |
| **DTR** | Data Terminal Ready |
| **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 |
| **IoE** | Internet of Everything |

# Definitions

| Term | Definition |
|---|---|
| **IoT** | Internet of Things |
| **LED** | Light Emitting Diode |
| **LTE** | Long Term Evolution |
| **M2M** | Machine to Machine |
| **MMS** | Multimedia Messaging Service |
| **RF** | Radio Frequency |
| **RI** | Ring Indicator |
| **RS232** | Recommended Standard 232 |
| **RTS** | Request to Send |
| **RX** | Receive Signal |
| **RXD** | Receive Signal |
| **SIM** | Subscriber Identity Module |
| **SMA** | Sub Miniature Version A |
| **SMS** | Short Message Service |
| **TTFF** | Time To First Fix |
| **TTL** | Transistor - Transistor Logic |
| **TX** | Transmit Signal |
| **TXD** | Transmit Signal |
| **UMTS** | Universal Mobile Telecommunications System |
| **USB** | Universal Serial Bus |
| **Vcc** | Positive Power Supply |
| **Vin** | Input voltage |

# About Siretta

Siretta is a wireless communications company located in Reading, United Kingdom manufacturing & supplying industrial IoT products since 1998.

Siretta's product portfolio is made up of:

» Antennas, plus their associated Cable Assemblies & Adapters,

» Cellular Network Analysers

» Industrial Modems

» Industrial Routers

» Associated Cloud Management

Siretta supplies products directly and via a worldwide network of distributors, into numerous markets and applications across the globe.

Siretta's distribution partners range from industrial IoT specialists through to global catalogue organisations.

Whether "off the shelf" or custom solutions are required, Siretta has a wide portfolio of products to fit many types of application.

Siretta's extensive knowledge and experience in the wireless market allows support of a wide range of customer applications, focusing on frequencies between 400 MHz to 6 GHz. These encompass modems, routers and antennas for:

» Cellular technologies: GSM / UMTS / LTE (including Cat M & NB) / 5G NR and other cellular technologies as they emerge.

» Global positioning: GPS/GNSS

» WLAN/Wi-Fi

Whilst providing the above products for the industrial cellular market, Siretta also has a number of antennas to cover applications for:

» Bluetooth, Zigbee, ISM band, LoRa and Sigfox

With a heavy emphasis on design, Siretta has a team of dedicated Engineers and Product Managers, who specialise in wireless applications.

Siretta continually makes significant investment in R&D endeavouring to provide customers with market leading, future-proofed, wireless solutions. Siretta works closely with many technology partners to stay at the forefront of industrial IOT.

Siretta

Enabling Industrial IoT

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