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# ZEUS Series

## GPRS/UMTS/LTE ARM Cortex M4 Modem Range with 10 Base-T Ethernet Port

## Hardware Reference Manual

Rev 3.8

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# Introduction

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

The ZEUS series of GPRS/UMTS/LTE M2M ARM microprocessor modems are an advanced range of Ethernet modems developed for easy application development.

The ZEUS series modem range is based on the Telit xE910 GPRS/UMTS/LTE module series and is available with or without GPS. The additional ARM Cortex M4 32bit processor manages the Telit module and is intended for the user to program custom applications.

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

# About Siretta

Siretta Ltd, 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 GSM 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.



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# General Description

The ZEUS range of GPRS modems are amongst the most advanced and capable modems available today. The ZEUS series offers a range of options including 10 Base-T Ethernet and RS232 serial port communication. With its powerful built in ARM Cortex M4 32bit processor you are able to develop your own applications directly on the modem to implement the functionality you require.

## Specifications

Table 1. Specifications of the ZEUS modem

| | ZEUS-GPRS | ZEUS-UMTS |
|---|---|---|
| 2G frequency band: | 850, 900, 1800, 1900MHz | 850, 900, 1800, 1900MHz (EU Version) |
| 3G frequency band: | - | 850, 900, 1700, 1900, 2100MHz |
| GPS support (optional): | GPS, Glonass, Galileo, QZSS | GPS |
| Dimensions: | 134mm x 74mm x 33mm | 134mm x 74mm x 33mm |
| Weight: | 143g | 143g |
| Supply voltage: | 5 - 42V | 5 - 42V |
| Operating temperature range: | -30 to +80°C | -30 to +80 °C |
| GSM antenna connector: | SMA Female | SMA Female |
| GPS antenna connector (optional): | SMA Female | SMA Female |

Table 2. Modem data transfer speeds

| Model | Region | Coverage | Max Download | Max Upload |
|---|---|---|---|---|
| ZEUS-V2-N-GPRS | | Global | 236.8Kbps | 59.2Kbps |
| ZEUS-V2-G-GPRS | | Global | 236.8Kbps | 59.2Kbps |
| ZEUS-V2-N-UMTS | | Global | 21Mbps | 5.76Mbps |
| ZEUS-V2-G-UMTS | | Global | 21Mbps | 5.76Mbps |
| ZEUS-V2-N-UMTS | (EU) | (Europe) | 7.2Mbps | 5.76Mbps |
| ZEUS-V2-G-UMTS | (EU) | (Europe) | 7.2Mbps | 5.76Mbps |
| ZEUS-V2-N-LTE | (EU) | (Europe) | 100Mbps | 50Mbps |
| ZEUS-V2-G-LTE | (EU) | (Europe) | 100Mbps | 50Mbps |

**NOTE -** For part numbering and ordering information see page 14

## AT Commands

The ZEUS range of wireless modems has a GSM 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 modem 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.co.uk**

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

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

## ZEUS Interface

### Standard Hardware Interfaces

As standard, the ZEUS series modem comes with the following interfaces:

- 1 x RS232 serial port interface for direct serial connection to microprocessor / module
- 1 x RJ45 10 Base-T Ethernet port
- 1 x RJ12 power connection with 2 power lines and 4 input interfaces (5 - 42V)
- 1 x SMA female GSM antenna connector
- 1 x SIM card reader (push-push)
- 1 x internal LED charge status indicator (Green)
- 9 x internal LED GPIO status indicators (Orange)
- 3 x external LED status indicators (Red, Blue, Green)
- 128Mbit internal SPI flash
- 3-axis high sensitivity accelerometer to detect motion, rotation and freefall
- High power relay with independent microprocessor control (600mA 60V DC normally open)
- Intelligent Li-Ion battery charge management controller with battery protection
- 36-Way connector
  - 1 x wired (36-way) power supply
  - 1 x wired (36-way) Vcc_IO general purpose output voltage control line
  - 1 x wired (36-way) hardware boot loader control signal
  - 1 x wired (36-way) RS232 serial command port
  - 1 x wired (36-way) RS232 debug port for direct serial connection to module
  - 1 x wired (36-way) Ignition interface
  - 1 x wired (36-way) CAN interface
  - 1 x wired (36-way) I2C interface
  - 1 x wired (36-way) 1-wire interface
  - 1 x wired (36-way) 3.3V power supply output interface
  - 1 x wired (36-way) relay interface
  - 2 x wired (36-way) 12-bit DAC interfaces (0-42V)
  - 2 x wired (36-way) 12-bit ADC interfaces (42V tolerant)
  - 5 x wired (36-way) general purpose input interfaces
  - 4 x wired (36-way) general purpose output interfaces

## Optional Modem Features*

### Optional Hardware

The ZEUS series modems have the following optional hardware features:

» High performance SirfStarIV GPS engine (Options available for GPS/Glonass/Galileo/QZSS)
» 2000mAh Li-Ion battery

### Optional Technologies

The ZEUS series modems have the following optional technologies available:

» GPRS (2G)
» UMTS (3G)
» LTE (4G)

### Optional Coverage

The ZEUS series modems have the following coverage options available:

» (EU) European
» (NA) North America

### Optional Software Packages

The ZEUS series modems have the following optional software packages available:

» Webserver Configuration
Configure and change modem settings using a standard web browser locally or over GPRS/UMTS

» V-LinkLAN Software
Wireless cable replacement using Ethernet LAN over GPRS/UMTS

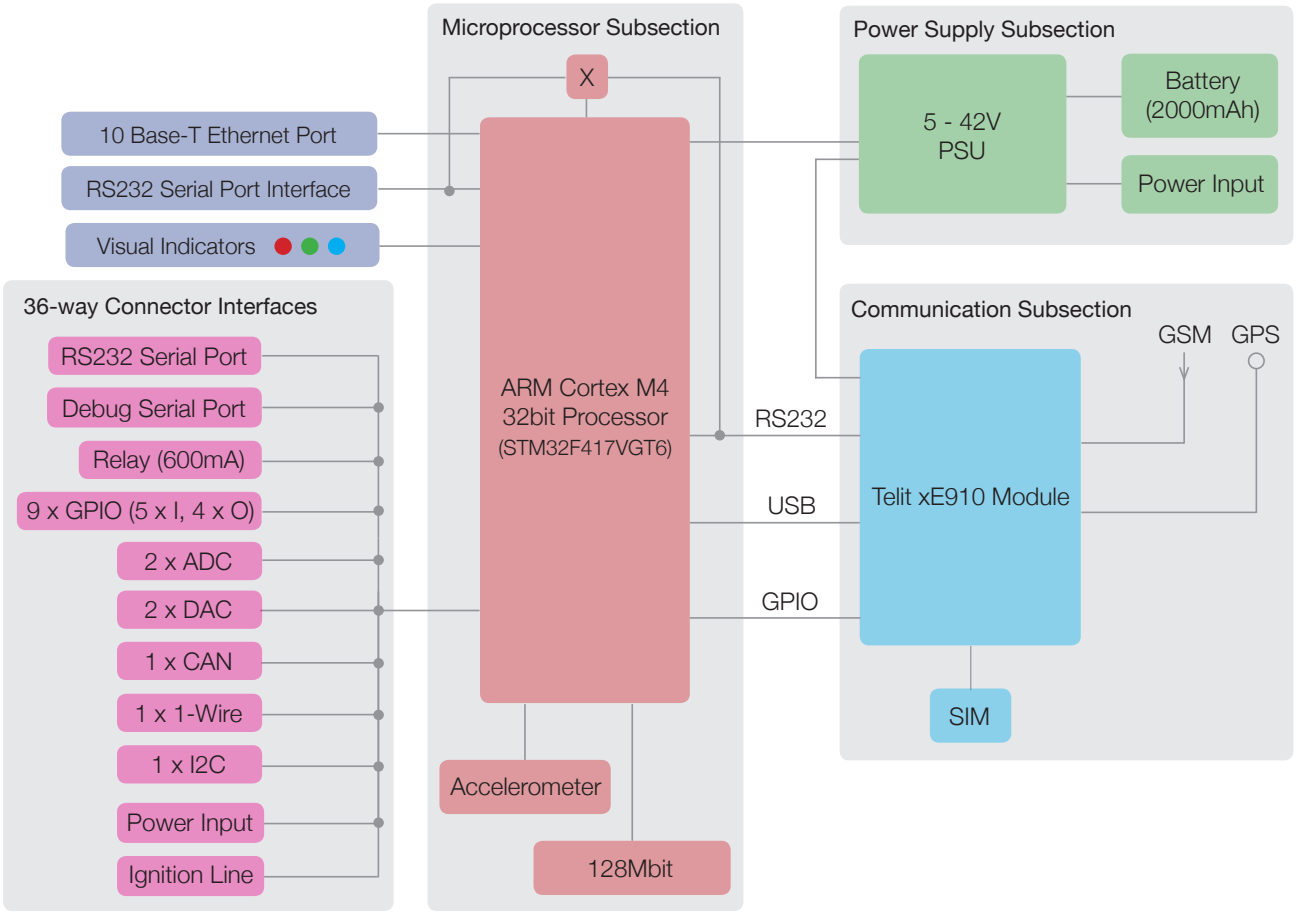
» V-Link232 Software
Wireless cable replacement using RS232 serial cable over GPRS/UMTS

*To add optional features on your modem, see 'Ordering Information' on page 14

## System Diagram

The ZEUS series is an intelligent range of ARM Cortex M4 Microprocessor modems offering 10 Base-T Ethernet for full 10Mbit communication. The system diagram below gives a visual representation of the ZEUS interfaces available to the user and shows the various subsections which make up the complete ZEUS modem.

**Figure 1.** ZEUS system diagram



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# ZEUS Series

GPRS/UMTS/LTE ARM Cortex M4 Modem Range
with 10 Base-T Ethernet Port

## System Overview

### ARM Cortex M4 32bit Processor

The ZEUS core is built around the ARM Cortex M4 32bit processor which has been configured to offer the following features as standard:

- 32 bit CPU running at 168MHz (210DMIPS)
- Onboard 1Mbyte flash storage
- 192 Kbyte SRAM volatile memory
- Memory controller supporting: Compact Flash, Flash, SRAM, PSRAM, NOR, NAND memory
- 1 x UART H/W port (supporting TX, RX, CTS, RTS) for connection to the outside world
- 1 x RS232-SEL controller input to interface directly to the microprocessor or module from the outside world
- 1 x UART-Debug port (supporting TX, RX) for connection to the module
- 1 x USB host controller for high speed internal connection to the module
- 1 x 10 Base-T Ethernet port
- 1 x high speed CAN interface
- 1 x I2C bus
- 1 x 1-wire bus
- 5 x high speed GPI (0-42V tolerant)
- 1 x ignition line (0-42V tolerant)
- 4 x high speed GPO (0-42V driven output hardware controlled with Vcc_IO pin)
- 2 x 12-bit A/D converters (0-42V tolerant)
- 2 x 12-bit D/A converters
- Hardware cryptographic accelerator
- RTC and hardware watchdog timer
- Low power utilising sleep, stop and standby modes
- Internal JTAG interface for system debug and programming

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

- V-Link232 Software (Wireless cable replacement using RS232 serial cable over GPRS/3G)
- GPIO Monitor (Monitor/Set and report on GPIO status)
- Standard RS232 modem attached to existing equipment (PC/MAC/Server etc)
- V-LinkLAN Software (Wireless cable replacement with Ethernet over GPRS/3G)
- Embedded webserver over 2.5G/3G required (For simple modem configuration)
- Embedded webserver with router functionality for EPOS/transactions etc (Intelligent modem)

Typically connected devices are:

» PC/MAC/Linux platforms for use as modem
» Embedded (connected directly to remote equipment without a PC attached)
» Ethernet network interfaces to internet enabled connected devices

## Operating System Connected Modem

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

## Embedded Systems

The V-Link software can be used with an embedded system where automated end to end communication is required.

If the embedded system has limited intelligence or has limited configuration capability the Siretta V-Link software can be used to connect the system to a central server easily and simply.

The V-Link software can also be used to control and manage the remote modem so that the connection from the embedded system to the central server/control head office is seamless and reliable.

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



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## Modes of Operation

### Ethernet Interface

10 Base-T Ethernet is fitted as standard on the ZEUS and the software settings can be controlled through the Ethernet connection to manage the embedded webserver application.

The configuration will typically be used to setup the following parameters:

- GPRS network settings
- Socket configuration settings
- Timeout settings
- Server address details
- Security settings
- Ping settings
- Ethernet port configuration
- RS232 Serial settings
- RS232 character framing

These settings are saved in non volatile memory and once configured, the ZEUS will use these settings to control the gateway application. The settings can be configured in real time locally using the Ethernet interface or remotely using configuration SMS messages.

### V-Link Software

EPOS modems will most likely use the Ethernet port to get an internet connection over the GPRS connection, to send data to a remote server securely and with minimal setup.

Embedded systems can use the RS232 serial port to connect to a remote device to a central server. The serial configuration supports most configurations and can be changed either via the Ethernet interface, or via SMS commands.

### DHCP

The ZEUS supports DHCP dynamically to assign IP addresses to connected devices which enables the ZEUS to operate as an interface enabled router for multiple connected devices. This functionality is limited due to memory and processing power restrictions but will allow up to 5 simultaneously connected devices to operate at the same time.

### Configurable Embedded Webserver

Serve and display web pages to enable configuration of the modem and to serve pages to embedded devices, i.e. Internet enable/web page enable an end piece of equipment.

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GPRS/UMTS/LTE ARM Cortex M4 Modem Range
with 10 Base-T Ethernet Port

## Ordering Information

ZEUS - X X - XXXX (XX) (XXXX)

**Modem Identifier**

ZEUS = Intelligent Siretta Modem with ARM Cortex M4 32bit Processor, Ethernet and RS232 Serial Port Interfaces

**Module Type**

N = Without GPS
G = With GPS

**Modem Options***

B = With Battery

**Product Module Version**

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

**Coverage Options**

(EU) = European Coverage of GSM and UMTS Only
(NA) = North American Coverage of GSM and UMTS Only

**Software Package Options**

(WEB) = Ethernet webserver configuration
(V-LinkLAN) = V-LinkLAN Software
(V-Link232) = V-Link232 Software

### Part Numbering Examples

» ZEUS-N-GPRS = GPRS Modem with ARM Cortex M4 32bit Processor Ethernet and RS232 Serial Port Interfaces, without GPS

» ZEUS-GB-UMTS (EU) (V-Link232) = EU Coverage UMTS and GPS Modem with ARM Cortex M4 32bit Processor, Ethernet and RS232 Serial Port Interfaces, Battery and V-Link232 Software

*This is an additional option and doesn't have to be selected

# Dimensions

All dimensions are shown in mm.

Figure 2. ZEUS front view

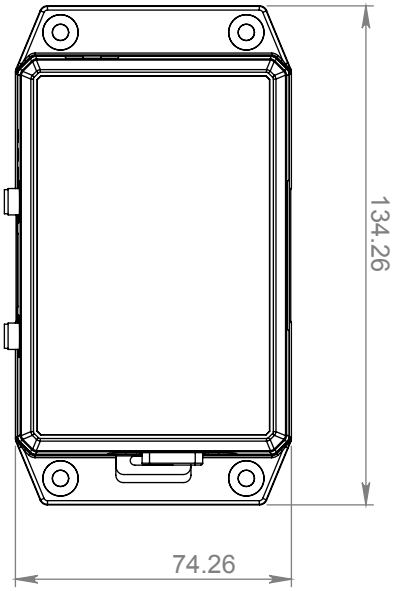



Figure 3. ZEUS underside view

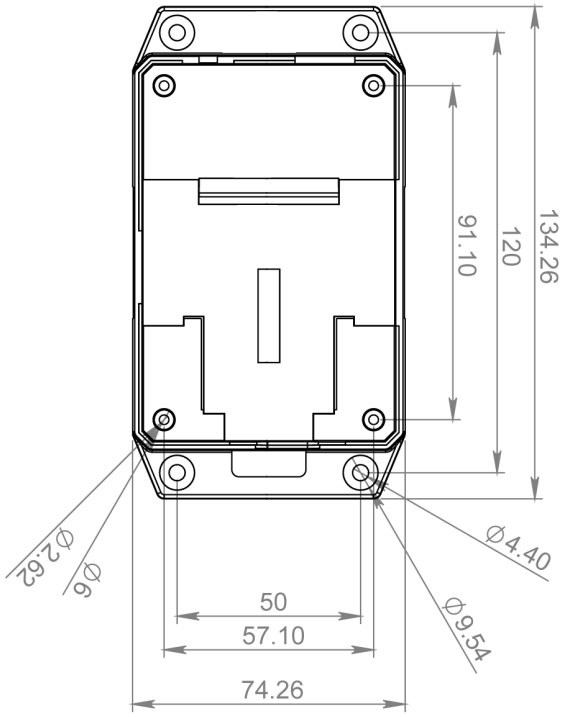



Figure 4. ZEUS antennas and LED view

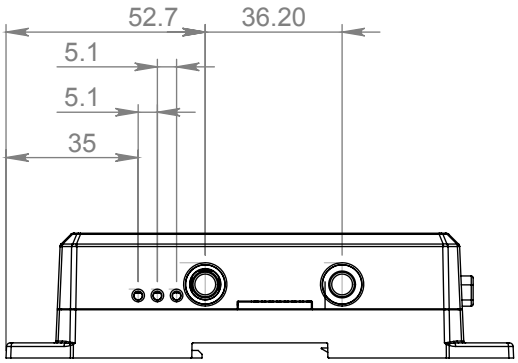
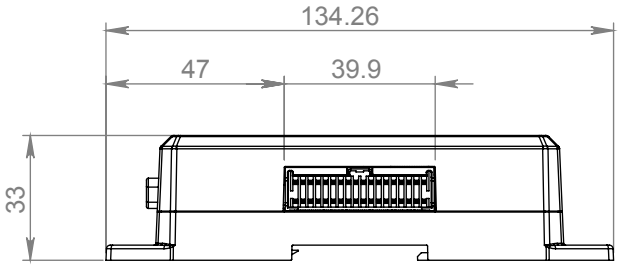



Figure 5. ZEUS 36-way connector view

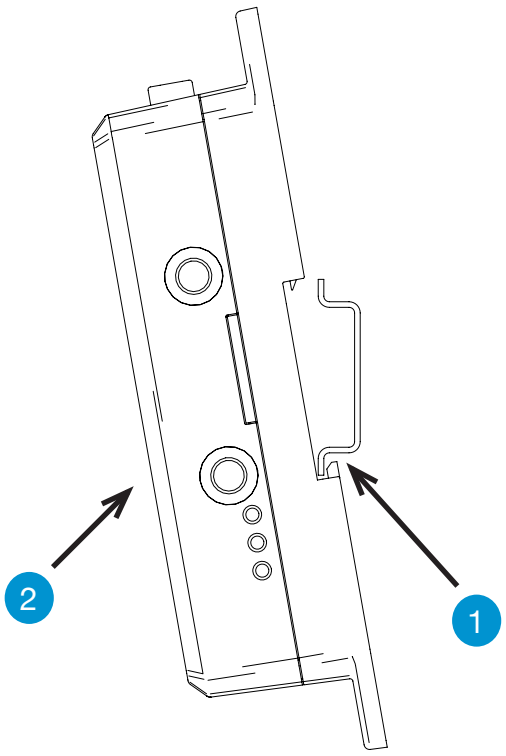


# DIN Rail Mount

The ZEUS has an integrated DIN rail mount housing which allows the modem to connect on to the standard rail widely used for mounting industrial control equipment inside equipment racks. This has been adopted as a European (EN) and International (ISO) Standard.

## Mounting the ZEUS

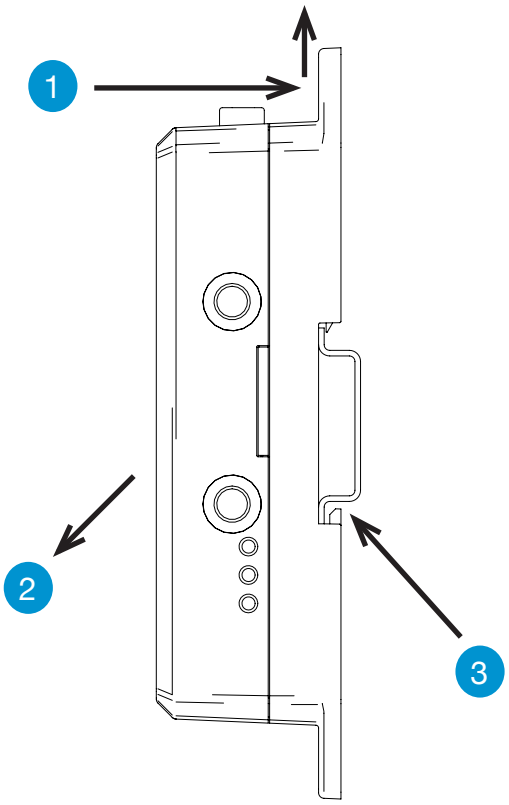
**Figure 6.** Mounting ZEUS to DIN rail




1. Hook the bottom modem DIN rail clip onto the bottom of the DIN rail
2. Push modem 45° until the top DIN rail clip locks onto the top of DIN rail

## Removing the ZEUS

**Figure 7.** Removing ZEUS from DIN rail




1. Slide DIN rail clip upwards
2. Pull modem 45° until the top DIN rail clip unlocks from the top of DIN rail
3. Slide modem down, until bottom DIN rail clip unlocks from the bottom of the DIN rail



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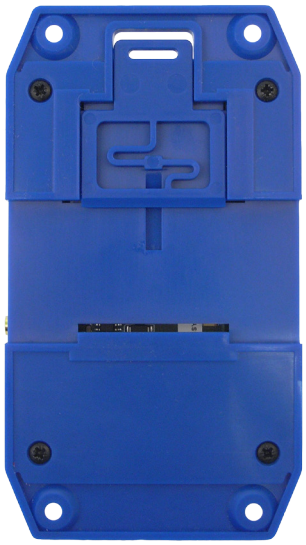
# ZEUS Series Images

Figure 8. 3D view of the ZEUS-G variant


Figure 9. Front view of the ZEUS-G variant


Figure 10. Underside view of the ZEUS modem



# ZEUS LED Indicators

There are 3 LED outputs on the ZEUS modem that can be configured simply and easily to indicate the functional/operational state of the modem. This can be done via software configuration.

The red status LED is driven directly by the GSM engine within the modem to indicate GSM network registration status. Please refer to **table 3** below for more information.

Figure 11. LEDs

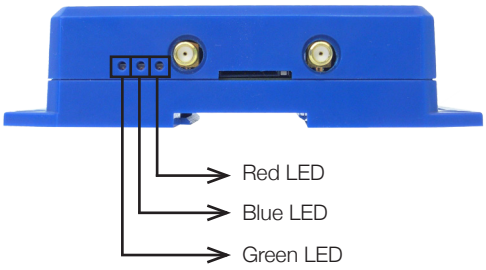



Table 3. LEDs

| LEDs | Description |
|---|---|
| Red | Configurable via ARM Cortex M4 32bit processor (default setting to show visual indication of network registration status. Please see AT#SLED command.)* |
| Green | Configurable via ARM Cortex M4 32bit processor** |
| Blue | Configurable via ARM Cortex M4 32bit processor** |

*LED default state is off. Need to configure AT#SLED command to enable software control of LED flashing state.

AT#GPIO=1,0,2

AT#SLED=2

AT#SLEDSAV

**See 'User Programmable LED Status Control' section on page 19

## User Programmable LED Status Control

The green and blue LED's can be controlled in two different ways:

1) The ARM cortex M4 directly controls the LED indicators and can control the LED's independently to the modem. This allows the application running in the ARM processor to indicate the modem status to the user.

2) Alternatively the GPIO lines on the modem can be configured to control the LED indicators directly. This allows the module to control the LED's via standard AT commands or using python to indicate modem status to the user.

### Example AT Commands to Control LED Status

In the example below the green LED is configured in the ARM Cortex M4 to directly connect to GPIO2 on the module and the blue LED is configured in the ARM Cortex M4 to directly connect to GPIO3 on the module. (This is a special case which has been programmed in software running on the ARM Cortex M4 processor to demonstrate the example. This configuration can be changed as required and is purely to demonstrate the capability of the two devices working together.)

The AT commands are entered on the module via the serial port to control the LED's directly. (This could also be achieved by executing the commands in Python script running on the module.)

AT#GPIO=2,1,1 (switch general purpose output 1 on, PIN7, 36-way connector - connected to green LED)

AT#GPIO=2,0,1 (switch general purpose output 1 off, PIN7, 36-way connector - connected to green LED)

AT#GPIO=3,1,1 (switch general purpose output 2 on, PIN9, 36-way connector - connected to blue LED)

AT#GPIO=3,0,1 (switch general purpose output 2 off, PIN9, 36-way connector - connected to blue LED)

# Modem States

The current modem state and function is shown below in **table 4.**

Table 4. Modem states (assume AT#SLED=2*)

| Current Modem State | Input | Next state | Indication of new state |
|---|---|---|---|
| Power Off | Connect power | Run Mode | Red LED will be on continuously* |
| Run Mode | Insert a valid SIM card | On Network | Red LED will flash once every 3 seconds* |
| On Network | Hold PWROFF_IN (Pin 3 on RJ12 Power Connector) to 0.5V - 42V for >0.5 seconds | Power off | No activity on any LED** |
| Run Mode | Hold PWROFF_IN (Pin 3 on RJ12 Power Connector) to 0.5V - 42V for >0.5 seconds | Power off | No activity on any LED** |
| Power Off | Hold PWRON_IN (Pin 4 on RJ12 Power Connector) to 0.5V - 42V for >0.5 seconds | Run Mode | Red LED will be on* |
| Run Mode | Insert a valid SIM card | On Network | Red LED will flash once every 3 seconds* |

**NOTE -** Normal Operation: When the modem is first switched on with a valid SIM card, the red LED will be on continuously for about 10-15 seconds (this may vary considerably) whilst the modem searches for the network. After this period if the modem correctly registers to the network then the red LED will start to blink once every 3 seconds indicating everything is running correctly and the modem is registered to the network.

If the red LED is on continuously for a long period of time (more than 5 minutes) then this suggests there may be a problem with the SIM setup, the network signal or the antenna connection.

*LED default state is off. You will need to configure AT#SLED command to enable software control of LED flashing state.

AT#GPIO=1,0,2

AT#SLED=2

AT#SLEDSAV

**When the command SLED=2 has been set then no activity on the red LED indicates that the modem is powered off.

# Interfaces

## RS232 Serial Port Interface

This connector provides a serial RS232 communication between the ZEUS modem and the connected equipment. The connection to the modem via the serial port is the default configuration and the serial port can be routed to the microprocessor using the GPIO RS232_SEL selector (PB6 pin 92 - STM32F417VGT6 ARM processor). The modem can be configured via the RS232 connection using AT commands as specified in the AT command manual.

**Figure 12.** RS232 serial port

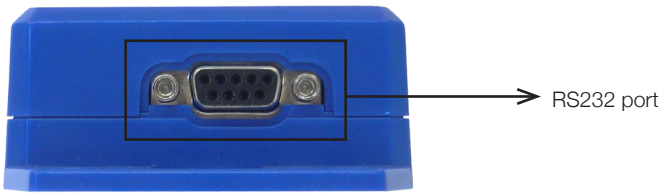



**Figure 13.** Pin numbering

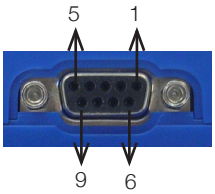



**Table 5.** Pin usage

| 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 |

## RS232 Male to RS232 Female Cable

The RS232 serial cable is the standard cable used for connecting the ZEUS modem to other devices such as a PC or industrial control equipment. The RS232 serial cable allows a serial connection to the modem which you can use to setup and change the modem configuration as well as providing a communication channel for connected equipment over the GSM/UMTS network. Please turn to page 54 for ordering details.

Figure 14. RS232 Male to RS232 Female Cable

## RS232 Male to USB Cable

The RS232 Male to USB cable allows you to connect to the RS232 serial port which is the standard cable used for connecting the ZEUS modem to other devices such as a PC or industrial control equipment. The USB to RS232 Male serial cable allows a serial connection to the modem via USB which you can use to setup and change the modem configuration as well as providing a communication channel for connected equipment over the GSM/UMTS network. Please turn to page 54 for ordering details.

Figure 15. RS232 Male to USB Cable

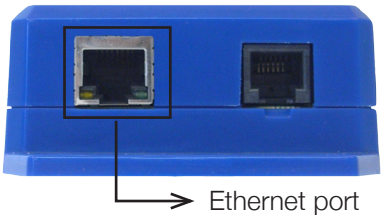
## 10 Base-T Ethernet

The ZEUS modem provides an IEEE-802.3-2002-compliant media access controller for Ethernet LAN communications through an industry-standard medium independent interface (MII). The ZEUS incorporates the physical interface modem to connect to the physical LAN over a twisted-pair network cable.

The Ethernet interface includes the following features:

- Supports 10 Mbit/s rates
- Dedicated DMA controller allowing high-speed transfers between the dedicated SRAM
- Tagged MAC frame support (VLAN support)
- Half-duplex (CSMA/CD) and full-duplex operation
- MAC control sub layer (control frames) support
- 32-bit CRC generation and removal
- Several address filtering modes for physical and multicast address (multicast and group addresses)
- 32-bit status code for each transmitted or received frame
- Internal FIFOs to buffer transmit and receive frames. The transmit FIFO and the receive FIFO are both 2 Kbytes.
- Supports hardware PTP (precision time protocol) in accordance with IEEE 1588 2008 (PTP V2)
- Triggers interrupt when system time becomes greater than target time

**Figure 16.** Ethernet port



## Ethernet Patch Cable

The Ethernet interface cable is a category 5 twisted pair cable. This cable is used to connect the ZEUS modem to other Ethernet enabled equipment such as an industrial PC, Embedded computer or EPOS /modem equipment. The cable provides performance up to 100MHz and is suitable for 10BASE-T and 100BASE-TX Ethernet connections. Please turn to page 54 for ordering details.

Figure 17. Ethernet cable

## GPIO 36-Way Connector

This ZEUS modem 36-way connector provides general purpose multi-way interface for the user to access various parts of the modem. This convenient interface allows connections to be made to the modems peripheral connections such as the RS232 serial port, GPIO and power.

**Figure 18.** 36-way connector

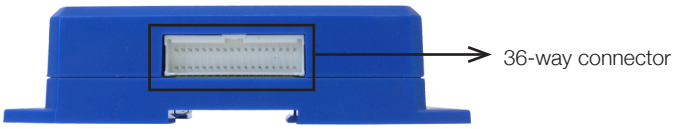



**Figure 19.** Pin numbering

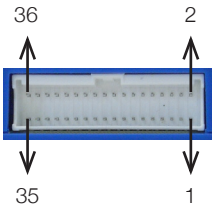



**Table 6.** 36-way connector

| Pin | Name | Direction | Usage | Voltage Level |
|---|---|---|---|---|
| **Power Section** | | | | |
| 1 | Vin | Input | Input Power (5-42V) | 0 - 42V |
| 2 | Vcc_IO | Input | GPO Output Voltage Select | 0 - 42V* |
| 3 | GND | Input | Power Ground (0V) | 0V |
| 4 | GND | Input | Power Ground (0V) | 0V |
| **GPIO Section** | | | | |
| 5 | Ignition | Input | Ignition Input (0-42V) | 0 - 42V |
| 6 | GPI_05 | Input | General Purpose Input Signal 5 | 0 - 42V |
| 7 | GPO_01 | Output | General Purpose Output Signal 1 | (Set output level with Vcc_IO)* |
| 8 | GPI_06 | Input | General Purpose Input Signal 6 | 0 - 42V |
| 9 | GPO_02 | Output | General Purpose Output Signal 2 | (Set output level with Vcc_IO)* |
| 10 | GPI_07 | Input | General Purpose Input Signal 7 | 0 - 42V |
| 11 | GPO_03 | Output | General Purpose Output Signal 3 | (Set output level with Vcc_IO)* |
| 12 | GPI_08 | Input | General Purpose Input Signal 8 | 0 - 42V |
| 13 | GPO_04 | Output | General Purpose Output Signal 4 | (Set output level with Vcc_IO)* |
| 14 | GPI_09 | Input | General Purpose Input Signal 9 | 0 - 42V |

*Vcc_IO is directly connected to VIN by default. (To set Vcc_IO independently please contact your Siretta representative for more information and ordering options.)

| | | | | |
|---|---|---|---|---|
| **Analogue Section** | | | | |
| 15 | DAC_01 | Output | DAC Output 1 | 0 - 3V |
| 16 | ADC_01 | Input | ADC Input 1 | 0 - 42V |
| 17 | DAC_02 | Output | DAC Output 2 | 0 - 3V |
| 18 | ADC_02 | Input | ADC Input 2 | 0 - 42V |
| **Interface Section** | | | | |
| 19 | CANL | Input/Output | CANL Low | 3.3V |
| 20 | RLY_01 | Input/Output | Relay Pole (NO) | 0 - 60V |
| 21 | CANH | Input/Output | CAN high | 3.3V |
| 22 | RLY_02 | Input/Output | Relay Pole (NO) | 0 - 60V |
| 23 | RX_DBG | Input | Debug Port Receive | 3.3V |
| 24 | I2C_SCL | Input/Output | I2C Clock | 5V |
| 25 | TX_DBG | Output | Debug Port Transmit | 3.3V |
| 26 | I2C_SDA | Input/Output | I2C Data | 5V |
| 27 | 3.3V | Output | 3.3V Voltage Reference | 3.3V |
| 28 | 1-Wire | Input/Output | GPIO 1-Wire Interface | 0 - 5V |
| **RS232 Section** | | | | |
| 29 | GND | Input | Power Ground (0V) | 0V |
| 30 | BOOT | Input | Boot Loader Pin (Active low) | 0V |
| 31 | RS232_TX | Input | RS232 TX Input | ± 25V |
| 32 | RS232_CTS | Output | RS232 CTS Output | ± 5.4V |
| 33 | RS232_RX | Output | RS232 RX Output | ± 5.4V |
| 34 | RS232_RTS | Input | RS232 RTS Input | ± 25V |
| 35 | GND | Input | Power Ground (0V) | 0V |
| 36 | GND | Input | Power Ground (0V) | 0V |

The maximum/minimum input/output voltages allowed on the I/O pins are shown overpage in **table 7**.

Table 7. Input/output voltages

| Signal Name | Parameter | Minimum | Maximum | Maximum Current |
|---|---|---|---|---|
| GPO_01 - GPO_04 | Output high level | Vcc_IO (42V)* | Vcc_IO (42V)* | 2.85mA |
| GPO_01 - GPO_04 | Output high level | Vcc_IO (40V)* | Vcc_IO (40V)* | 3mA |
| GPO_01 - GPO_04 | Output high level | Vcc_IO (24V)* | Vcc_IO (24V)* | 5mA |
| GPO_01 - GPO_04 | Output high level | Vcc_IO (12V)* | Vcc_IO (12V)* | 10mA |
| GPO_01 - GPO_04 | Output high level | Vcc_IO (5V)* | Vcc_IO (5V)* | 24mA |
| GPO_01 - GPO_04 | Output high level | Vcc_IO (3.3V)* | Vcc_IO (3.3V)* | 36mA |
| GPO_01 - GPO_04 | Output high level | Vcc_IO (3V)* | Vcc_IO (3V)* | 40mA |
| GPO_01 - GPO_04 | Output low level | 0V | 0.5V | 1mA |
| GPI_05 - GPI_08 | Input high level | 2.1V | 42V | 100µA |
| GPI_05 - GPI_08 | Input low level | 0V | 0.5V | 100µA |
| ADC_01 and ADC_02 | Input range | 0V | Vcc | 1mA |
| ADC_01 and DAC_02 | Output range | 0V | 3.0V | 1mA |
| Relay | Power rating | 0V | 60V @ 0.6A | 600mA |

*Vcc_IO is directly connected to VIN by default. (To set Vcc_IO independently please contact your Siretta representative for more information and ordering options.)



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## 36-Way Cable

The 36-way cable is designed to give access to the more advanced features of the ZEUS including:

- Power Supply
- General Purpose Inputs
- General Purpose Outputs
- RS232 Serial Port
- Modem Trace / Debug Port
- ADC / DAC
- Reprogramming Boot Pin
- Relay
- CAN Bus
- I2C Bus
- 1-Wire Bus

The functionality available through the cable can be activated and controlled within embedded software running in the ARM Cortex processor, and allows for many advanced applications to be developed. Please turn to page 54 for ordering details.

Figure 20. 36-way cable

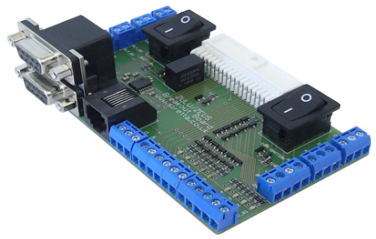
Table 7. Cable wiring colours

| Pin | Function | Colour Suggestions |
|---|---|---|
| **Power Section** | | |
| 1 | Vin | Red |
| 2 | Vcc_IO | Brown |
| 3 | GND | Black |
| 4 | GND | Black |
| **GPIO Section** | | |
| 5 | Ignition | Yellow |
| 6 | GPI5 | Brown/Blue |
| 7 | GPO1 | White/Blue |
| 8 | GPI6 | Brown/Black |
| 9 | GPO2 | White/Red |
| 10 | GPI7 | Red/Blue |
| 11 | GPO3 | Green/Blue |
| 12 | GPI8 | Brown/Red |
| 13 | GPO4 | White/Pink |
| 14 | GPI9 | Brown/Green |
| **Analogue Section** | | |
| 15 | DAC1 | Yellow/Blue |
| 16 | ADC1 | Yellow/Pink |
| 17 | DAC2 | Yellow/Brown |
| 18 | ADC2 | Yellow/Grey |
| **Interface Section** | | |
| 19 | CANL | Grey |
| 20 | Relay | Blue |
| 21 | CANH | Grey/Brown |
| 22 | Relay | Purple |
| 23 | RX Debug | Grey/Pink |
| 24 | I2C CL | Pink/Green |
| 25 | TX Debug | Grey/Green |
| 26 | I2C DA | Pink/Brown |
| 27 | 3V3 | Pink |
| 28 | 1-Wire | Green |
| **RS232 Section** | | |
| 29 | GND | Black |
| 30 | BOOT | White |
| 31 | TX | White/Black |
| 32 | CTS | White/Green |
| 33 | RX | White/Grey |
| 34 | RTS | White/Yellow |
| 35 | GND | Black |
| 36 | GND | Black |

## ZEUS-EVK Evaluation and Development Board

The EVK provides simple and convenient access to the ZEUS interfaces through the 36-way cable. It provides standard DB9 connectors for RS232/Trace serial ports as well as screw terminal block connectors for GPIO/ADC/DAC/Power/CAN/Relay/BOOT/IGN ports. This enables you to quickly and easily connect external equipment to the ZEUS and integrate it to your application. Please turn to page 54 for ordering details for the ZEUS-EVK, alternatively visit www.siretta.co.uk/zeus-evaluation-development-platform-p-456.html for more information about this product.

Figure 21. ZEUS-EVK



# Digital Functions

## Digital Output

» Output voltage can be set with Vcc_IO signal, PIN2, 36-way connector. (Default setting Vcc_IO = VIN)
» Maximum output current 2.85mA at 42V (Please see table 7)
» Under full control of embedded application

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

AT#GPIO=2,1,1 (switch general purpose output 1 on, PIN7, 36-way connector)
AT#GPIO=2,0,1 (switch general purpose output 1 off, PIN7, 36-way connector)
AT#GPIO=3,1,1 (switch general purpose output 2 on, PIN9, 36-way connector)
AT#GPIO=3,0,1 (switch general purpose output 2 off, PIN9, 36-way connector)
AT#GPIO=4,1,1 (switch general purpose output 3 on, PIN11, 36-way connector)
AT#GPIO=4,0,1 (switch general purpose output 3 off, PIN11, 36-way connector)
AT#GPIO=5,1,1 (switch general purpose output 4 on, PIN13, 36-way connector)
AT#GPIO=5,0,1 (switch general purpose output 4 off, PIN13, 36-way connector)

## Digital Input

» Under full control of embedded application

The following AT commands can be used to initialise and to read the status of the GPIO:

AT#GPIO=6,2,0 (read general purpose input 5, PIN6, 36-way connector)

AT#GPIO=7,2,0 (read general purpose input 6, PIN8, 36-way connector)

AT#GPIO=8,2,0 (read general purpose input 7, PIN10, 36-way connector)

AT#GPIO=9,2,0 (read general purpose input 8, PIN12, 36-way connector)

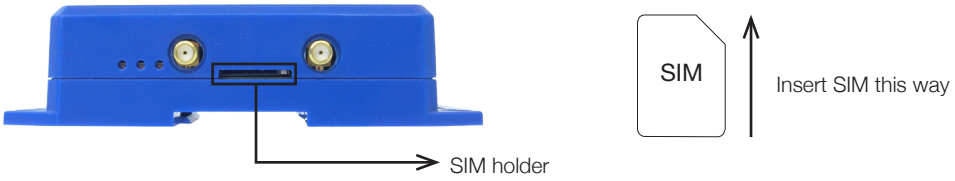
AT#GPIO=10,2,0 (read general purpose input 9, PIN 14, 36-way connector)

# SIM Socket

The ZEUS 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 ZEUS 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 22. SIM holder




## SIM Requirements

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

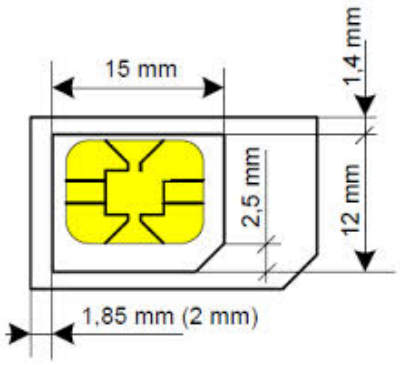
SIM services available for the ZEUS-GPRS series include:

- 2G GSM (850/900/1800/1900MHz)
- SMS,
- GPRS
- CSD

SIM services available for the ZEUS-UMTS series include:

- 2G GSM (850/900/1800/1900MHz)
- 3G UMTS (850/900/1700/1900/2100MHz)
- SMS
- GPRS
- CSD

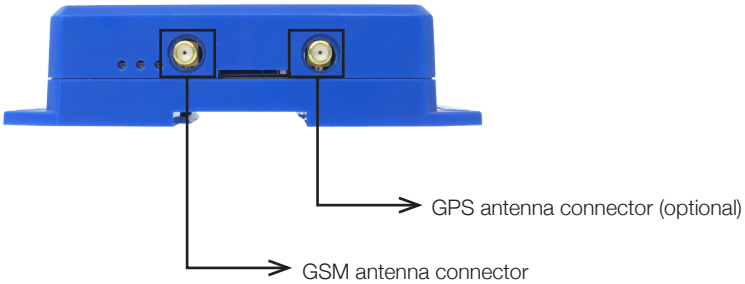
Figure 23. SIM card dimensions




**NOTE -** 3G only SIM will not be supported on 2G GSM only modem. Please ensure SIM is 2G and 3G capable for greatest compatibility.

# Antenna Connectors

Figure 24. 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.

## GSM/UMTS 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: GSM 850/900/1800/1900MHz
- For 3G UMTS operation specified operation in the following bands: GSM 800/850/1700/1900/2100MHz
- 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

### GSM Antenna

The GSM antenna we recommend to use for the ZEUS series is the Mike 1A SMA male magnetic mount antenna, (Most other Siretta styles of GSM antennas are usable depending on customer preference). Please turn to page 54 for ordering details for the Mike 1A, alternatively visit www.siretta.co.uk/mike1a-p-339.html for more information about this antenna.

Figure 25. Mike 1A GSM antenna

## 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 ZEUS 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 Antenna

The GPS antenna we recommend to use for the ZEUS series is the Mike 3A SMA male magnetic mount antenna. Please turn to page 54 for ordering details on the Mike 3A, alternatively visit www.siretta.co.uk/mike3a-p-302.html for more information about this antenna.

Figure 26. Mike 3A GPS antenna

# GPS

## ZEUS-G-GPRS Modem

The ZEUS-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 ZEUS-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.

## ZEUS-G-UMTS Modem

The ZEUS-G-UMTS modem features 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 ZEUS-G-UMTS modem also supports 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 (ZEUS-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



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## GPS Characteristics

Table 9. 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 |
| TTFF from Cold Start | 42 secs |
| TTFF from Warm Start | 30 secs |
| TTFF from Hot Start | 1.8 secs |

## GPS Power Supply

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

Table 10. 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 11. 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.

# Internal Connections

The ZEUS modem has a number of features available to the user accessible from the internal PCB. This includes access to the JTAG reprogramming port, battery connector, battery charge status LED and GPIO status LEDs.

Figure 27. ZEUS PCB

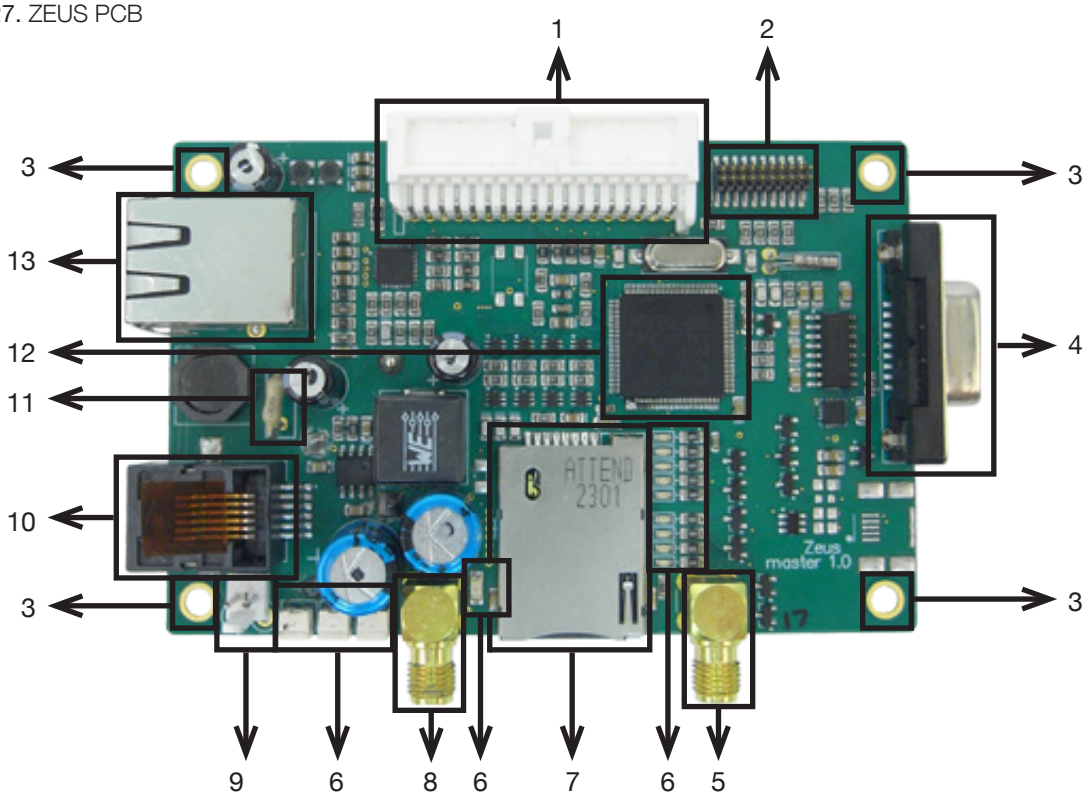



Table 12. ZEUS PCB connections

| No. | Part |
|---|---|
| 1 | 36-Way Connector |
| 2 | JTAG Programming Interface |
| 3 | Mounting Hole |
| 4 | RS232 Interface |
| 5 | GPS Antenna Connector |
| 6 | See 'Onboard LEDs' (**Page 39**) |
| 7 | SIM Reader (Push - Push) |
| 8 | GSM Antenna Connector |
| 9 | Battery Socket |
| 10 | RJ12 Power Connector |
| 11 | Fast Blow 4A Fuse |
| 12 | ARM Cortex M4 32bit Processor |
| 13 | 10 Base-T Ethernet Port |

## Onboard LEDs

The ZEUS PCB has LEDs to indicate the status of the general purpose inputs and general purpose outputs as well as indicating the charge status of the integrated battery charger.

Figure 28. LED positions

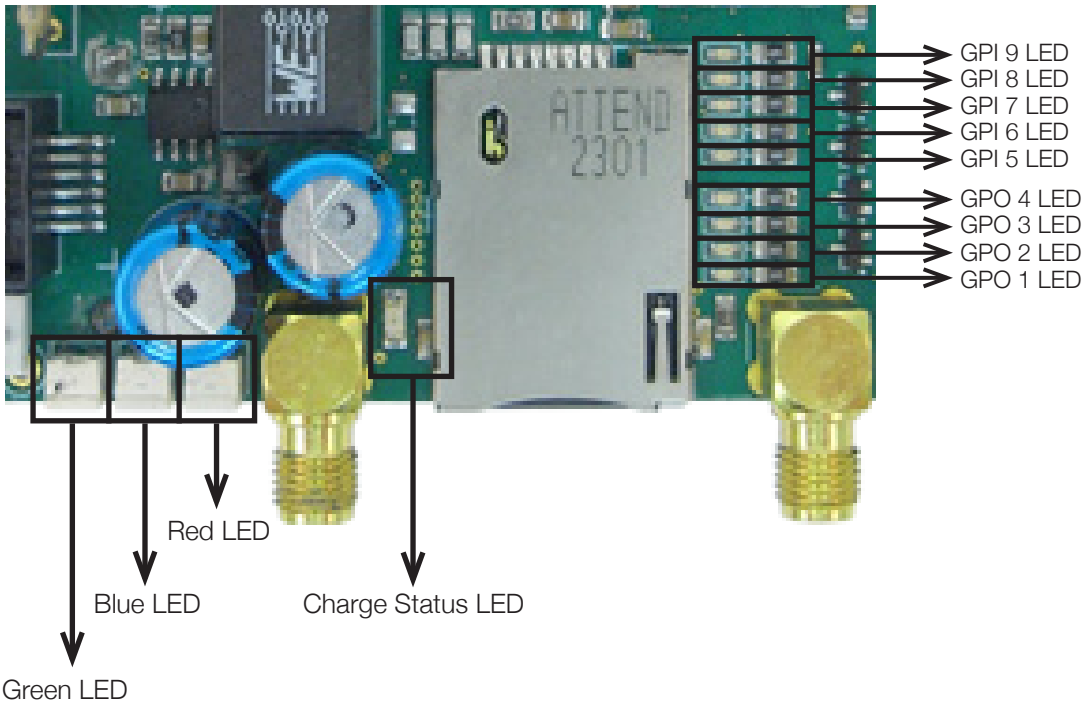



Table 13. Charge Status LED

| Charge Cycle State | LED Status |
|---|---|
| Shutdown | OFF |
| Standby | OFF |
| Preconditioning | ON |
| Constant Current Fast Charge | ON |
| Constant Voltage | ON |
| Charge Complete - Standby | OFF |
| Temperature Fault | OFF |
| Timer Fault | OFF |
| Preconditioning Timer Fault | OFF |

## Relay

The ZEUS relay is a low on-state resistance solid state relay containing GaAs LEDs on the controller input side and MOS FETs on the output side. It is suitable for driving a stable output because of its large continuous load current and low on-state resistance.

### Features

- Low on-state resistance (R on - 0.6 Ω TYP.)
- Large continuous load current (IL = 600mA)
- Designed for compatibility with an AC/DC switching line charger
- Small and efficient package
- High isolation voltage (BV = 1500 V r.m.s)
- Low offset voltage
- Complies to the following safety standards:
  - UL Approved: No. E72422
  - BSI Approved: No. 8241, 8242

# Power

## RJ12 Power Connector

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

**Figure 29.** RJ12 power connector

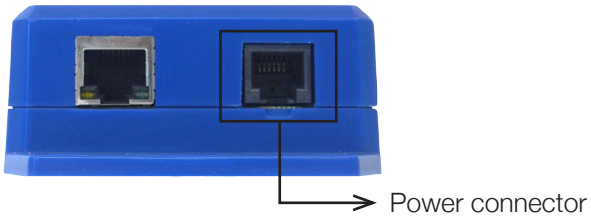



**Figure 30.** Pin numbering

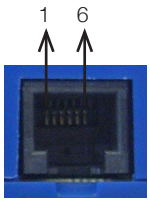



**Table 14.** Pin usage

| Pin | Description | Type | Usage |
|---|---|---|---|
| 1 | Vcc (5-42V DC) | Power In | Power supply for the modem |
| 2 | RESET_IN | Input | Reset signal to reset the modem active high (0.5V - 42V) for >0.5 seconds |
| 3 | PWROFF_IN | Input | Power down signal to power OFF the modem active high (0.5V - 42V) for >0.5 seconds |
| 4 | PWRON_IN | Input | Power up signal to power ON the modem active high (0.5V - 42V) for >0.5 seconds |
| 5 | Ignition line | I/O | General purpose input pin for the user (0.5 - 42V) |
| 6 | GND | 0V | Ground |

Each pin of type Input is activated when the voltage on the pin is in the range +0.5V to +42V DC. The minimum output drive voltage on output pins is set using Vcc_IO on 36 way connector. (Default setup Vcc_IO = VIN)

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 14**. 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 15. Characteristics of power input

| | ZEUS 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 ZEUS modem has a wide operating voltage and can be powered from 5V to 42V. Powering the modem can be done in 3 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

» Integrated Battery Option* - Power the modem from the optional battery which is charged from the main power input through the intelligent battery charger which can be used as a backup supply in the event of power loss.

The ZEUS 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 ZEUS 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.

*This can be specified at the time of ordering. See section 'Ordering Information' on page 14, alternatively contact your Siretta representative or visit **www.siretta.co.uk**

Table 16. ZEUS modem states

| ZEUS 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 |

## Modem Power Supply

The Siretta power supply for the range of modems provides an industry standard output which is compatible across the range of Siretta modems. With a stable 12V output voltage, the Modem PSU offers a wide input voltage as well as being highly efficient. Please turn to page 54 for ordering details.

Figure 31. Siretta Modem PSU

## Power Cable

The Siretta RJ12 open ended power cable provides an easy way to power the modem with your end equipment using an existing power source. It also allows a convenient way to control the modems basic functionality including power on, power off, reset and ignition control lines. The cable is compatible across the entire range of Siretta modems and is colour coded for easy integration. Please turn to page 54 for ordering details.

Figure 32. Siretta Modem power cable

## Current Consumption

The current consumption of the ZEUS during use can be seen in **table 17** below.

Table 17. Current consumption values

| Function | State | Current |
|---|---|---|
| **Processor Section** | | |
| ARM Cortex M4 | On at 168MHz | 87mA |
| ARM Cortex M4 | On at 16MHz | 10mA |
| ARM Cortex M4 | On at 2MHz | 2mA |
| **Peripheral Section** | | |
| SPI Flash | Operating | 3mA |
| Level Translator | Operating | 5mA |
| Board LED | Operating | 10mA |
| Accelerometer | Operating | 1mA |
| **Modem Section** | | |
| Modem On (Not registered) | Idle | 39mA |
| Modem On (Registered) | Idle | 36mA |
| Modem On (Registered with IP address) | Idle | 40mA |
| Modem On (Registered with socket connected) | Idle | 41mA |
| Modem On (Registered with socket connected) - Peak | Transmitting | 109mA |
| Modem On (Registered with socket connected) - Average | Transmitting | 98mA |
| **Ethernet Section** | | |
| Ethernet PHY | On full speed | 45mA |
| Ethernet Transformer | Operating | 10mA |
| **Total Board Section** | | |
| Total board consumption with modem off and Ethernet on | On at 168MHz | 153mA |
| Total board consumption with modem off and Ethernet on | On at 16MHz | 105mA |
| Total board consumption with modem off and Ethernet on | On at 2MHz | 97mA |
| Total board consumption with modem idle and Ethernet on | On at 168MHz | 189mA |
| Total board consumption with modem idle and Ethernet on | On at 16MHz | 141mA |
| Total board consumption with modem idle and Ethernet on | On at 2MHz | 133mA |

## Switching the Modem ON/OFF

### Power on the ZEUS

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

1) Auto power up using the embedded ARM Cortex M4 processor. This process can be implemented very simply in the ARM processor to control the modem functionality in software and allows for vast power savings to be made with the modem still fully functional. 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 (0.5V - 42V) for >0.5 seconds the modem will power up.

In both cases you can monitor PWRMON pin in software to determine the current modem status. When PWRMON is logic high (1.8V) then the modem is powered on.

**NOTE** - The modem is fully operational after it has powered on and PWRMON is asserted to logic high (1.8V). This may take anything from 2 to 6 seconds depending on the startup procedure. Once the modem is powered up it will automatically attempt to logon to the GSM 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 ZEUS

The ZEUS modems have several options to power off. The 3 main options are shown below:

1) Auto power off using the embedded ARM Cortex M4 processor. This process can be implemented very simply in the ARM processor to control the modem functionality in software and allows for vast power savings to be made with the modem still fully functional. The auto power off control will automatically power off the modem as required and manage its status whilst it is offline.
2) 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 (0.5V - 42V) for >0.5 seconds the modem will power off.
3) Manually power down the modem using the AT command AT#SHDN. This command will safely disconnect from the network and power down the module.

In both cases you can monitor PWRMON pin in software to determine the modem status. When PWRMON is logic low (0V) then the modem is powered off.

## Considerations when manually powering the ZEUS 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 ZEUS modem has a special power down reset function for disaster recovery and modem system failures.

This function should only be used in the event of the standard power down functions using the auto power off function in software, the PWROFF_IN pin or the software shutdown AT command failing to operate correctly.

» The disaster recovery reset RESET_IN pin on the RJ12 power connector (Pin2)

» The disaster recovery reset is active high (0.5V - 42V) for >0.5 seconds

**NOTE** – This reset pin hard resets the microprocessor and must only be used as a last resort.

**NOTE** - Misuse of this function can cause latch up problems on the modem and improper functioning of the modem. It will also not detach safely from the GSM network and may cause the modem 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. If you do not have very specific requirements then you may have the option to use the embedded software package included within the GSM/UMTS engine. All the modules used within the ZEUS modems support 3 embedded software platforms which are available for use and can be chosen to suit your exact design requirements.

The available platforms for the ZEUS modem are shown below:

» Telit AppZone
» Telit Easy Script in Python
» Embedded C/C++ Development for ARM Cortex M4

**NOTE -** Contact your Siretta representative for information about these 3 programming environments.

## 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 GSM 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 Easy Script in Python

Telit Easy Script in Python is a high-level Python programming language script interpreter. Python is often characterized as minimalist, although this applies mainly to the language's core syntax and semantics. The standard library provided within the development environment offers a large number of additional extensions to perform many complex tasks to enable fast application development.

The ZEUS modems offer the Python script interpreter engine with around 3MB of nonvolatile memory for the user application scripts and data storage. There is an additional 1.2MB of RAM reserved for Python engine usage and integrated TCP/IP stack. There are many benefits of the Python programming language and it is already being used in a wide variety of applications.

Some of the key distinguishing features of Python include:

- Extremely clear, readable syntax
- Strong introspection capabilities
- Intuitive object orientation
- Natural expression of procedural code
- Full modularity, supporting hierarchical packages
- Exception-based error handling
- High level dynamic data types
- Extensive standard libraries and third party modules

## Embedded C/C++ Development for ARM Cortex M4

The ZEUS modem supports full software development on the ARM Cortex M4 processor. This allows you to build custom applications and for you to complete a full design cycle on the same hardware platform without the need for any hardware development.

Supporting the embedded C/C++ development environment you can ensure that your end product uses the smallest amount of code space and executes with exceptional performance. This means that you can build very complex systems which can have intelligence to make decisions based on the vast array of inputs presented to the modem.

Another advantage of running an embedded application on the ZEUS is the exceptional power management which can be achieved. You can reduce all functionality to a minimum and just execute essential tasks. For example you may want to monitor a system for several months on battery and if a threshold is exceeded you can wake everything up and take some action.

The possibilities are endless and many applications examples are available to get your application development started. Please see your Siretta representative for more information.

## IAR Embedded Workbench

The compiler we recommend for use with the ZEUS is the IAR 6.60 workbench, please see link below:

http://www.iar.com/en/Products/IAR-Embedded-Workbench/ARM/

To program the ZEUS we recommend using the following JTAG interface connector which is an ST-LINK/V2, please see link below:

http://www.st.com/web/catalog/tools/FM146/CL1984/SC724/SS1677/PF251168

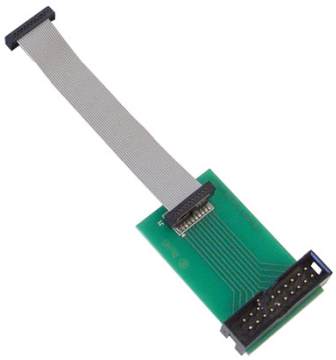
For direct pin mapping on the ARM Cortex M4 32bit processor please refer to tables 18 - 23 over page. 'Pin' refers to the microprocessor pin which is mapped to the relevant function.

To communicate with the ARM Cortex M4 32bit processor with a standard compiler, please use the JTAG interface cable to connect to the JTAG programming port. The JTAG programming interface allows you to connect the mini JTAG connector port on the ZEUS modem to the standard JTAG connector on the ST-LINK in-circuit debugger.

## JTAG Interface Cable

THE ST-LINK debugger and programmer interface connects to your PC over a standard USB port. The debugger allows the IDE to debug code running on the ARM Cortex M4 32bit processor on the ZEUS and allows reprogramming of the on board flash and real time control of the software. This is required for development of your own embedded application and for programming low level code into the ARM processor memory. Please turn to page 54 for ordering details.

Figure 33. JTAG interface cable



## JTAG Connector Functions

Table 18. Functions of JTAG connector

| PIN | Direction | Function |
|---|---|---|
| PA13 | IN | TMS |
| PA14 | IN | TCK |
| PA15 | IN | TDI |
| PB3 | OUT | TDO |
| PB4 | IN | TRST |
| PH1 | IN | NRST |

## RS232 Connector Functions

Table 19. Functions of RS232 connector

| PIN | Direction | Function |
|---|---|---|
| PD3 | OUT | UART2 CTS |
| PD4 | IN | UART2 RTS |
| PD5 | OUT | UART2 TX |
| PD6 | IN | UART2 RX |

## Microprocessor Functions

Table 20. Functions of the microprocessor

| PIN | Direction | Function |
|---|---|---|
| PB6 | OUT | RS232_SEL |
| PC7 | OUT | BLUE_LED |
| PC8 | OUT | GREEN_LED |
| PE4 | OUT | STAT_LED |
| PC9 | OUT | MCO_CLK |
| PD7 | OUT | RLY (Relay Control) |
| PD14 | OUT | ON_OFF (Module) |
| PD15 | IN | PWRMON (Module) |
| PE3 | OUT | SHUTDOWN (Module) |

## Microprocessor Peripherals

Table 21. Microprocessor peripherals

| PIN | Direction | Function |
|---|---|---|
| PC10 | OUT | Flash CLK |
| PC12 | I/O | Flash MOSI |
| PC11 | I/O | Flash MISO |
| PC13 | OUT | Flash CS |
| PA9 | OUT | USB VBUS (Module) |
| PA11 | I/O | USB N (Module) |
| PA12 | I/O | USB P (Module) |
| PB12 | OUT | MII_ETH TXD0 |
| PB13 | OUT | MII_ETH TXD1 |
| PC2 | OUT | MII_ETH TXD2 |
| PE2 | OUT | MII_ETH TXD3 |
| PB11 | OUT | MII_ETH TX_EN |
| PC3 | OUT | MII_ETH TX_CLK |
| PC4 | IN | MII_ETH RXD0 |
| PC5 | IN | MII_ETH RXD1 |
| PB0 | IN | MII_ETH RXD2 |
| PB1 | IN | MII_ETH RXD3 |
| PA1 | IN | MII_ETH RX_CLK |
| PB10 | IN | MII_ETH RX_ER |
| PA7 | OUT | MII_ETH DV |
| PC1 | I/O | MII_ETH MDC |
| PA2 | IN | MII_ETH MDIO |
| PA3 | IN | MII_ETH COL |
| PA0 | IN | MII_ETH CRS |
| PE0 | IN | MII_ETH IRQ |
| PE1 | OUT | MII_ETH RESET_N |

**NOTE** - MCO (PA9) drives the PHY clock input and the STM32 needs to configure the clock output from the 25Mhz HSE.

The PHY is mapped to memory address 0x01 for the MIDO bus and is configured to work in MII mode not RMII.

## 36-Way Connector Functions

Table 22. Functions of 36-way connector

| PIN | Direction | Function |
|---|---|---|
| PD8 | OUT | UART3 TX (Debug) |
| PD9 | IN | UART3 RX (Debug) |
| PA4 | OUT | DAC_1 |
| PA5 | OUT | DAC_2 |
| PA6 | IN | ADC_1 |
| PC0 | IN | ADC_2 |
| PB8 | OUT | I2C_CLK |
| PB9 | I/O | I2C_DATA |
| PE5 | I/O | 1-Wire |
| PD0 | IN | CAN_RX |
| PD1 | OUT | CAN_TX |
| PD13 | IN | BOOT_LOAD |
| PE7 | OUT | GPIO_1 (GPO_1) |
| PE8 | OUT | GPIO_2 (GPO_2) |
| PE9 | OUT | GPIO_3 (GPO_3) |
| PE10 | OUT | GPIO_4 (GPO_4) |
| PE11 | IN | GPIO_5 (GPI_1) |
| PE12 | IN | GPIO_6 (GPI_2) |
| PE13 | IN | GPIO_7 (GPI_3) |
| PE14 | IN | GPIO_8 (GPI_4) |
| PE15 | IN | GPIO_9 (GPI_5) |

## RJ12 Connector Functions

Table 23. Functions of RJ12 connector

| PIN | Direction | Function |
|---|---|---|
| PD2 | IN | PWROFF_IN |
| PC6 | IN | PWRON_IN |
| PD10 | IN | IGNITION |
| PH1 | IN | RESET |

# Siretta Recommends

All ZEUS series modems will require extra product which are all available from Siretta.
Below are some of the products we recommend for your modem:

| Product | Part No. | Description |
|---|---|---|
| **Interface Cables** | | |
| RS232 Male to Female Cable  | **29284** | The RS232 serial cable is the standard cable used for connecting the ZEUS modem to other devices such as a PC or industrial control equipment. The RS232 serial cable allows a serial connection to the modem which you can use to setup and change the modem configuration as well as providing a communication channel for connected equipment over the GSM/UMTS network.<br><br>**29284 - Cable length:** 1m |
| USB to RS232 Male Cable  | **29891** | The USB to RS232 Male serial cable allows a serial connection to the modem via USB which you can use to setup and change the modem configuration as well as providing a communication channel for connected equipment over the GSM/UMTS network.<br><br>**29891 - Cable length:** 1.5m |
| Ethernet Patch Cable  | **29286** | The Ethernet interface cable is a category 5 twisted pair cable. This cable is used to connect the ZEUS modem to other Ethernet enabled equipment such as an industrial PC, Embedded computer or EPOS /modem equipment. The cable provides performance up to 100 MHz and is suitable for 10BASE-T and 100BASE-TX Ethernet connections<br><br>**29286 - Cable length:** 1m |

36-Way Cable

**34212 / 34218**

The 36-way cable is desiged to give access to the more advanced features of the ZEUS. The functionality available through the cable can be activated and controlled within embedded software running in the ARM Cortex M4 32bit processor, and allows for many advanced applications to be developed.

**34212 -** Cable length: 500mm

**34218 -** Cable length: 1m

JTAG Cable

**34388**

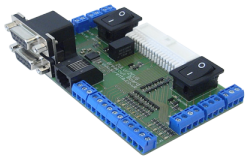
The JTAG programming interface allows you to connect the mini JTAG connector port on the ZEUS modem to the standard JTAG connector on the ST-LINK in-circuit debugger.

THE ST-LINK debugger and programmer interface connects to your PC over a standard USB port. The debugger allows the IDE to debug code running on the ARM Cortex M4 32bit processor on the ZEUS and allows reprogramming of the on board flash and real time control of the software. This is required for development of your own embedded application and for programming low level code into the ARM Cortex M4 32bit processor memory.

**34388 -** Cable length: 300mm

## Evaluation and Development

ZEUS-EVK



**34739**

The EVK provides simple and convenient access to the ZEUS interfaces through the 36-way cable. It provides standard DB9 connectors for RS232/Trace serial ports as well as screw terminal block connectors for GPIO/ADC/DAC/Power/CAN/ Relay/BOOT/IGN ports. This enables you to quickly and easily connect external equipment to the ZEUS and integrate it to your application.

## Antennas

Mike 1A

**33529 / 33530**

The Mike 1A is a versatile ¼ wave magnetic mount antenna, and is very popular being used by many users of GSM / GPRS and 3G equipment. Of rigid construction with a unity gain whip, the magnetic mount base ensures a solid connection to metallic surfaces.

**33529 -** Cable length: 1.2m
Connector: SMA Male

**33530 -** Cable length: 2.5m
Connector: SMA Male

Mike 3A

**33312**

The Mike 3A antenna is embedded with the latest generation, two stage, preamplifier circuit offering 28dB gain. Capable at operating within 3.0-5.0V. Its low current draw of just 10mA at 3V helps keep the operating voltage to a minimum making it suitable for applications where power saving is important.

**33312 -** Cable length: 3m
Connector: SMA Male

## Power

Siretta Modem PSU

**32889**

The Siretta power supply for the range of modems provides an industry standard output which is compatible across the range of Siretta modems. With a stable 12V output voltage, the Modem PSU offers a wide input voltage as well as being highly efficient.

**32889 -** Cable length: 1m

Siretta Modem Power Cable

**31557**

The Siretta RJ12 open ended power cable provides an easy way to power the modem with your end equipment using an existing power source. It also allows a convenient way to control the modems basic functionality including power on, power off, reset and ignition control lines.

**31557 -** Cable length: 1m



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# Installation

## Considerations for Installations Incorporating the ZEUS

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.

GSM signal strength: The modem/antenna has to be placed in a position that ensures sufficient GSM 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 GSM 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 GSM signal tester which provides a full breakdown of the GSM 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 ZEUS 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

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 ZEUS series modem to the host application using 4 M3 3mm diameter pan-head screws or use DIN rail mount.

# Safety and Product Care

Please read the information on this page and page 57 “Installation” before you begin your system integration.

## General Precautions

» The ZEUS 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 ZEUS series modems must not be installed or located where the surface temperature of the enclosure may exceed 85°C.

» All cables connected to the ZEUS 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 ZEUS 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 ZEUS series modem into your application, the accessibility of the SIM card should be taken into account so that it can be removed or changed.

» We always recommend that you have the SIM card protected by a PIN code. This will ensure that the SIM card cannot be used by an unauthorized person.

## 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 GSM 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 GSM and UMTS. After existing research had been reviewed, and after compliance to all applicable safety standards has been tested, it has been concluded that the ZEUS 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 our 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.

Medical electronic equipment: Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc.) to determine if they are adequately shielded from external RF energy.

Turn your modem OFF in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

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 ZEUS 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 ZEUS 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 ZEUS 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 | Adaptive Multi-Rate |
| AT | Attention |
| CAN | Controller Area Network |
| CBS | Cell Broadcasting Service |
| CSD | Circuit Switched Data |
| DAC | Digital to Analog Converter |
| DHCP | Dynamic Host Configuration Protocol |
| EGNOS | European Geostationary Navigation Overlay Service |
| EPOS | Electronic Point of Sale |
| EVK | Evaluation Kit |
| FIFO | First In, First Out |
| 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 |
| I2C | Multimaster serial single-ended computer bus |
| IDE | Integrated Development Environment |
| I/O | Input/Output |
| JTAG | Joint Test Action Group |
| LAN | Local Area Network |
| LED | Light Emitting Diode |
| LNA | Low Noise Amplifier |
| LTE | Long Term Evolution |
| M2M | Machine to Machine |
| MSAS | Multi-functional Satellite Augmentation System |
| PCB | Printed Circuit Board |
| RF | Radio Frequency |
| RS232 | Radio Sector |
| SIM | Subscriber Identity Module |
| SMA | Sub Miniature Version A |
| SMS | Short Message Service |
| SPI | Serial Peripheral Interface |
| STM32 | Microcontroller Family |
| TTFF | Time To First Fix |
| UMTS | Universal Mobile Telecommunications System (Same as 3G) |
| USB | Universal Serial Bus |
| Vcc | Positive Power Supply |
| WAAS | Wide Area Augmented System |

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