

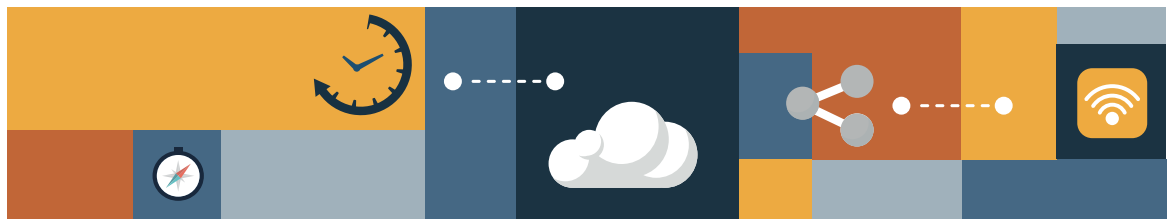
# M2M Applications Handbook



# Siretta

Inspired Wireless M2M Technology

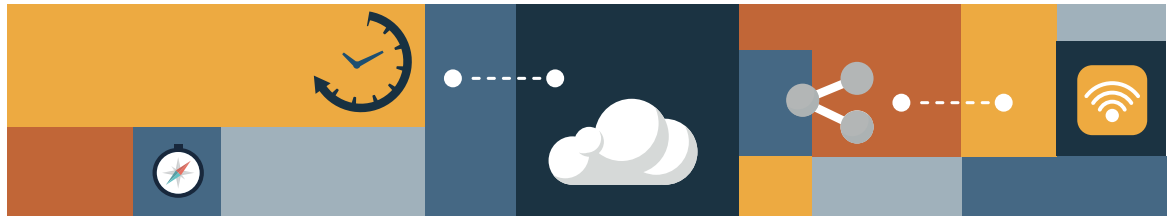




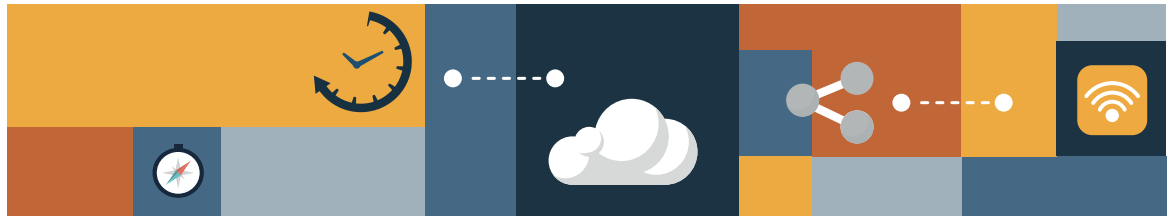
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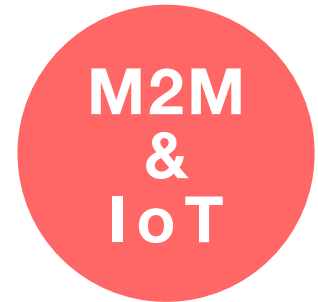
# Who Are Siretta?



## Introduction

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The **Siretta M2M Applications Handbook** has been created to help with the development of M2M / IoT applications. Whether you just need to connect serial devices over GSM, remotely monitor, control, or track assets, this guide covers technology, software and solutions examples.



### *About Siretta*

Our expertise in wireless technology has enabled us to build a broad M2M application base, but in addition, a relevant product range.

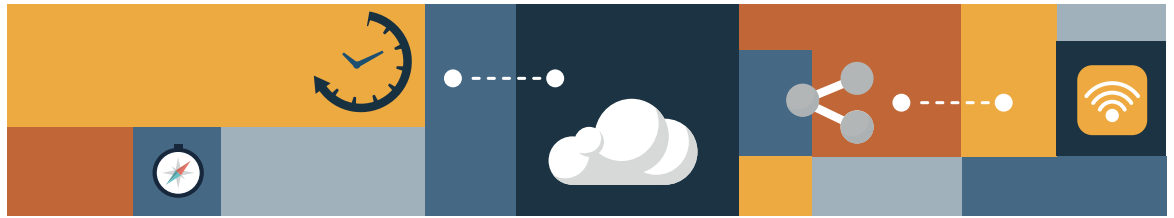
Our high level of technical support and advice is now well known and sought after on all matters regarding wireless connectivity and M2M developments.

We have always strived to add significant value to our customer's applications whether offering complete end to end solutions or specific system components.

#### **Our key attributes are:**

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- » A **leading developer** of Cloud based wireless M2M solutions
- » Multi year **track record** of deploying cloud based systems
- » **Comprehensive range** of 2G / 3G / 4G Modems for M2M
- » Designed for Product Developers, Systems Integrators and Enterprise Customers



## Siretta Product Families



### **airCONNECT Antennas**

Antennas suitable for 2G/3G/4G, wide choice of mounting styles and WiFi/GPS versions.



### **linkCONNECT Intelligent Managed Modems**

Intelligent managed modems for 2G/3G/4G with GPS, GPIO options and wide operating voltage ranges.



### **quikCONNECT Modems**

2G/3G/4G modems with optional GPIO/GPS/DIN rail mount and wide operating voltage.



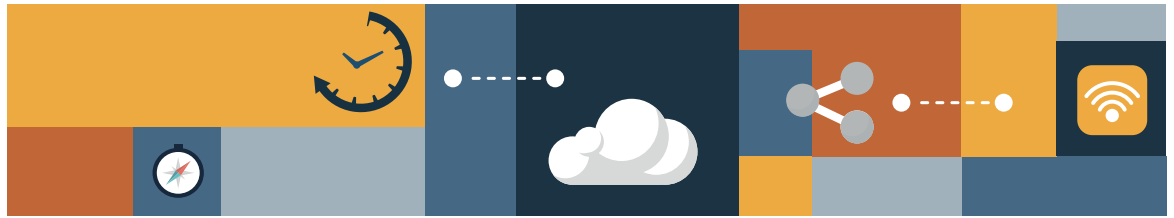
### **cloudCONNECT Solution**

2G/3G/4G modems pre-set to connect with Cloud-AXS, Siretta's cloud based management solution.



### **routeCONNECT Routers**

3G/4G routers with 10/100 Ethernet LAN and WIFI/GPS/RS485 options.



## Connectivity Overview



### Connecting legacy RS232 equipment to the internet

linkCONNECT modems are pre-loaded with Siretta's intelligent managed connectivity software.

linkCONNECT connects legacy RS232 equipment to the internet. This allows you to connect to your equipment from anywhere in the world.



### Ethernet to 2G/3G/4G

Siretta routeCONNECT intelligent industrial routers enable 2G/3G/4G to Ethernet and Wifi.

The routers are designed for industrial use with DIN rail mounting, wide operating voltage and options including RS485 and GPS.

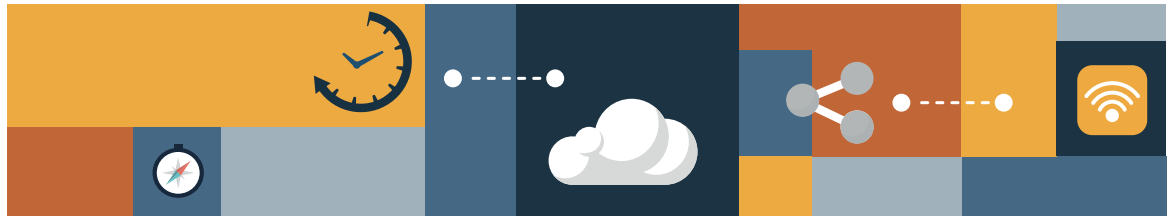


### Application Developers

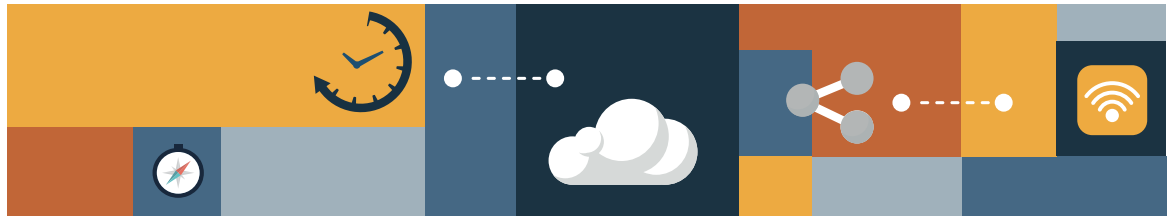
Siretta offer a broad range of 2G/3G/4G modems for applications developers.

These products incorporate a Python script interpreter in addition to GPIO, GPS and system-on-modem devices with USB/I2C/CAN/SPI/ADC and much more.

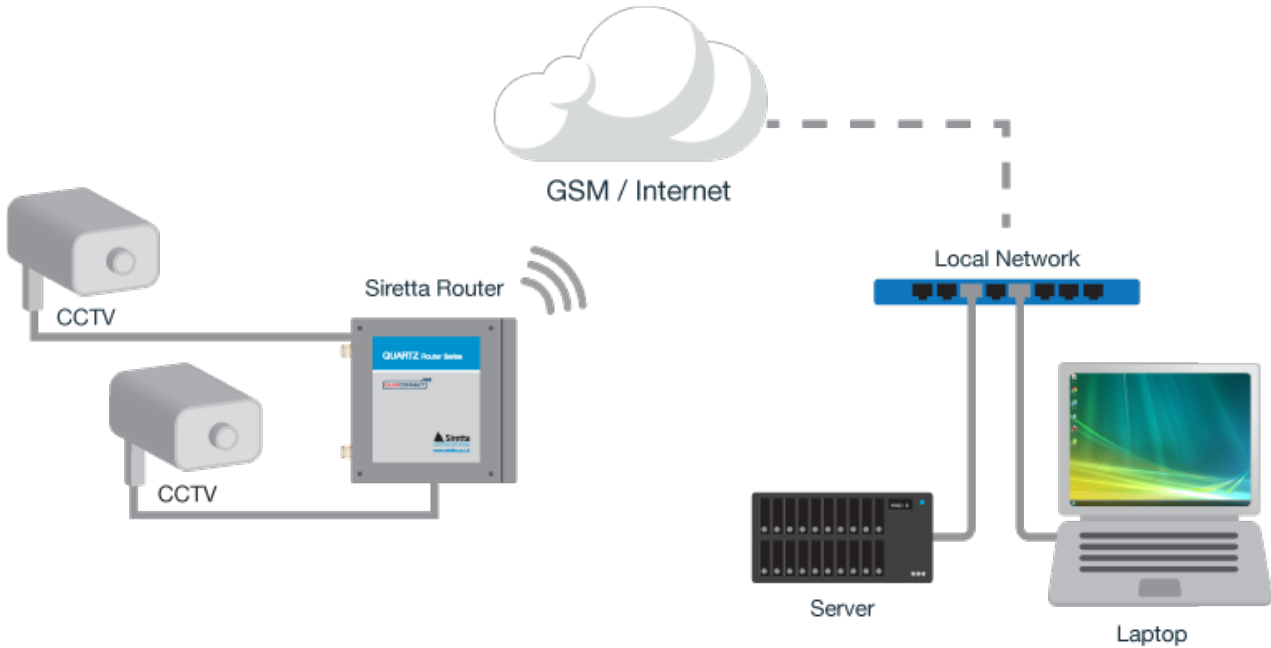




# Application Examples



## CCTV Security Systems



Siretta routeCONNECT solutions are used in remote CCTV security systems to enable standard Ethernet enabled CCTV cameras to transmit their video stream over the internet to a central location. Many CCTV systems are designed to connect to broadband internet via a wired Ethernet connection or in more recent designs over WIFI. The routeCONNECT solution will accept CCTV video stream from either wired Ethernet or via WIFI and stream the video channel securely over 3G/UMTS and 4G/LTE cellular networks.

The Siretta routeCONNECT solution enables remote access to CCTV equipment using cellular network and enables equipment to communicate over the web which was not designed to be internet enabled. This allows you to network enable equipment in the field and reuse existing equipment which would otherwise have to be upgraded to a more advanced version.

### Common application areas include:

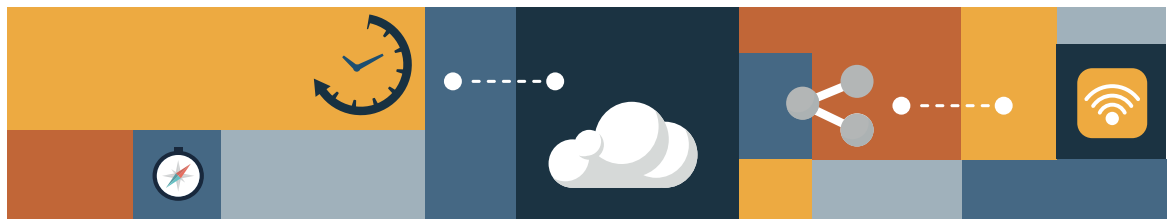
- » Watch video feed in real time from a remote location
- » Remotely access CCTV systems to access saved footage
- » Network enable older non-internet enabled systems
- » Reuse existing equipment and infrastructure to increase ROI
- » Remotely diagnose CCTV problems offsite
- » Monitor real time system performance
- » Remotely watch and control CCTV system from a central location

### *Recommended Products*

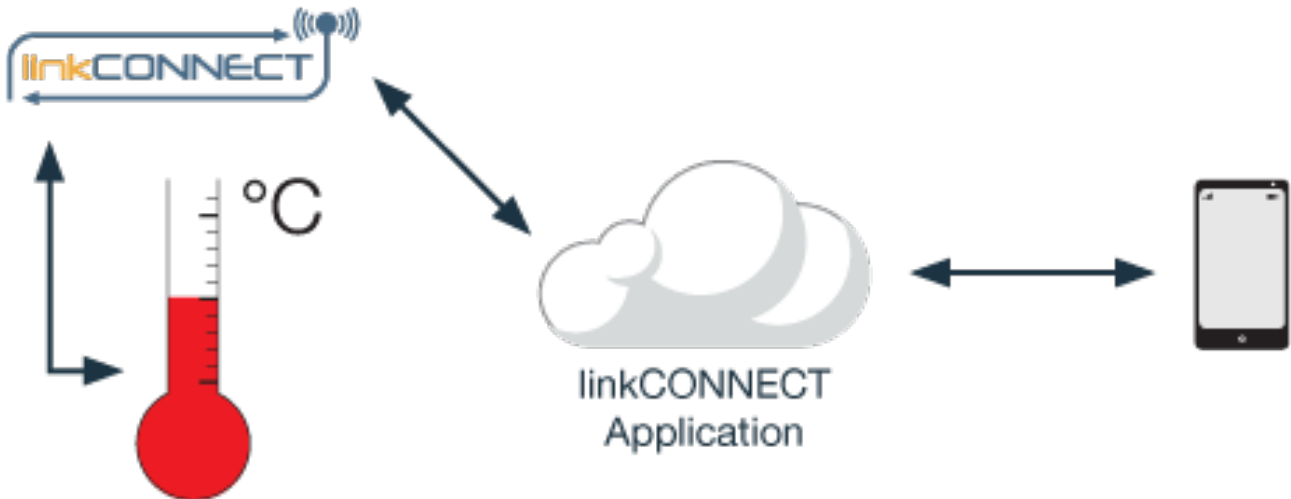
#### QUARTZ 3G/4G Router

- Dual-SIM Support
- DIN Rail mountable
- WiFi/Ethernet/RS485 (option)





## Temperature Logging



Siretta linkCONNECT solutions are used in end applications to stream live data from remote equipment. This solution is perfect for monitoring real time information in life threatening or dangerous situations where immediate action is required without delay. Loss of connectivity can be tracked and dealt with by using the built in backup CSD (circuit switched dialup) connection to maintain a constant reliable connection. The logging of real time information can be performed in the background and logged results can be reported at a later date to provide an on the spot detailed analysis or daily/weekly/monthly/yearly summary statistics.

The Siretta linkCONNECT solution enables devices to seamlessly stream information over the network to a central server or headquarters via a robust and reliable connection. Device connectivity enables any connected device to stream its information in real time for live updates and real time monitoring of end equipment.

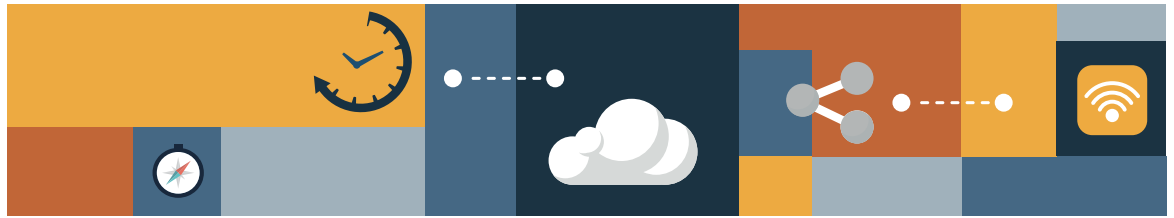
### Common application areas include:

- » Temperature logging
- » Temperature / humidity monitoring
- » Scheduled equipment logging to replace manual processes (clipboard and time stamp)
- » Real time monitoring of connected devices
- » Live updates in a central location
- » Monitoring trigger levels for automatic alarm generation
- » Resource monitoring
- » Device statistics

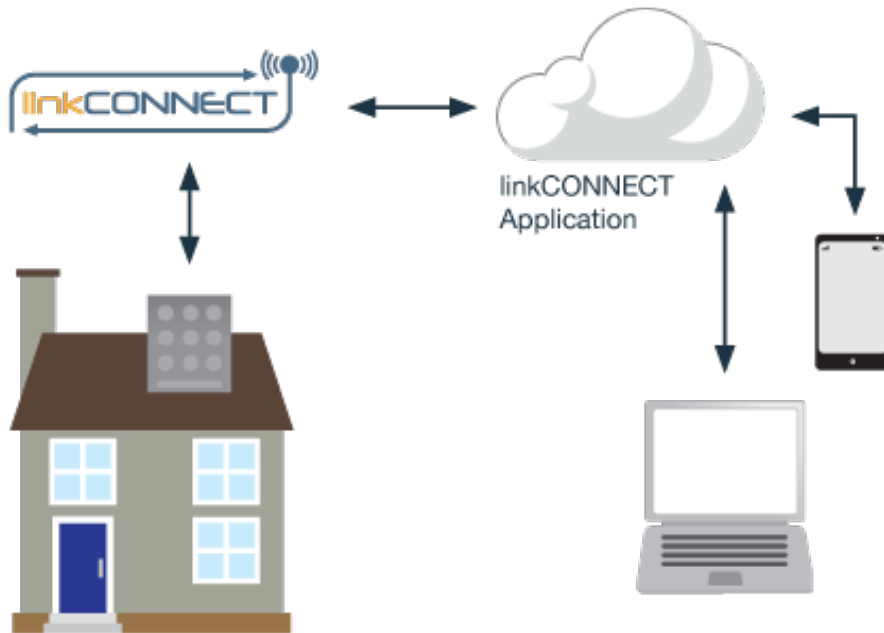
### *Recommended Products*

#### LC300 GPRS/3G Modems

- Intelligent solution
- RS232 Serial to TCP/IP Connectivity
- Simple SMS configuration
- Reliable network keepalive
- Support client/server mode



## Home Automation



Siretta linkCONNECT solutions are used in home automation projects to link the home to the home owner via a mobile application on their smart phone. The solution uses a remote link to capture information about the status of the home including monitoring lights, doors and windows and total energy usage,

The Siretta linkCONNECT solution enables remote access to a host of sensors around the home which can be used to report on a number of important parameters. There are a number of areas which are covered including providing a more energy efficient home or saving costs with energy usage over the year.

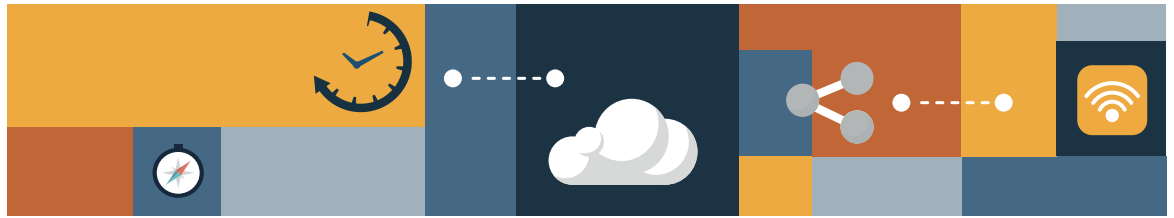
### Common application areas include:

- » Lighting monitoring
- » Lighting control
- » Heating control
- » Energy monitoring
- » Power control
- » Individual device energy management
- » Activate door and window locks
- » Door and window open status
- » Energy summary reporting
- » Total device itemised costs

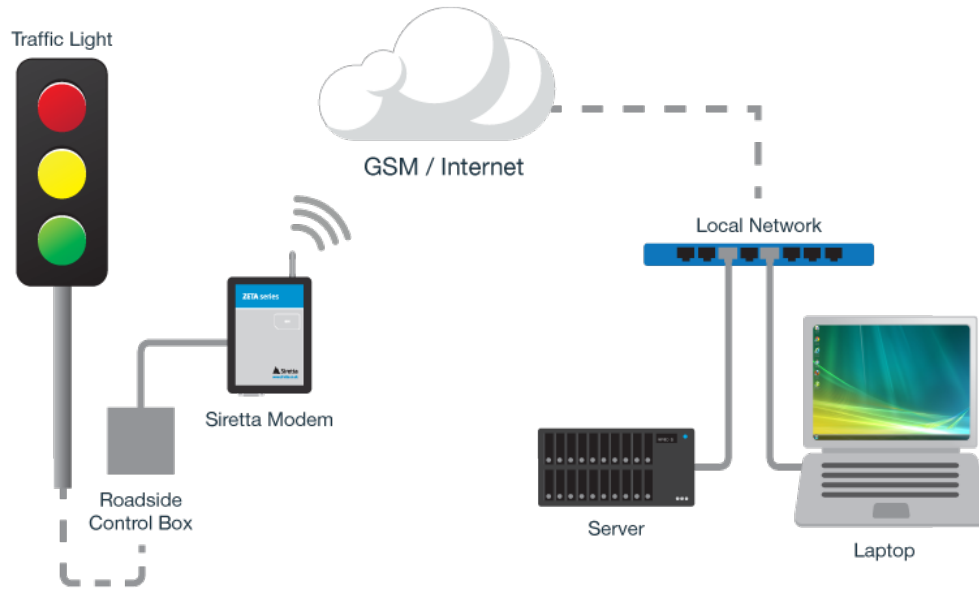
### *Recommended Products*

#### LC300 GPRS/3G Modems

- Intelligent solution
- RS232 Serial to TCP/IP Connectivity
- Simple SMS configuration
- Reliable network keepalive
- Support client/server mode



## Traffic Flow Control



Siretta linkCONNECT solutions are used in end applications to stream live 'real time' data from remote equipment. This solution is perfect for monitoring real time information in busy environments where immediate action is required to prevent delays and ensure the efficient delivery of service. Loss of connectivity can be tracked and dealt with by using the built in backup CSD (circuit switched dialup) connection to maintain a constant reliable connection. The logging of real time information can be performed in the background and logged results can be reported at a later date to provide an on the spot detailed analysis or daily/weekly/monthly/yearly summary statistics.

The Siretta linkCONNECT solution enables devices to seamlessly stream information over the network to a central server or headquarters via a robust and reliable connection. Device connectivity enables any connected device to stream its information in real time for live updates and real time monitoring of end equipment.

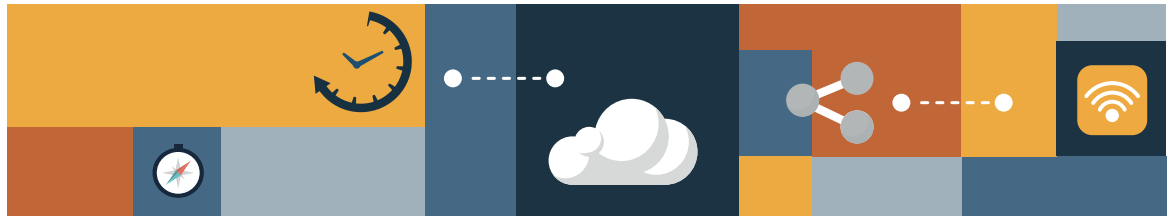
### Common application areas include:

- » Traffic control management
- » Traffic flow optimization
- » Scheduled flow control based on time of day
- » Logging system status to replace faulty equipment
- » Real time monitoring of all connected devices
- » Live updates in a central location
- » Monitoring trigger levels for automatic alarm generation
- » Performance statistics

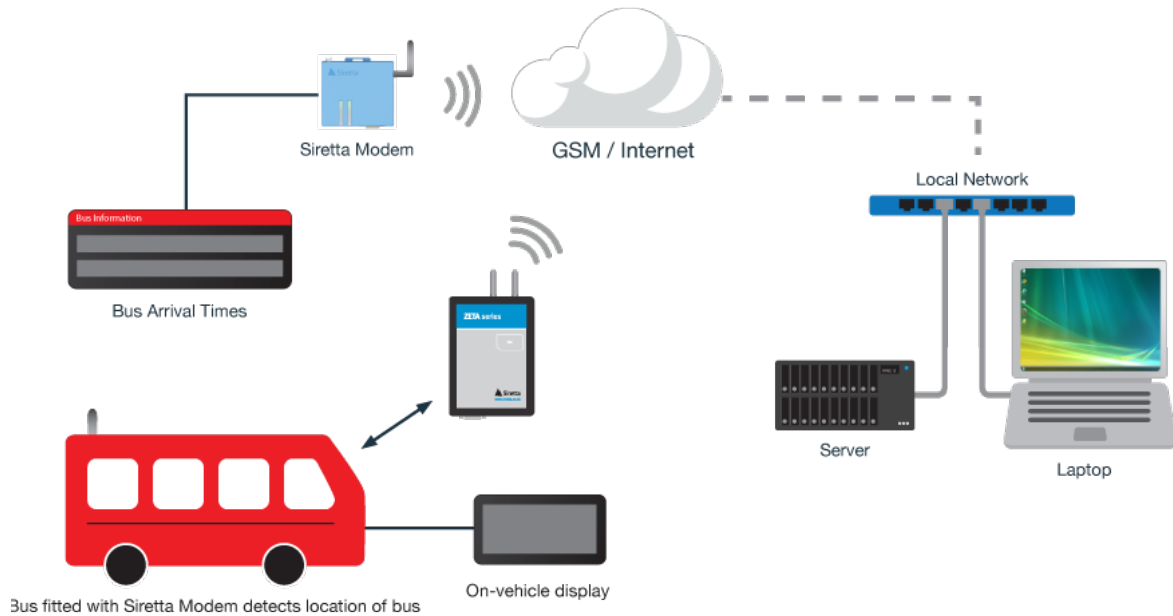
### Recommended Products

#### LC200/LC300

- Intelligent modem solution
- Robust, reliable connectivity
- Add cellular connectivity to remote equipment
- Convenient mounting options
- Simple SMS configuration



## Real-time Passenger Informations Systems



Bus passenger information systems or Real Time Passenger Information (RTPI) systems provide live information about arrival times of buses across a county. The systems use passenger information displays (digital signs) fitted at bus stops and each bus is fitted with a GPS tracking device.

The passenger information systems make use of cloud computing to track the position of buses in the area and calculate the arrival time to be displayed on the real time information system at the bus stop.

### Benefits to users and operators:

- » Increased use of public transport over others
- » Accurate information for passengers - wherever they are
- » Promote bus use
- » Improve brand strength

Siretta offers several products which can be used within the bus passenger information systems for 2G/GPRS and/or 3G/UMTS networks.

Siretta modems include GPS options for vehicle tracking and we also manufacture the GPS / GSM antennas and high quality RF connecting cables. The modems are designed with a wide input operating voltage and so are suitable for use on vehicles such as buses, coaches and others.

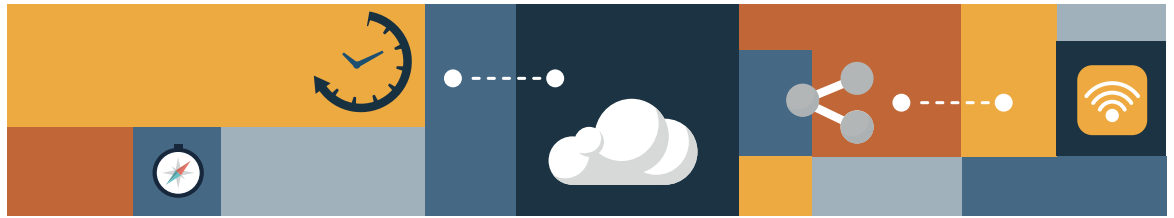
### Recommended Products

#### ZETA-G-GPRS/UMTS

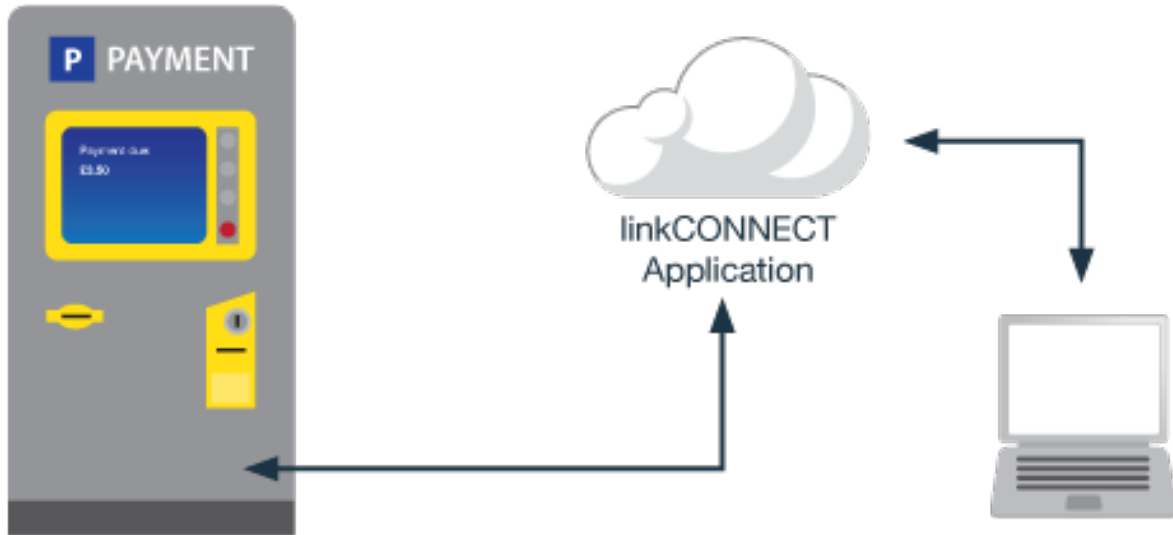
- Modems with GPIO, GPS and wide operating voltage

#### Tango 15

- Combined 2G/3G and GPS antenna, low profile through hole



## Car Parking Ticketing Machines



Siretta linkCONNECT solutions are used in automatic payment machines where authorisation to purchase a service is required via credit card payment or validated company credit account. The linkCONNECT solution provides a point to point link to the distribution point and provides a real time device status which can be used to authorise payments and initiate delivery of parking ticket/car park access/congestion charge etc.

The management system checks authorisation and provides access to the service directly and detailed statistics can be obtained from the application to provide performance reports, delivery breakdown and automatically trigger maintenance and service callouts.

The Siretta linkCONNECT solution enables remote access to remote equipment with a robust and reliable connection. Device connectivity can be affected by the environment and operating conditions which the linkCONNECT solution manages and tries to overcome.

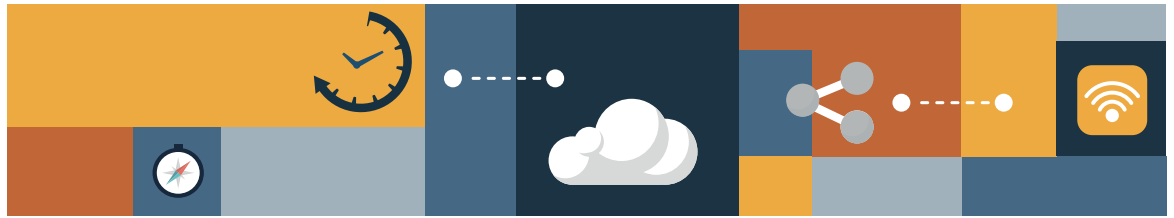
### Common application areas include:

- » Remote authentication
- » Payment authorisation
- » Credit card processing
- » Update ticket charges
- » System performance statistics
- » System alerts
- » System use / Maintenance alerts
- » Remote control of operating schedule
- » Remote trend monitoring

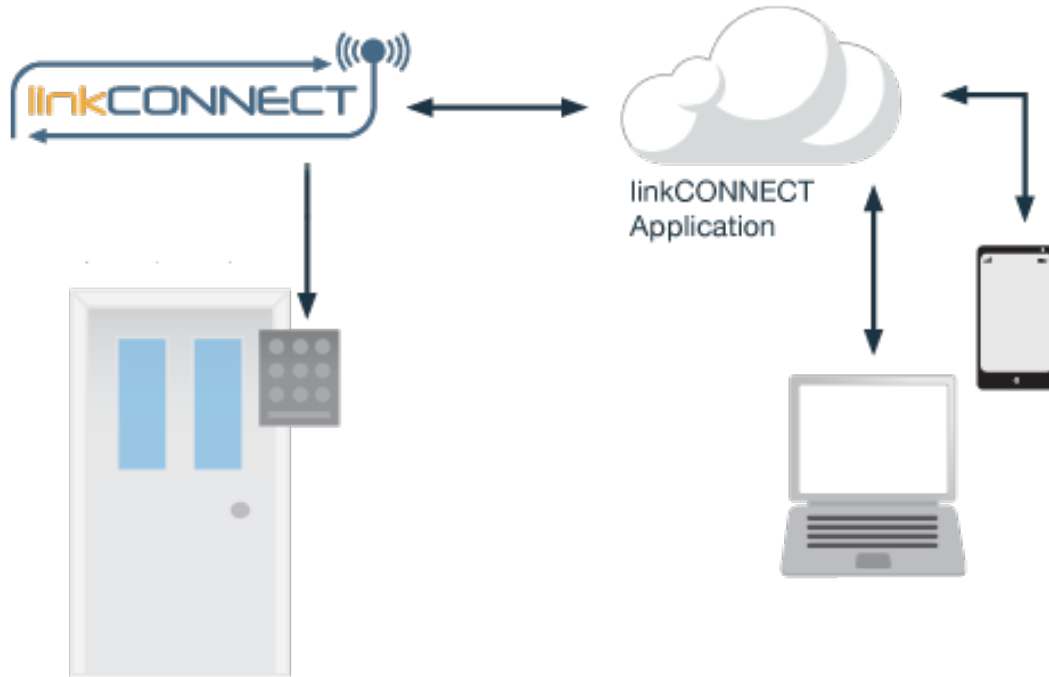
### *Recommended Products*

#### LC300 GPRS/3G Modems

- Intelligent solution
- RS232 Serial to TCP/IP Connectivity
- Simple SMS configuration
- Reliable network keepalive
- Support client/server mode



## Door Entry / Access Control Systems



Siretta linkCONNECT solutions are used in remote door entry applications to authenticate users via either a simple pin code entry mechanism or a more advanced system such as fingerprint recognition or Bluetooth phone authentication. Once user is authenticated the system is able to securely grant access to building premises, warehouses, garages etc without the need for a manual key exchange or a lock and key entry.

The Siretta linkCONNECT solution enables remote monitoring of users access history and date and time logging which enables a number of users to access the same resource at different times without the need to have many sets of keys in existence which creates a greater security risk.

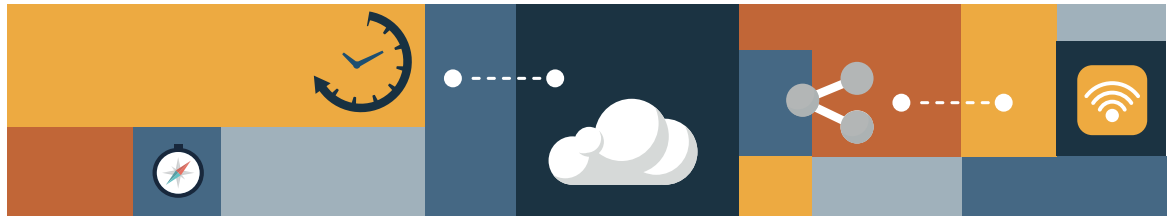
### Common application areas include:

- » Remote access to holiday apartments and villas
- » Provide access to mobile resources such as yachts
- » Remote access for cleaners with a scheduled timeslot
- » Easily update access rights to prevent access in real time
- » Grant additional user access in real time
- » Automatically set secondary secret keywords to further validate users
- » Monitor usage to detect strange activity and automatically trigger alarms

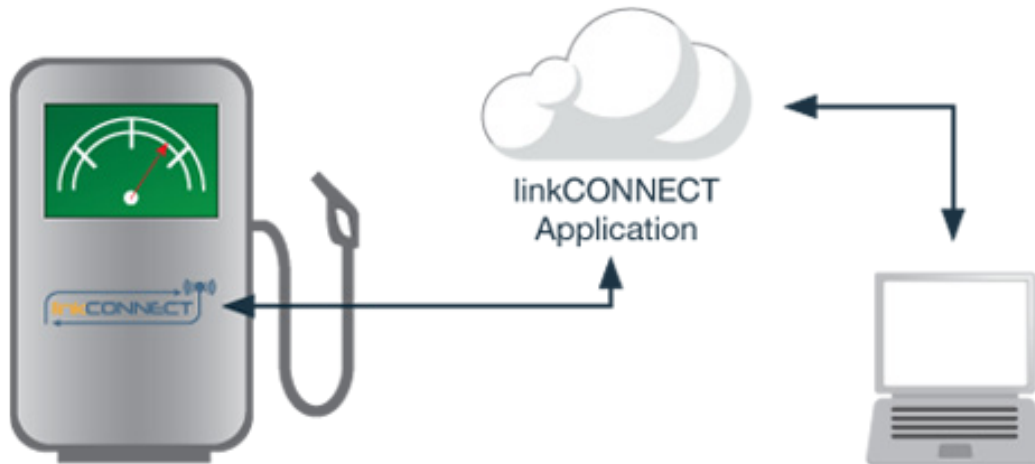
### Recommended Products

#### LC300 GPRS/3G Modems

- Intelligent solution
- RS232 Serial to TCP/IP Connectivity
- Simple SMS configuration
- Reliable network keepalive
- Support client/server mode



## Fuel Distribution Control Systems



Siretta linkCONNECT solutions are used in pump automation and distribution control system projects where authorisation to distribute fuel / oil / electricity is required via credit card payment or validated company credit account. The linkCONNECT solution provides a point to point link to the distribution point and provides a real time device status which can be used to authorise payments and initiate delivery of the service. The management system checks authorisation and provides access to the service directly and detailed statistics can be obtained from the application to provide performance reports, delivery breakdown and automatically trigger maintenance and service callouts.

The Siretta linkCONNECT solution enables remote access to remote equipment with a robust and reliable connection. Device connectivity can be affected by the environment and operating conditions which the linkCONNECT solution manages and tries to overcome.

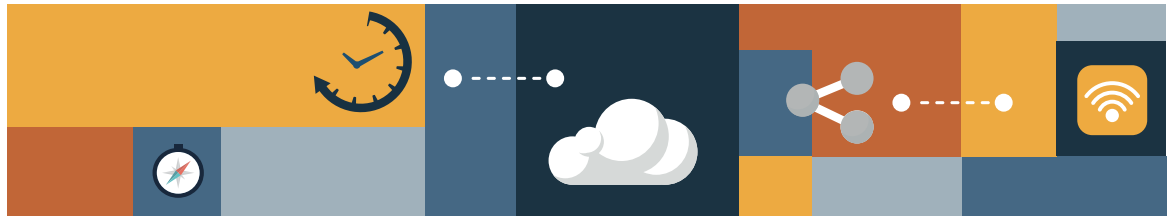
### Common application areas include:

- » Remote authentication
- » Payment authorisation
- » Credit card processing
- » Delivery amount
- » System performance statistics
- » Refuelling alerts
- » System use / Maintenance alerts
- » Remote control of operating schedule
- » Remote trend monitoring
- » Electric vehicle charging

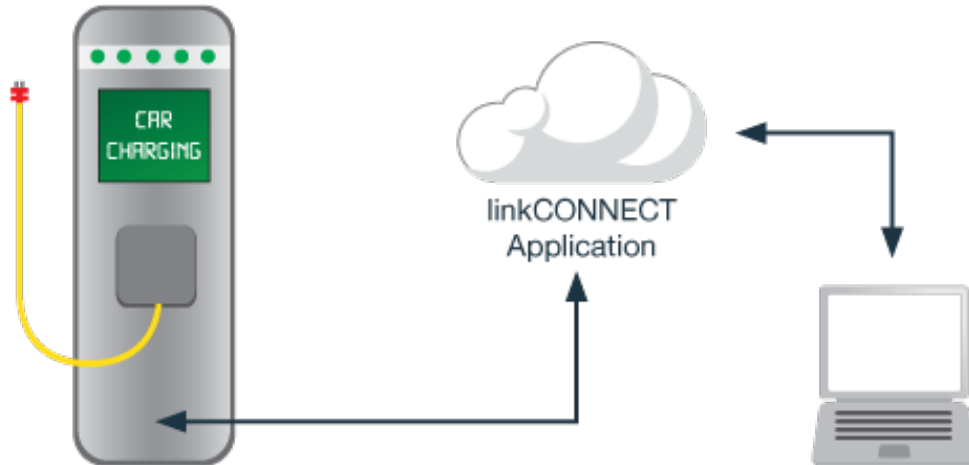
### Recommended Products

#### LC300 GPRS/3G Modems

- Intelligent solution
- RS232 Serial to TCP/IP Connectivity
- Simple SMS configuration
- Reliable network keepalive
- Support client/server mode



## Electric Vehicle Charging Stations



Siretta linkCONNECT solutions are used in pump automation and distribution control system projects where authorisation to distribute electricity is required via credit card payment or validated company credit account.

The linkCONNECT solution provides a point to point link to the distribution point and provides a real time device status which can be used to authorise payments and initiate delivery of the service. The management system checks authorisation and provides access to the service directly and detailed statistics can be obtained from the application to provide performance reports, delivery breakdown and automatically trigger maintenance and service callouts.

The Siretta linkCONNECT solution enables remote access to remote equipment with a robust and reliable connection. Device connectivity can be affected by the environment and operating conditions which the linkCONNECT solution manages and tries to overcome.

### Common application areas include:

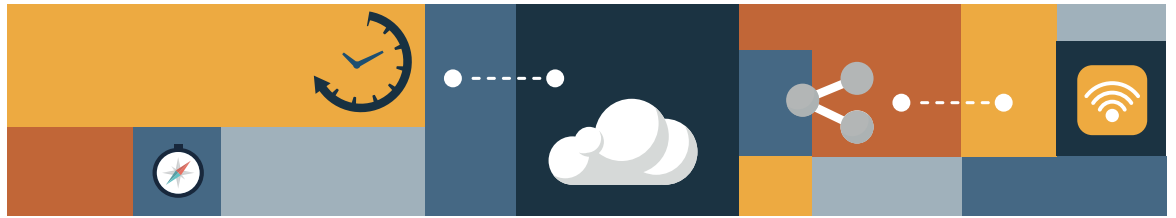
- » Remote authentication
- » Payment authorisation
- » Credit card processing
- » Tariff Changes
- » System performance statistics
- » Low energy alerts
- » System use / Maintenance alerts
- » Remote control of operating schedule
- » Remote trend monitoring

### *Recommended Products*

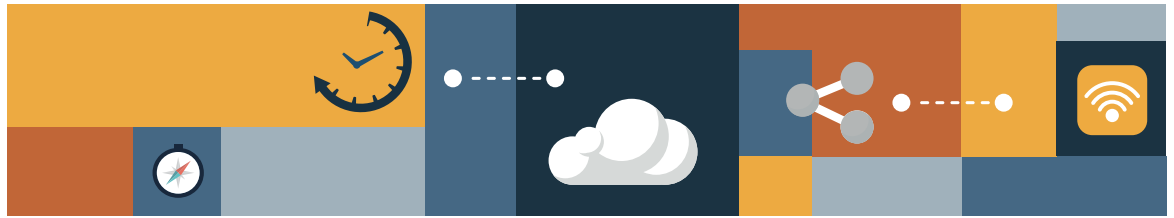
#### LC300 GPRS/3G Modems

- Intelligent solution
- RS232 Serial to TCP/IP Connectivity
- Simple SMS configuration
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- Support client/server mode





# Improving Signal Strength



## 5 Ways to Improve 2G/3G Signal Strength for M2M Devices

# #5 WAYS

to improve 2G/3G signal strength for M2M devices



Systems are only as reliable as their weakest link and when it comes to M2M wireless the weakest link is a lack of, or low signal strength. Low signal levels result in poor system performance, slow response times and reliability issues. For systems installers and other M2M vendors how do you ensure the very best 2G or 3G signal strength?

### Checking the 2G/3G signal strength

Typically most M2M cellular systems will simply not work, or the performance is substantially degraded by low signal strength. This may result in data not being transmitted, irregular polling success or complete lack of connection. Some wireless devices (routers / modems) have a signal strength indication facility but these only report on the connection available to them.

An independent check of signal strength can be performed using a 2G / 3G signal strength tester such as the Siretta SNYPER product. These testers are hand held, network independent, and analyse the signal strength for all available networks. SNYPER can be connected to the deployed antenna to check the actual signal strength of the installed system.

### Which network SIM to use?

Depending on location you may find one cellular network has a better signal strength than the other networks. The SNYPER product checks this for you without the need to buy a SIM from each network. Once the network has been decided the next step is to optimise the antenna and RF cables routing back to the M2M device.

### Re-positioning the antenna

Fitting the antenna in the best possible position has a significant effect on the signal levels received by your M2M equipment. This may mean moving the antenna further away from the M2M device (router, GSM modem) and/ or positioning it higher up by mounting to a wall or pole.

Directional antennas (e.g. Yagi) can also help improve the signal provided you know the direction of the receiving station. For most applications this information will not be easily available and due to reflections from walls, buildings and other surfaces, more often the signal is not received from the expected direction making omnidirectional antennas more appropriate.

### Go “High-Gain”

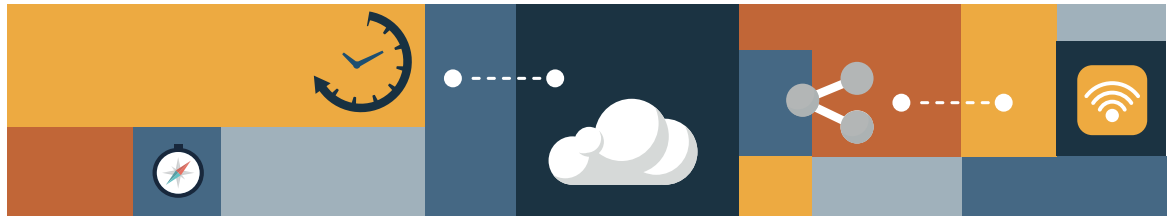
Some antennas are far better than others at specific frequencies so the right antenna should be selected for the application. Antennas with higher gain will perform far better than low cost alternatives.

### Reducing signal losses

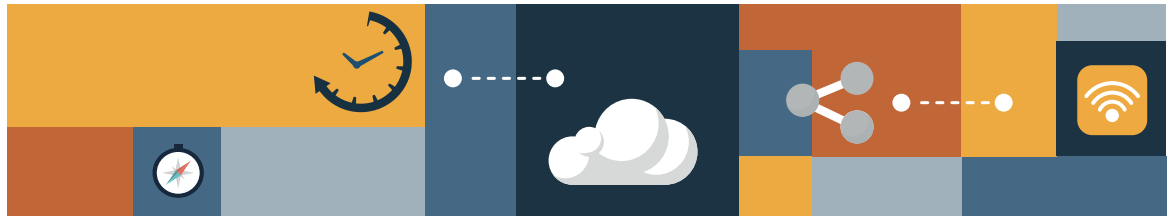
Running a length of RF cable between antenna and router/ GSM modem introduces further degradation of signal strength. Replacing a standard RG58 style RF cable with a low loss equivalent can solve signal strength issues and potentially mean that the antenna does not have to be repositioned. Additionally, low loss cables enable longer RF cable lengths to be used if required.

### Summary

Whilst RF signal strength can appear somewhat of a ‘black art’ there exists a number of tried and tested approaches to help improve signal strength for antennas. For most applications the starting point will be to determine the best cellular network and be able to accurately measure the 2G / 3G signal strength using a signal tester such as the SNYPER 3G.



# Electrical Interfaces



## *Common Electrical Interfaces*

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**Digital Inputs** - used in applications to detect if something is turned on or off

**Digital Outputs** - used in applications to turn something on or off

**Analogue Inputs** - used in applications to detect the level of something

**Analogue Outputs** - used in applications to set the level of something

**General Purpose IO** – used in applications as inputs or outputs

**Serial Ports** – used to send messages between two or more pieces of equipment

**Ethernet Ports** – used in applications to communicate over long distances at high speed

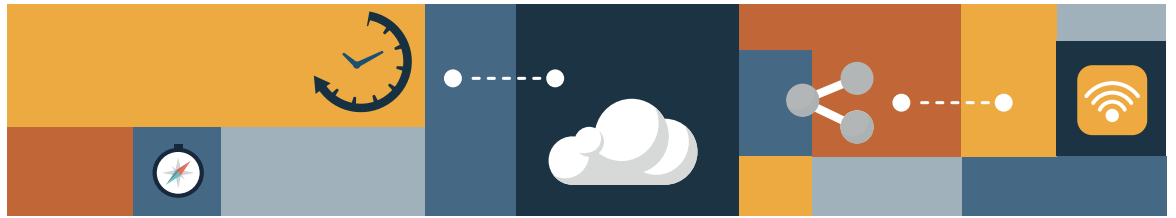
**WiFi** – used in applications to communicate at high speeds over a wireless connection

**CAN Bus** – used to talk to vehicles and production machinery

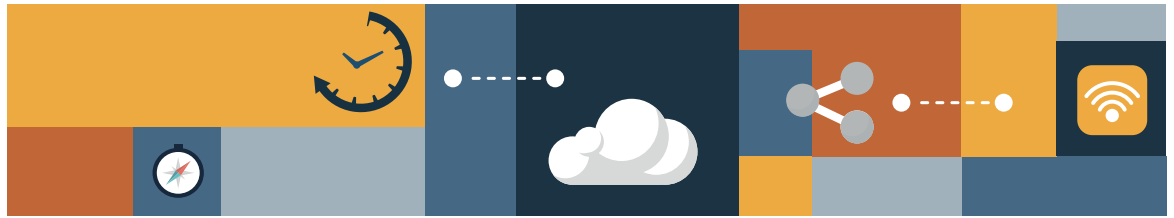
**SPI Bus** – used by a microprocessor to talk locally to another device

**I2C Bus** – used by a microprocessor to talk locally to another device

**1-Wire Bus** – used to communicate with external devices and sensors



# Digital Inputs and Outputs



## Digital Inputs

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**Digital inputs are used in applications to detect if something is turned on or off.**

It can only be in one of two states:

**ON STATE** – Also known as ‘high’ state or logic ‘1’

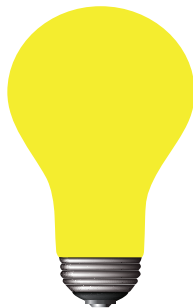
**OFF STATE** – Also known as ‘low’ state or logic ‘0’

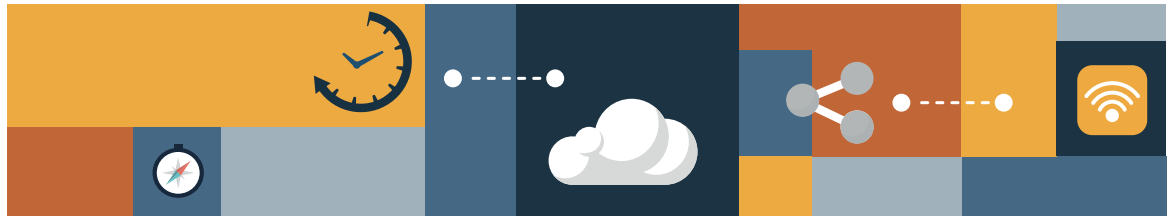
ON STATE and OFF STATE can be read by a Siretta modem and sent to a remote server to inform an application of the state of a system or device.

**For example:**

A light bulb can be on or off.

- If the light is off then it is in the OFF STATE.
- If the light is on then it is in the ON STATE.





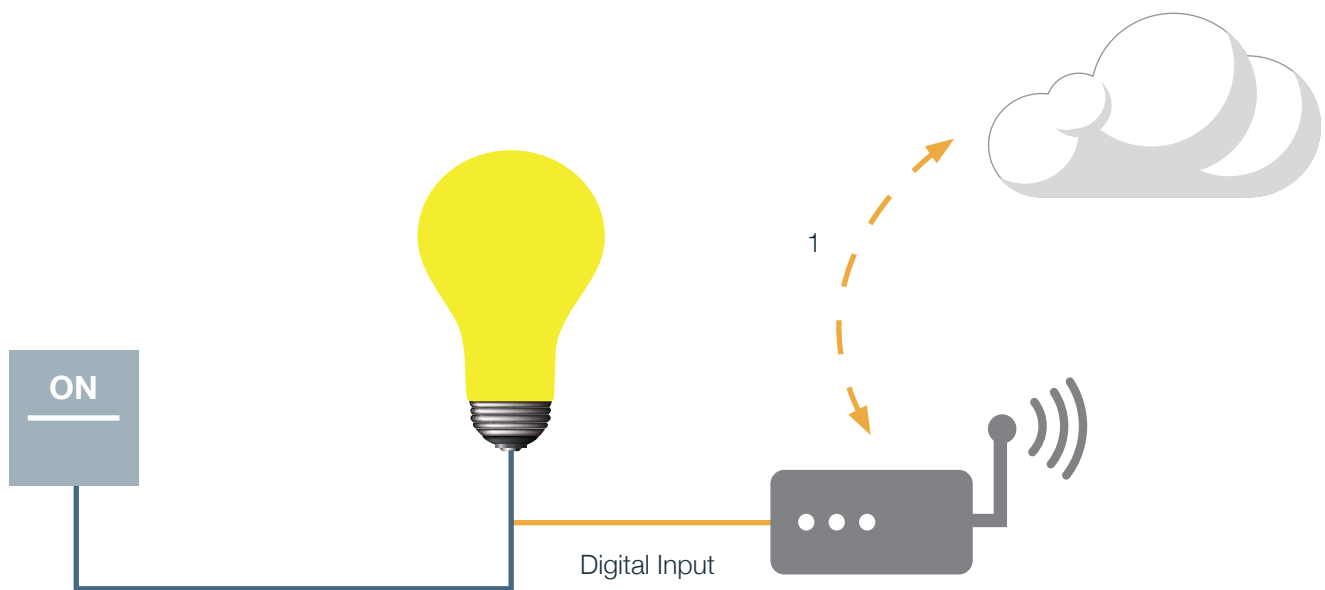
## How Are Digital Inputs Used? (Light Switch Example)

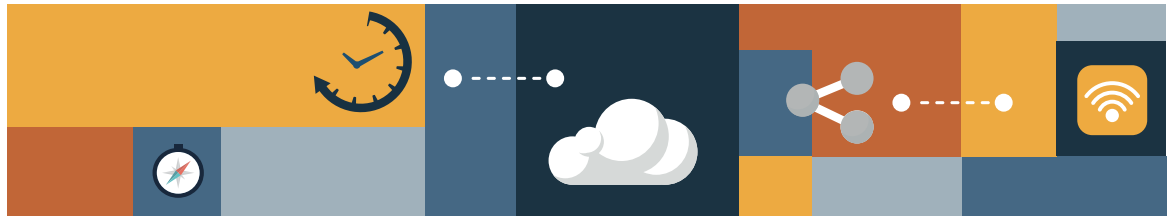
**Digital inputs are used in applications by connecting the input directly to the connected equipment.**

In a Siretta modem this would be done by connecting the input line of the modem directly to the signal you want to monitor.

A light bulb is turned on and off by a user changing the position of a light switch.

- If the light is off then '0' is sent to the server
- If the light is on then '1' is sent to the server





## Digital Outputs

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**Digital outputs are used in applications to turn something on or off.**

It can only be in one of two states:

**ON STATE** – Also known as ‘high’ state or logic ‘1’

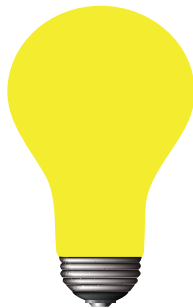
**OFF STATE** – Also known as ‘low’ state or logic ‘0’

ON STATE and OFF STATE can be read by a Siretta modem and sent to a remote server to inform an application of the state of a system or device.

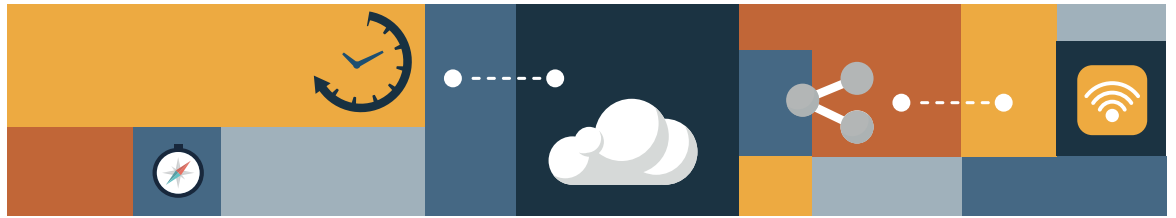
**Example:**

A light bulb can be turned on or off.

- When the light is turned off then it is in the OFF STATE.
- When the light is turned on then it is in the ON STATE.







## How Are Digital Outputs Used? (Light Switch Example)

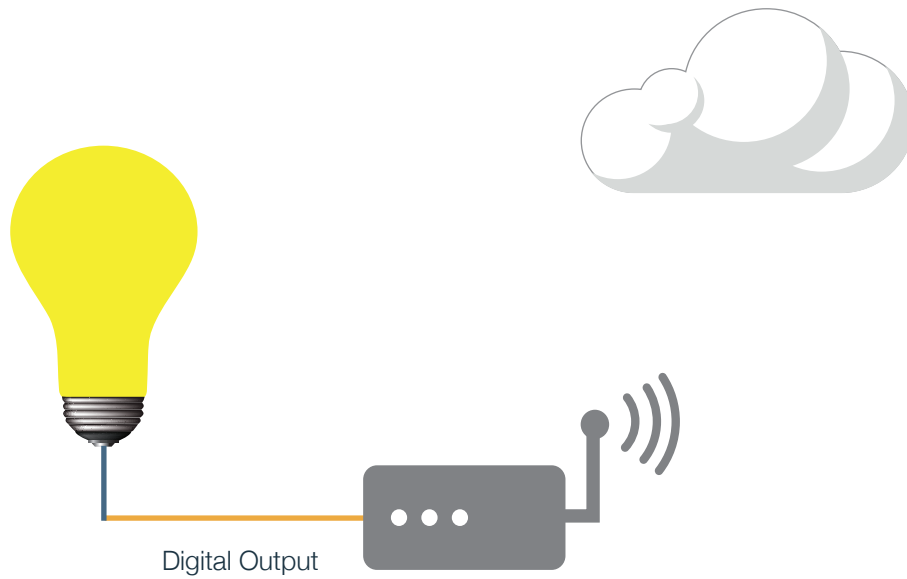
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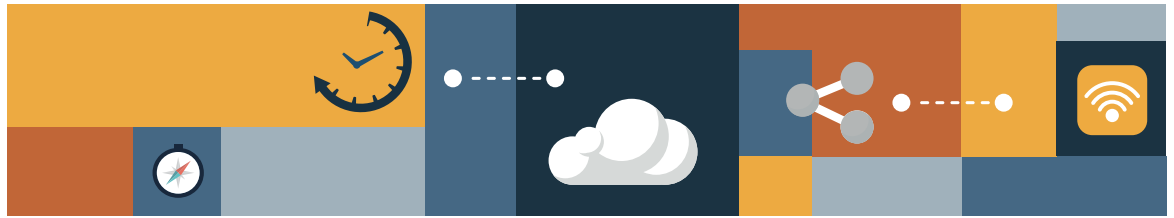
**Digital outputs are used in applications by connecting the output directly to the equipment that you want to control.**

In a Siretta modem this would be done by connecting the output line of the modem directly to the signal you want to turn on or off.

A light bulb is turned on and off directly by the modem

- When a '0' is sent from the server the light is turned off
- When a '1' is sent from the server the light is turned on





## General Purpose Input / Output

---

**GPIO can be configured as an input or as an output. They are used in applications to either monitor an input to detect if it is on or off or it is used to manually turn something on or off.**

It can only be used as an input or as an output not both at the same time

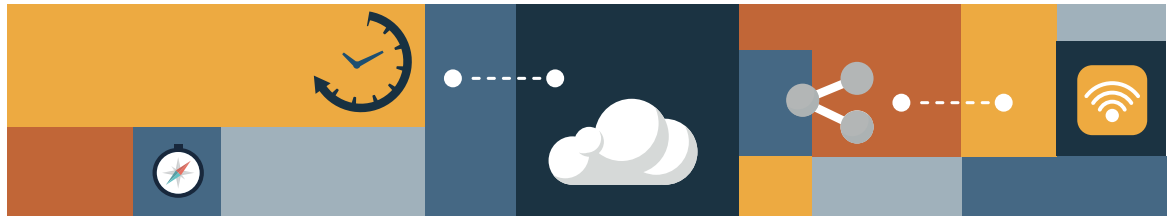
It can only be in one of two states as either an input or as an output:

**ON STATE** – Also known as ‘high’ state or logic ‘1’

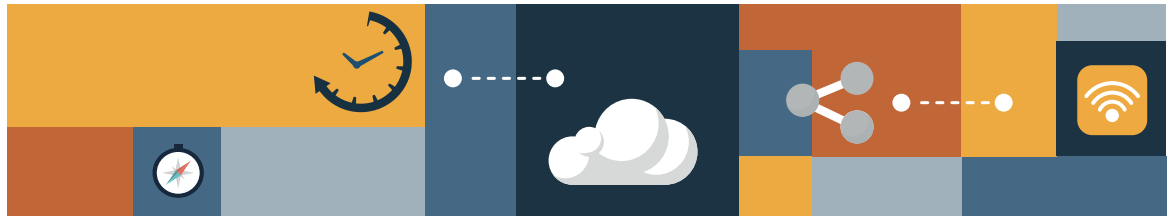
**OFF STATE** – Also known as ‘low’ state or logic ‘0’

When set as an input the ON STATE and OFF STATE can be read by a Siretta modem and sent to a remote server to inform an application of the state of the input.

When set as an output the ON STATE and OFF STATE can be set by a Siretta modem remotely by an application running on a remote server.



# Analogue Inputs and Outputs



## *Analogue Inputs - Analogue to Digital Converter (ADC)*

---

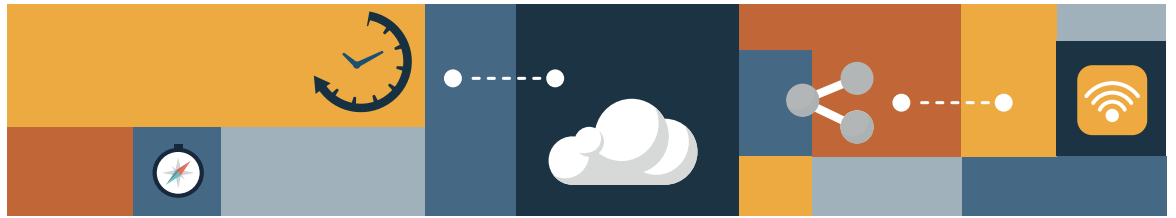
**Analogue inputs are used in applications to read the level of a system.**

It can be any value from 0% to 100%.

The analogue input measures a voltage and converts this voltage into a number. This is called an Analogue to Digital Converter (ADC).

An analogue level can be read by a Siretta modem and sent to a remote server to inform an application of the state of a system or device. This could indicate anything which can have a reading from 0% to 100% such as the amount of liquid in a tank.

ADC's can also measure changes in the input value at very a fast rate so it can detect that a value is rising or falling very quickly.

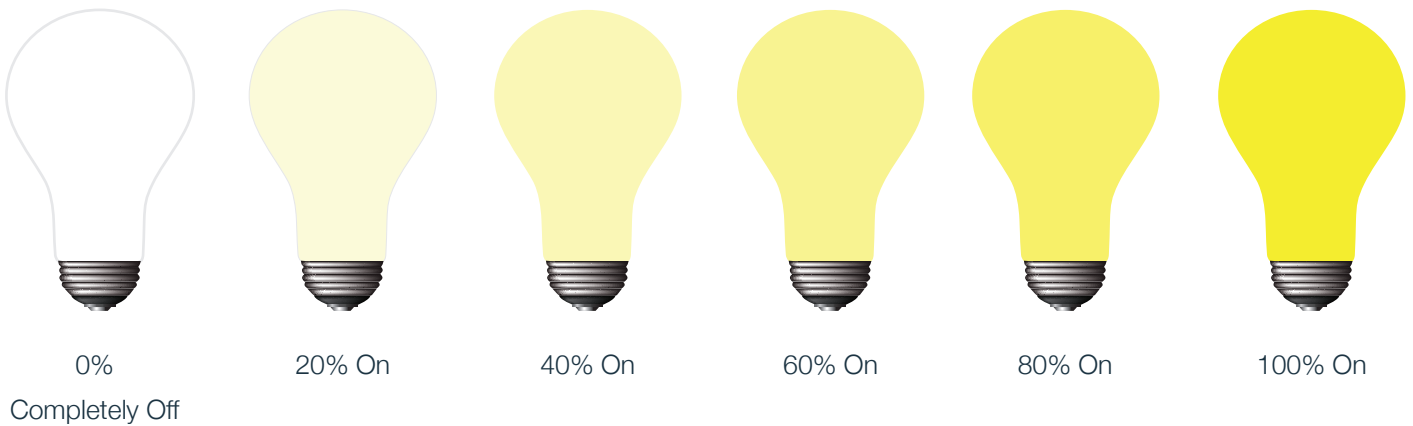


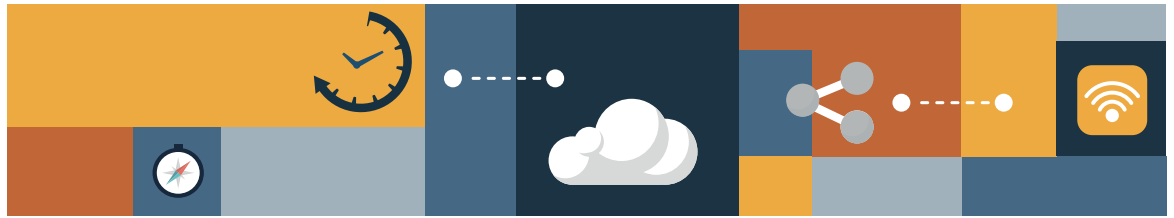
## Analogue to Digital Converter (Dimmer Switch Example)

**Analogue inputs can be used to detect the light level in a room by measuring the output from the dimmer switch.**

Dimmer can have any value at all from 0% to 100%.

Connect modem analogue input directly to the dimmer.





## *Analogue Outputs - Digital to Analogue Converter*

---

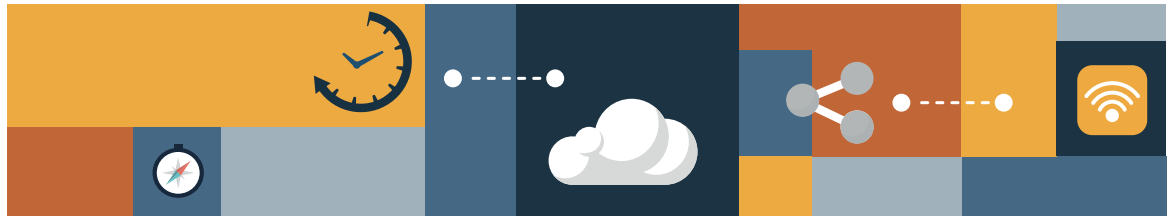
**Analogue Outputs are used in applications to set a specific level of a system / element.**

It can be any value from 0% to 100%.

The analogue output converts a digital number voltage into an analogue voltage. This is called an Digital to Analogue Converter (DAC).

An application running on a remote server can set an analogue voltage level on a Siretta modem to change the state of a system or connected device. This output can be changed based on a response from another input.

DAC's can make changes to the output value at a reasonably fast rate so the DAC can produce a output signal with a frequency response < 100Hz.



## *Analogue to Digital Converter (Fan Speed Example)*

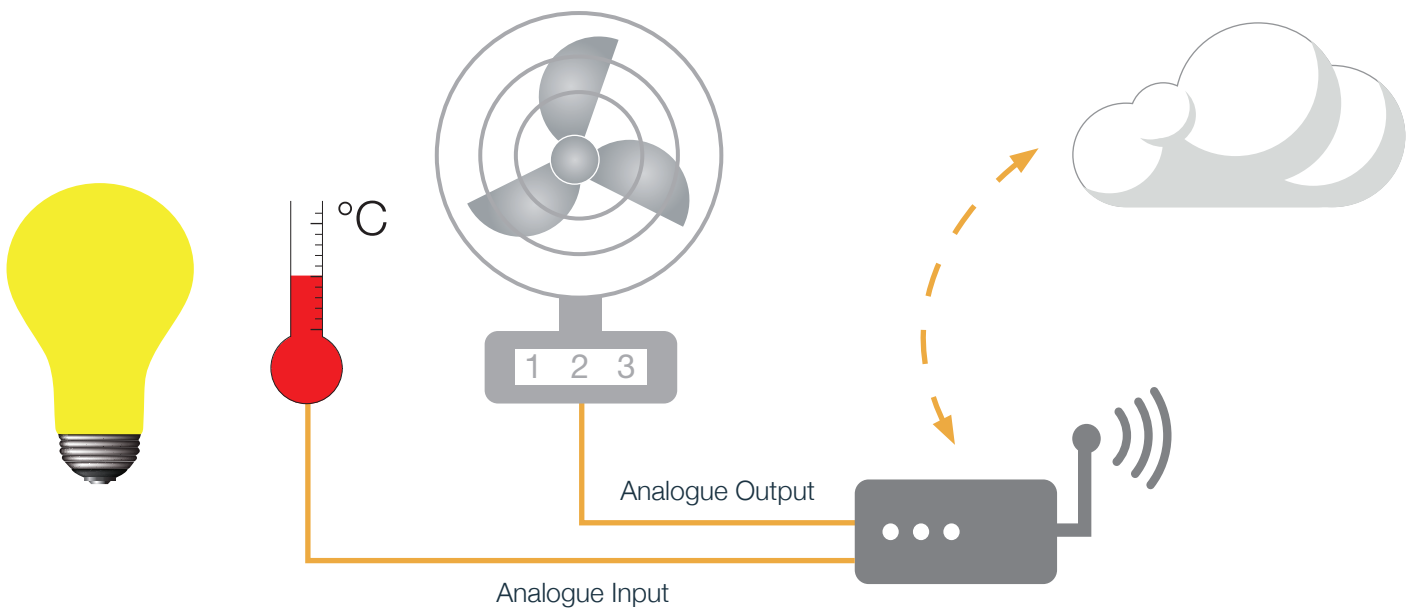
**Analogue outputs can be used to set the speed of a fan to respond to increasing temperature from a heat source to maintain a constant temperature.**

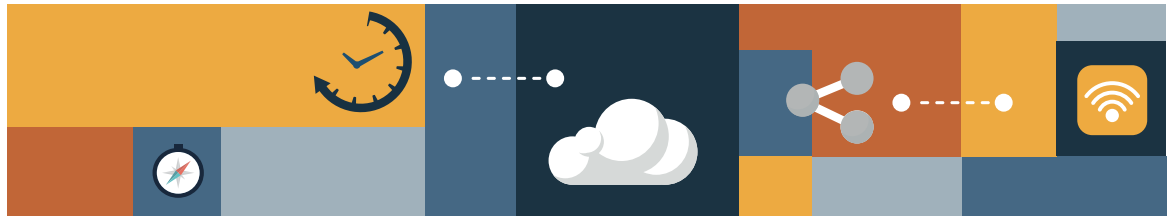
Siretta modem and fan devices will be connected together.

Analogue temperature sensor connected to modem ADC analogue input.

Modem DAC analogue output directly connected to fan controller to regulate temperature.

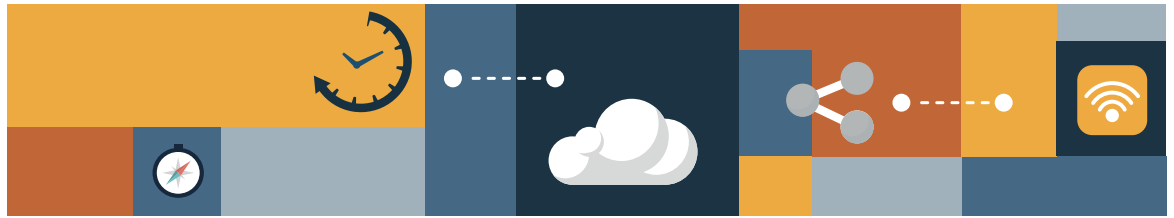
Report status of fan speed and temperature to remote server.





# Serial Ports





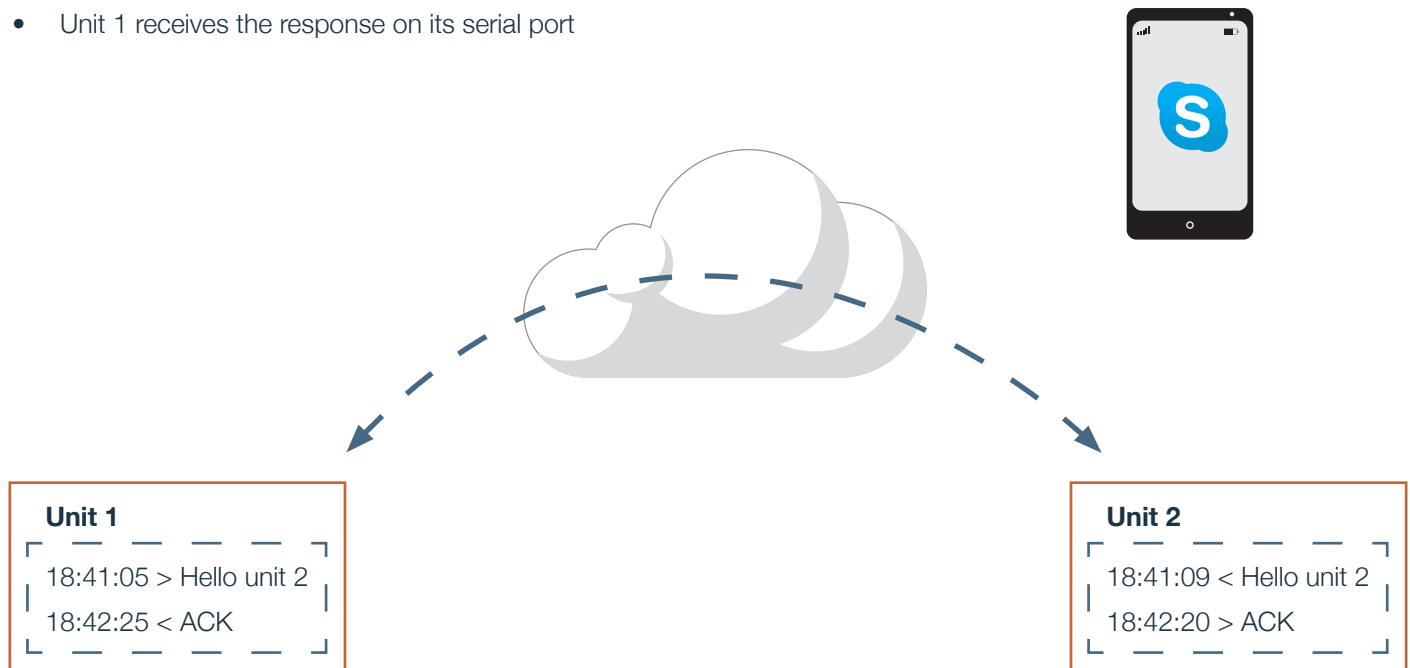
## Serial Ports

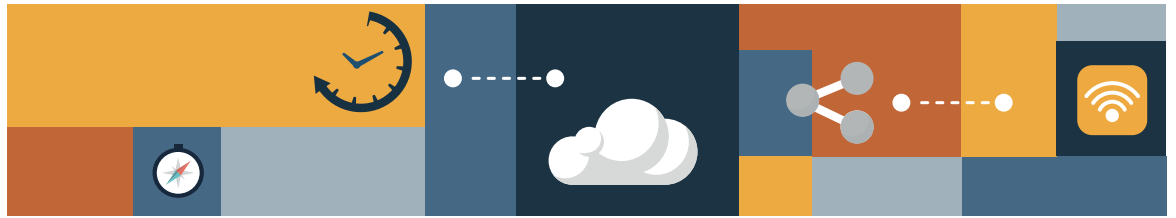
**Serial ports are commonly used in embedded applications to send messages to devices.**

They work in a very similar way to a text messaging system such as Skype or WhatsApp.

**Example: Serial ports on unit 1 and 2 are connected together over the internet.**

- Unit 1 sends a message to unit 2 through its serial port
- Unit 2 receives the message on its serial port
- Unit 2 sends a response back to unit 1 through its serial port
- Unit 1 receives the response on its serial port





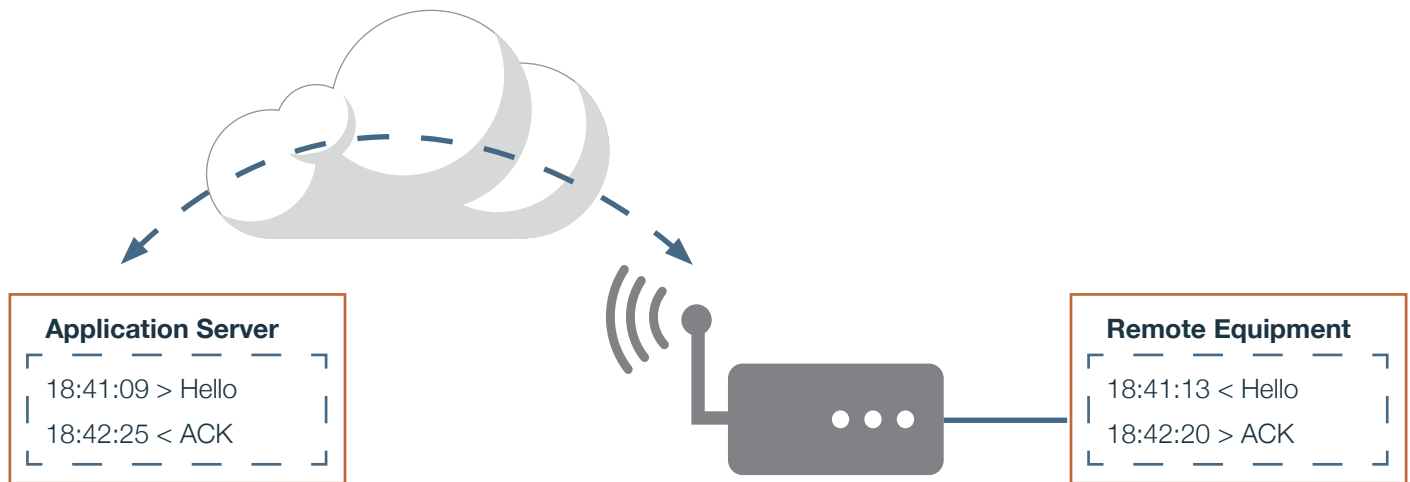
## How are Serial Ports Used in Applications?

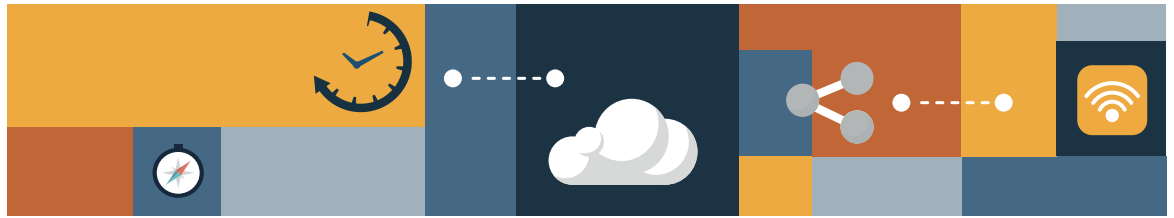
**The remote modem is connected to a remote device / remote system.**

The remote modem locally connects to the serial port on the remote device to push data to the remote equipment and pull real time information from the remote equipment.

**Example: Application server is connected to the remote modem over the internet.**

- Server sends a message to modem
- Modem receives message and sends out over its serial port to the remote equipment
- Remote equipment receives the message on its serial port
- Remote equipment sends a response back to the modem through its serial port
- Modem receives the response on its serial port and sends back to the server





## Different Serial Port Types (RS232)

---

**Serial ports are most commonly used in point to point applications.**

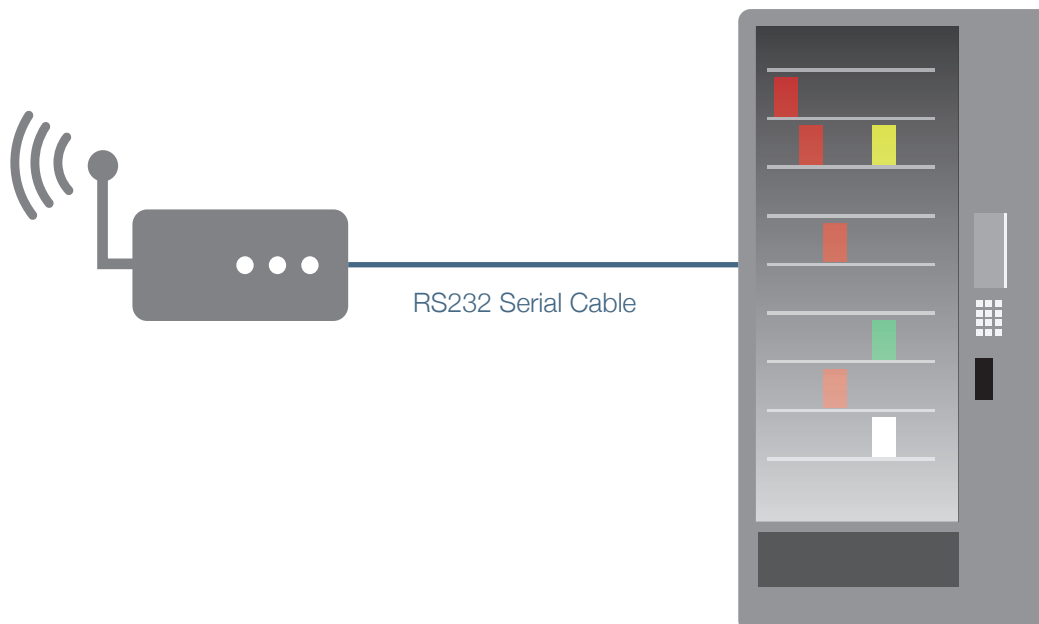
RS232 serial cable links enable two different pieces of equipment to talk to each other.

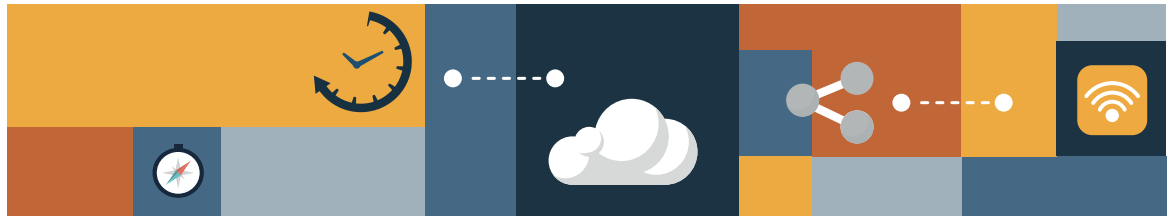
### Example:

- Embedded application is a vending machine
- Internet enabled communication device is a Siretta modem
- RS232 serial cable links the two points together

### Notes:

- RS232 has a limited speed of operation and this is capped at around 4MBit/s but is normally around 115200KBit/s
- RS232 also has a limited distance of operation and this is capped at 300M but it is normally used with around 2-5M for a local connection





## Different Serial Port Types (RS485)

---

### Serial ports can also be used in multi point applications.

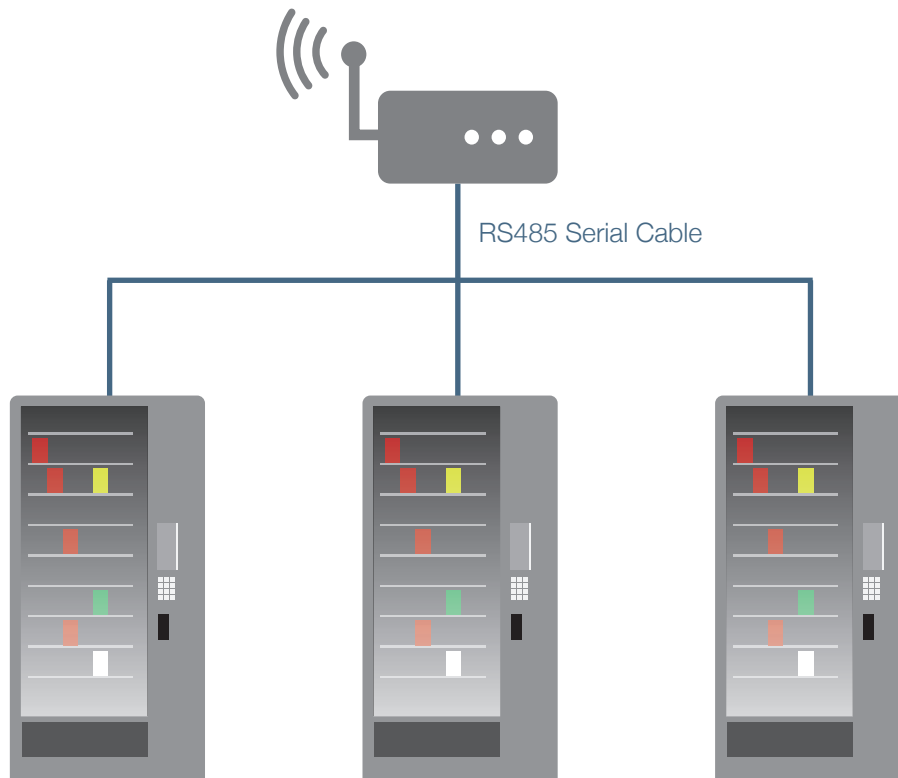
RS485 serial cable links enable many different pieces of equipment to talk to each other using a bus architecture.

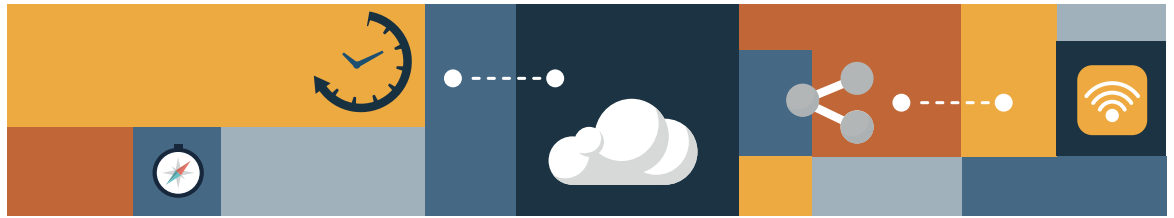
#### Example:

- Embedded application is multiple vending machines in a location
- Internet enabled communication device is a Siretta modem
- RS485 serial cable links the many points together

#### Notes:

- RS485 has a larger speed of operation than RS232 and this is capped at around 35Mbit/s at 10M
- RS485 also has a much larger distance of operation than RS232 and this is capped at 1200M (100Kbit/s)





## *Different Serial Port Types (USB Serial)*

---

**USB serial ports are most commonly used in point to point applications.**

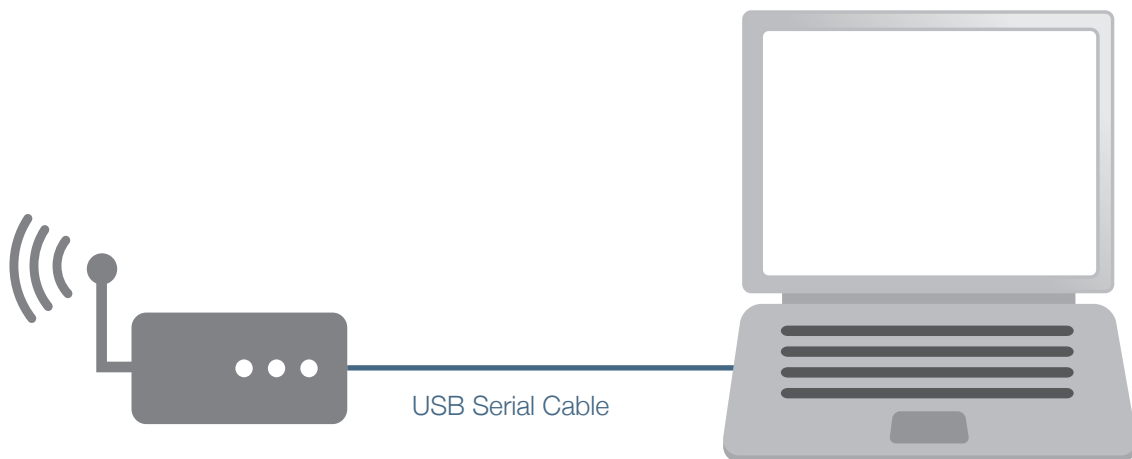
They are often used where faster speeds than RS232 or RS485 are needed.

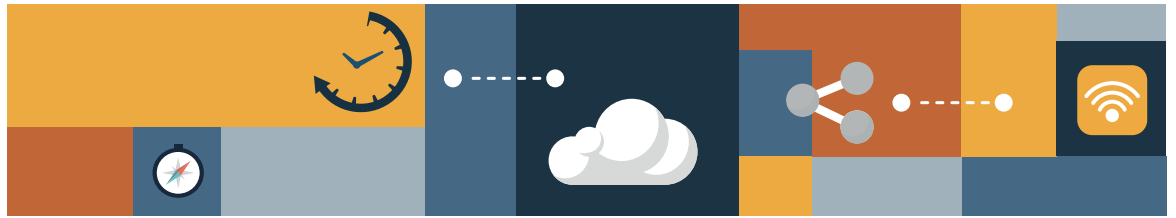
**Example:**

- End application is enabling internet access for a laptop
- Internet enabled communication device is a 4G / LTE Siretta modem
- USB serial cable links the two points together with very fast connection

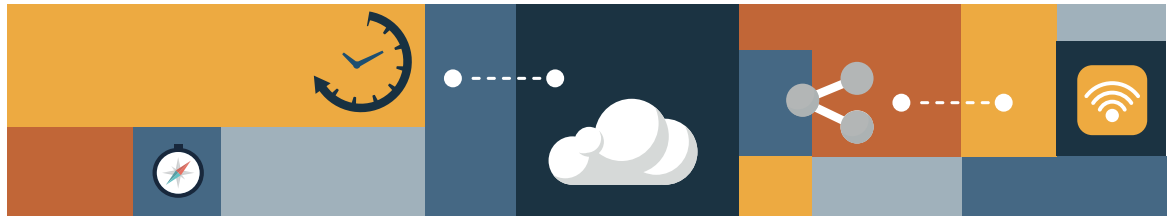
**Notes:**

- USB serial has a larger speed of operation as follows: USB1 – 12Mbit/s, USB2 – 480MBit/s, USB3 – 10GBit/s
- USB serial has a much smaller distance of operation as follows: USB1 – 5M, USB2 – 5M, USB3 – 3M





# Ethernet Ports



## Ethernet Ports

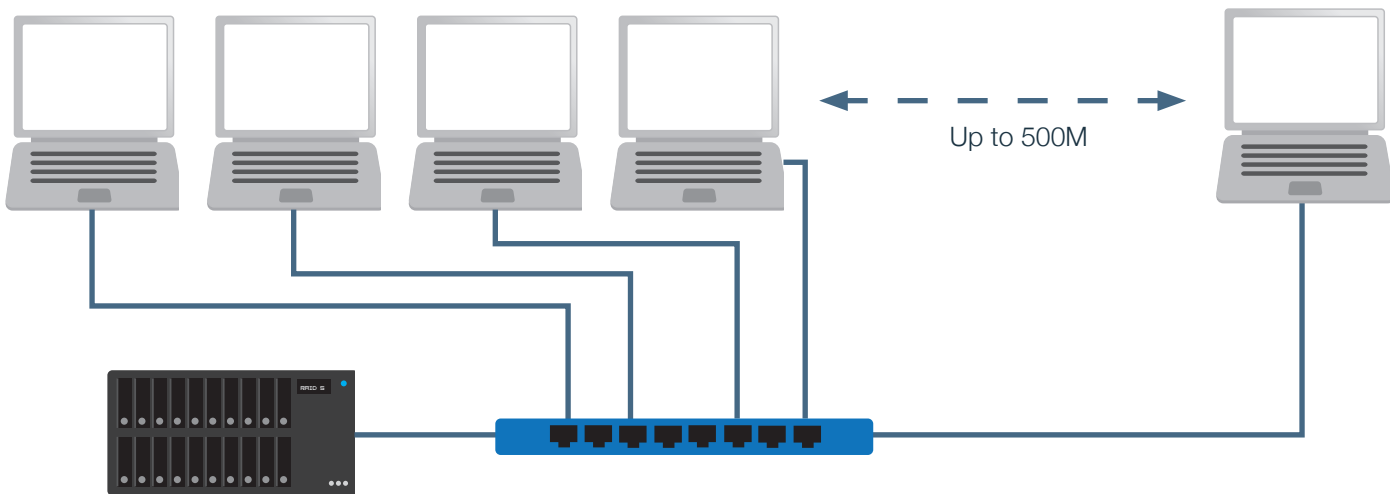
**Ethernet ports are commonly used in applications to connect devices together in a Local Area Network (LAN).**

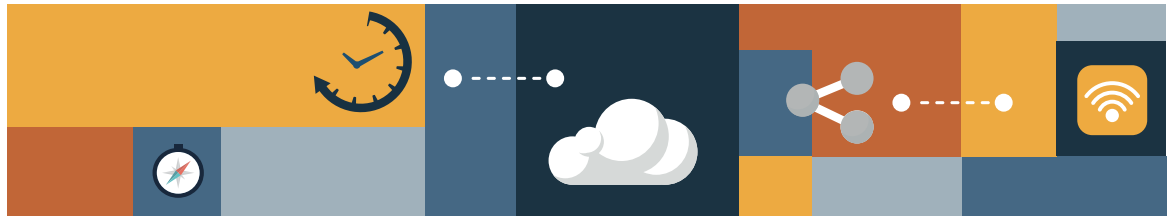
Ethernet networks work in a very different way to serial port protocols but they allow similar functionality but with much faster data rates and very long distances between nodes.

Ethernet also supports connecting multiple devices together but requires switch hardware.

### Notes:

- Ethernet supports: 10Mbit, 100MBit and 1000MBit
- Ethernet supports up to 500 metres per link





## Ethernet Ports Example - routeCONNECT

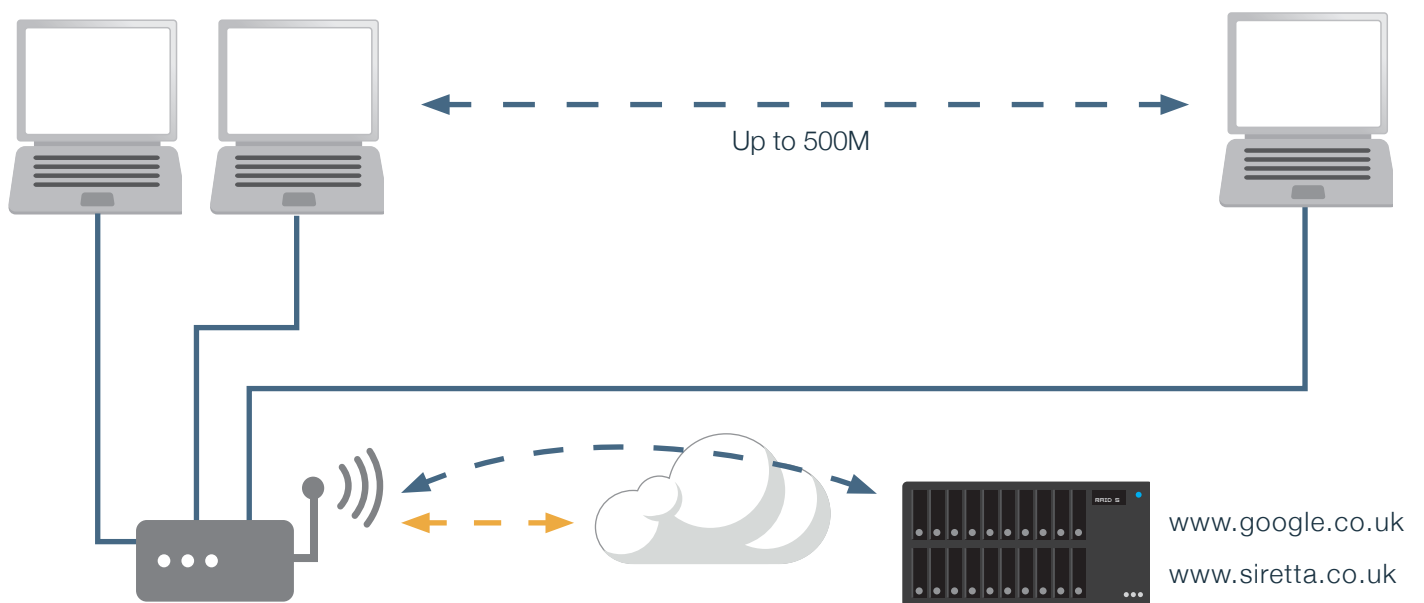
**Siretta routeCONNECT Ethernet router connects LAN to server over mobile connection.**

Local devices in isolation which need to connect to the internet.

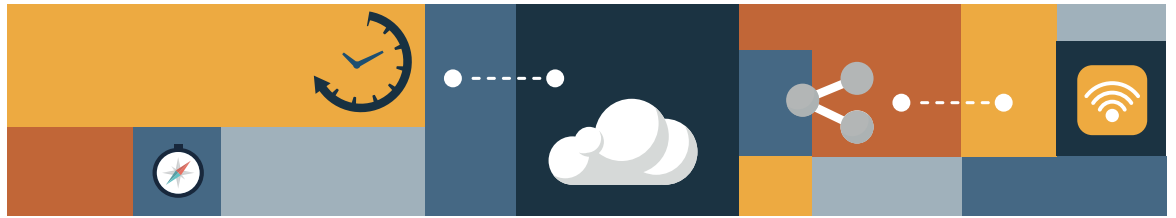
The router connects local devices together through the local Ethernet switch.

The router establishes and maintains a connection to the internet.

The router connects the LAN to the server over the internet connection.







## Wireless LAN (WiFi)

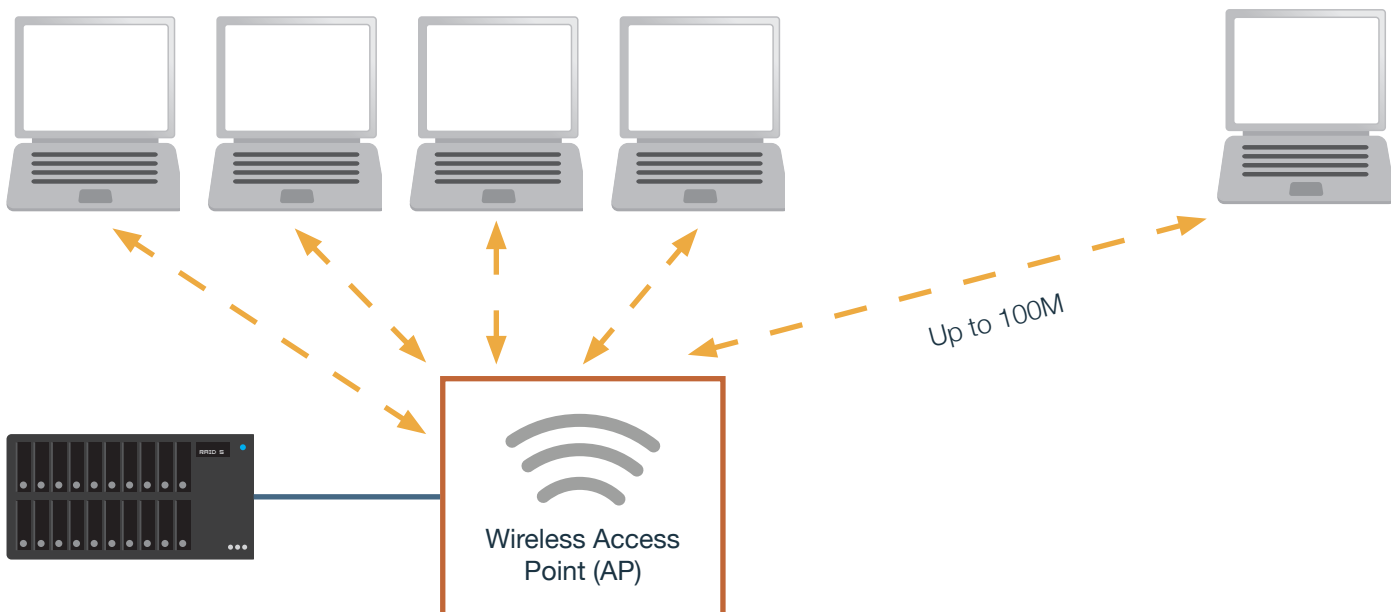
**WiFi is commonly used in applications to connect devices together to form a Local Area Network (LAN) over a wireless connection using an Access Point.**

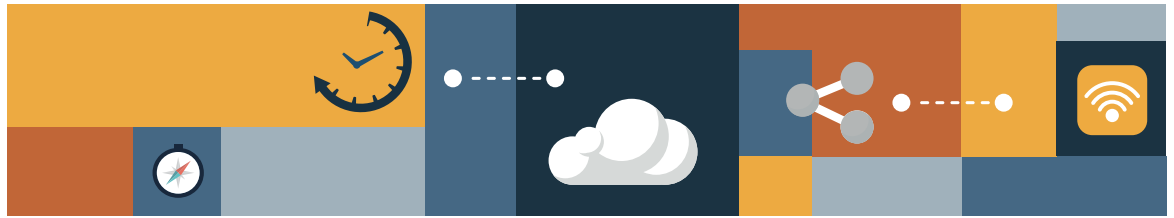
WiFi networks work in a very different way to serial port protocols but allow similar functionality with faster data rates and long distances between nodes over wireless connection.

WiFi also supports connecting multiple devices together but shares the bandwidth.

**Notes:**

- WiFi supports: 10Mbit, 54MBit and 300MBit
- WiFi supports up to 100 metres per link





## Wireless LAN (WiFi) Speed Categories

---

**The wireless LAN specification is defined by the IEEE802.11 specification.**

The 802.11 specification defines a number of classifications as shown below:

**802.11 – 1997:** First introduced in Jun 1997 with a maximum speed of 2 Mbit/s @ 2.4GHz

**802.11a:** Sep 1999 with a maximum speed of 54 Mbit/s @ 5GHz

**802.11b:** Sep 1999 with a maximum speed of 11 Mbit/s @ 2.4GHz

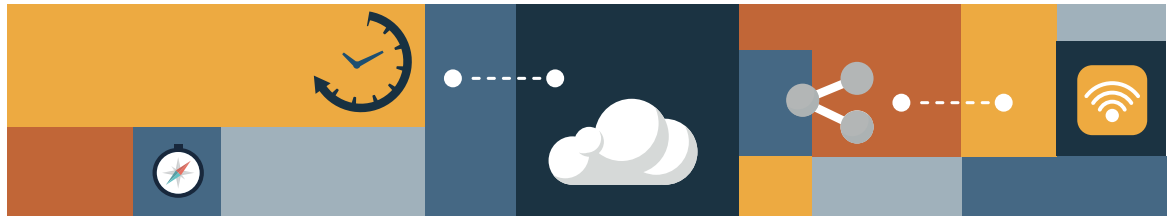
**802.11g:** Jun 2003 with a maximum speed of 54 Mbit/s @ 2.4GHz

**802.11n:** Oct 2009 with a maximum speed of 150 Mbit/s @ 2.4GHz/5GHz

**802.11ac:** Dec 2013 with a maximum speed of 780 Mbit/s @ 5GHz

**802.11ad:** Dec 2012 with a maximum speed of 6.75 Gbit/s @ 60GHz

**802.11ay:** Proposed 2017 with a maximum speed of 100 Gbit/s @ 60GHz



## Wireless LAN (WiFi) Example - routeCONNECT

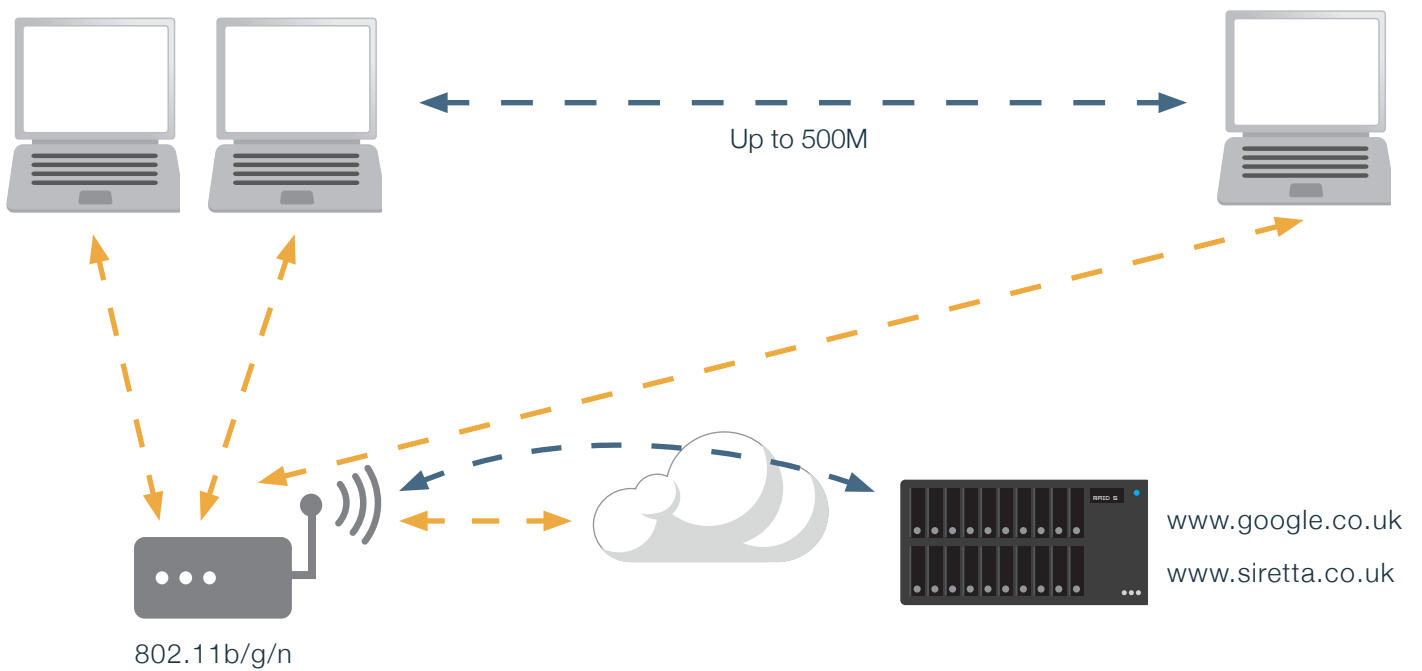
**Siretta routeCONNECT WiFi router connects Wireless LAN to server over mobile connection.**

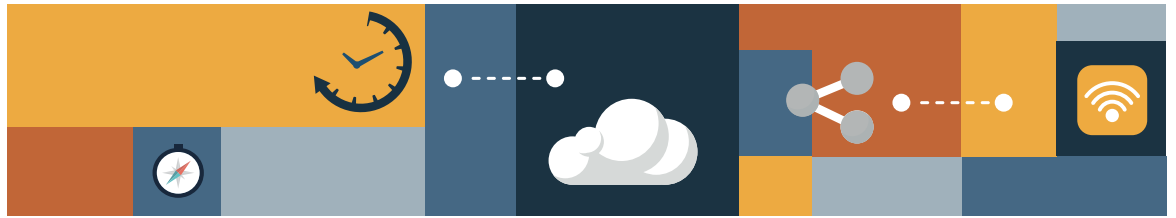
Connect local devices in isolation which need to connect to the internet.

The router connects local devices together through the wireless Access Point.

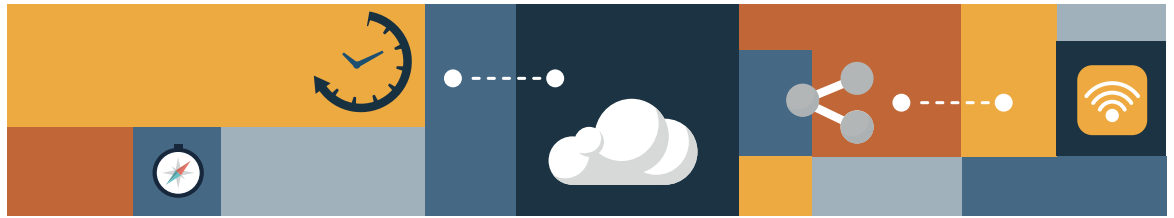
The router establishes and maintains a connection to the internet.

The router connects the Wireless LAN to the server over the internet connection.





# CAN Bus



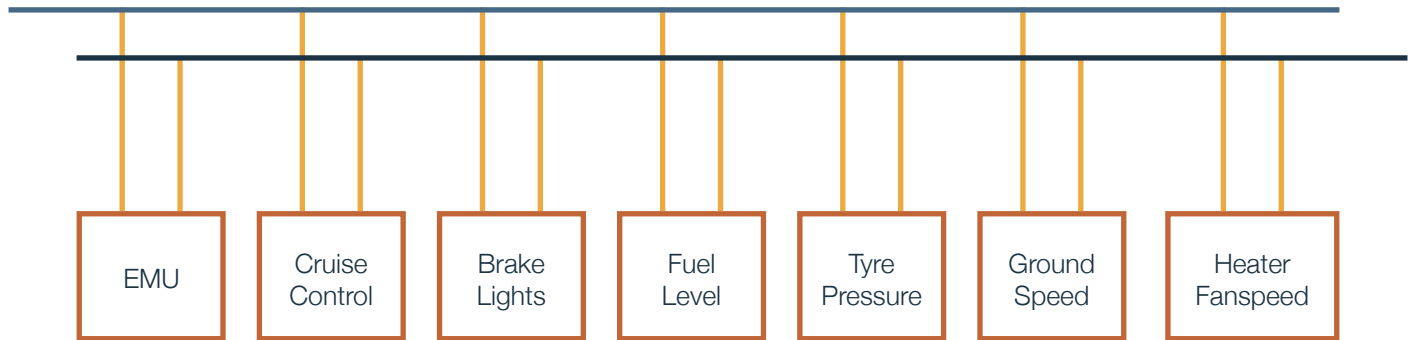
## CAN Bus (Controller Area Network)

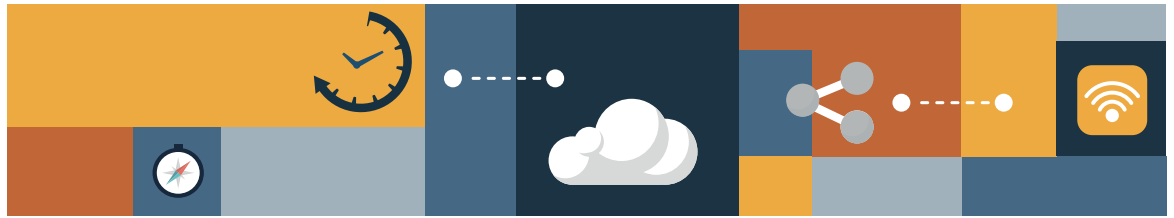
---

**The CAN bus is often used in vehicle applications to connect to the vehicle and read information directly from the vehicles operating system in real time.**

The CAN bus operates at very high speed with low latency to allow messaging systems to communicate on a single bus using a very strict messaging system.

The bus architecture allows for precise control of many of the vehicles safety systems and provides for different systems to control different parts of the vehicle.





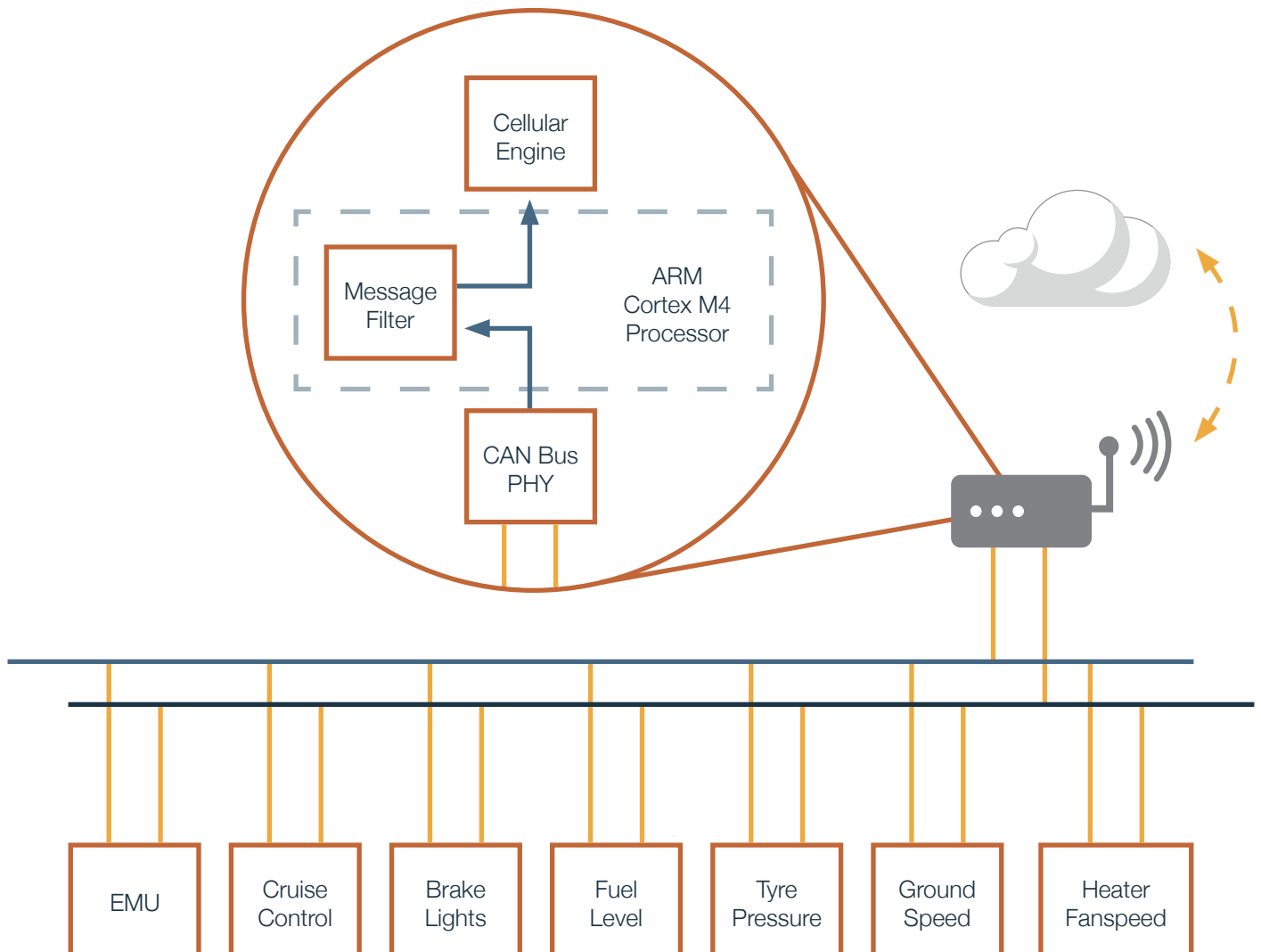
## CAN Bus used in Applications

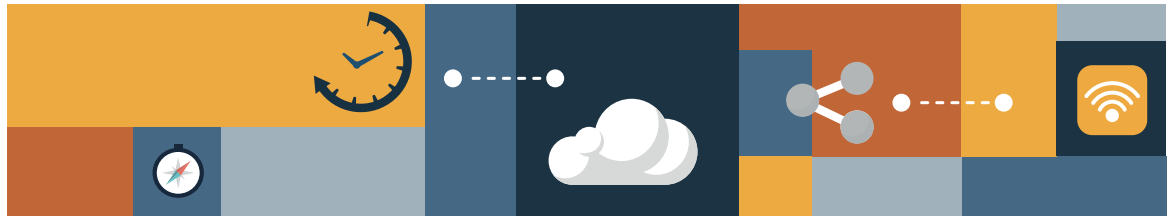
**The CAN bus information must be filtered before it can be forwarded on.**

The Siretta modem can capture the vehicle CAN information by connecting directly to the CAN bus and listening to the CAN messages.

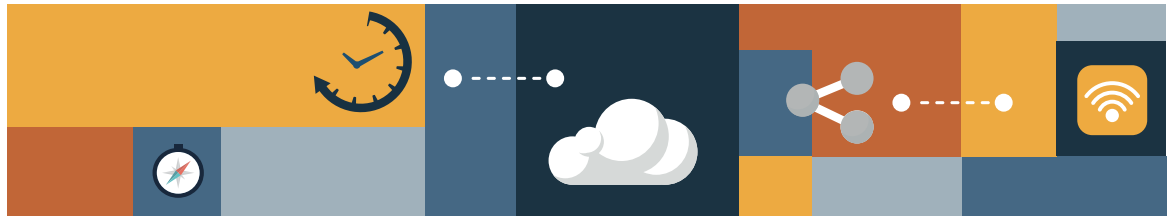
The message filter can identify individual parameters.

The modem sends these messages to a remote server.





# SPI Bus



## SPI Bus (Serial Peripheral Interface)

**The SPI bus is a serial communication bus used by a micro controller to send messages to other local devices.**

The SPI bus uses a common set of pins to communicate.

Single SPI devices can be connected.

Multiple SPI devices can be connected.

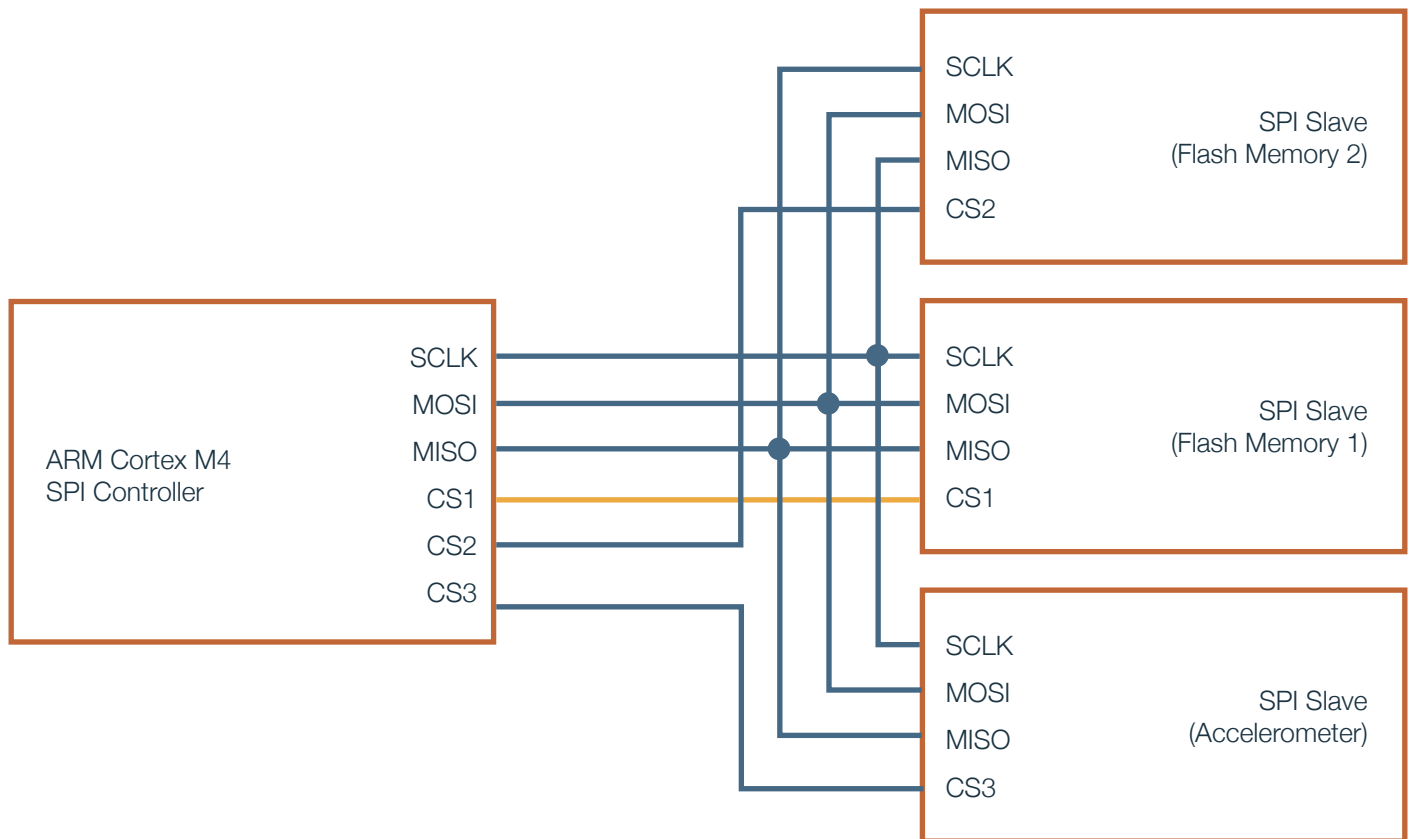
Devices are selected using a chip select.

CS lines are used to select a device.

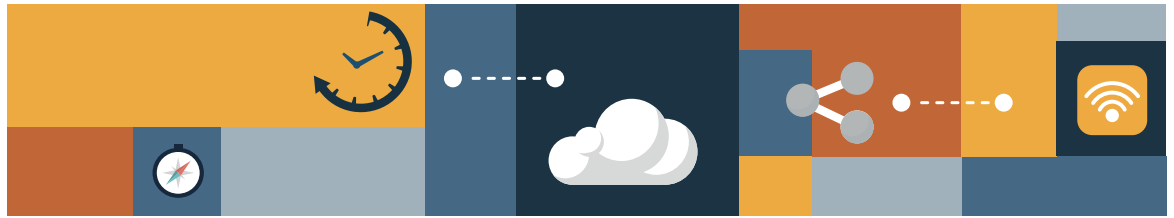
One device can communicate at a time.

Many different peripheral devices can be connected.

Distances between devices is usually small (< 20 cm).







## SPI Bus used in Applications

### An external sensor is connected to a Siretta modem.

The micro processor reads from the external sensor.

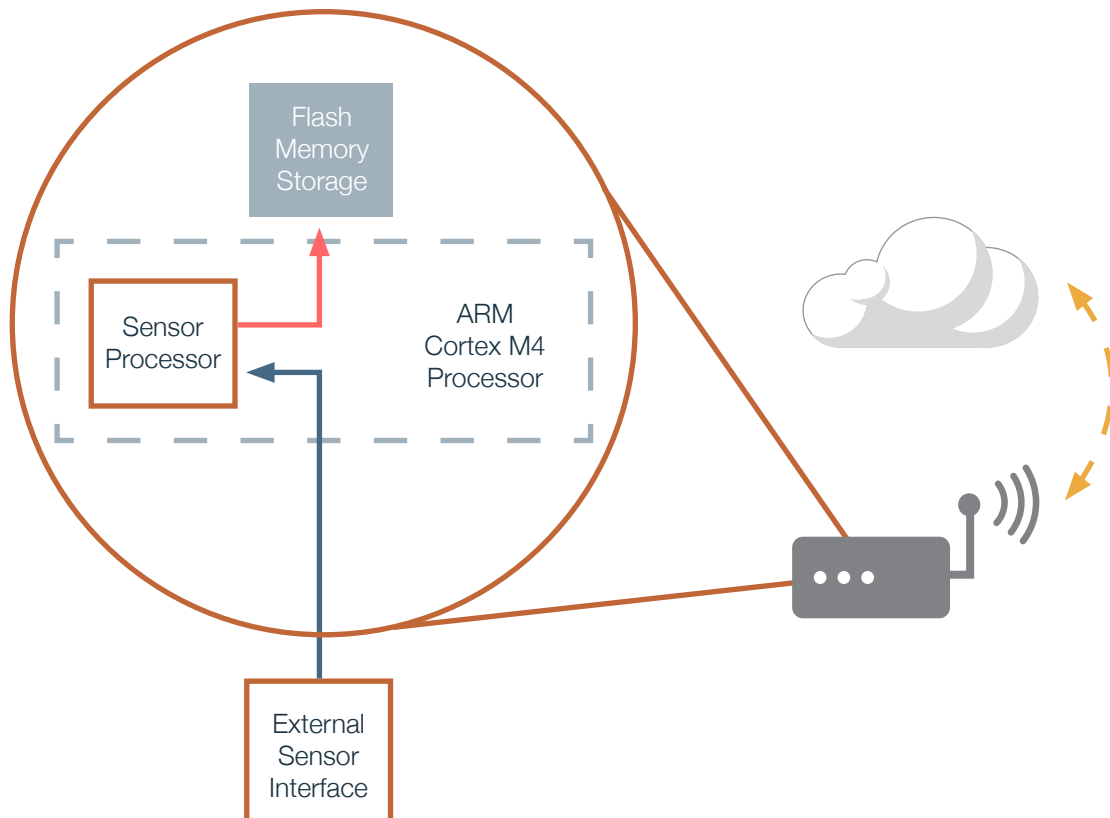
The sensor processor converts the sensor data.

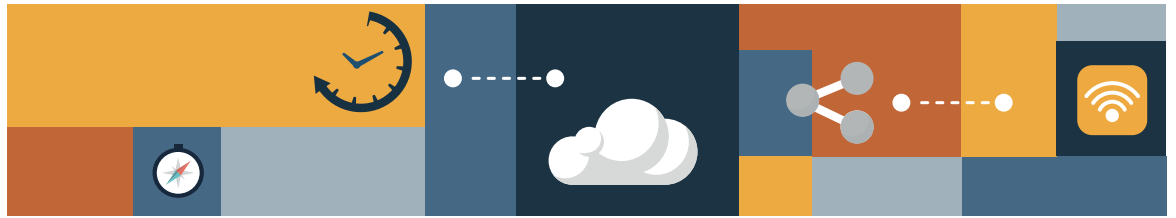
Flash memory is connected to the SPI bus.

The sensor data is stored in internal flash memory.

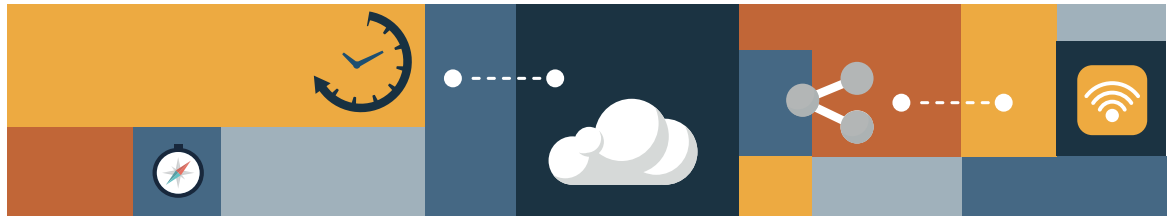
The saved sensor data is sent to a remote server.

Multiple SPI devices can be used at the same time which allows you to store different information in different places.





# I2C Bus



## I2C Bus (Inter-Integrated Circuit)

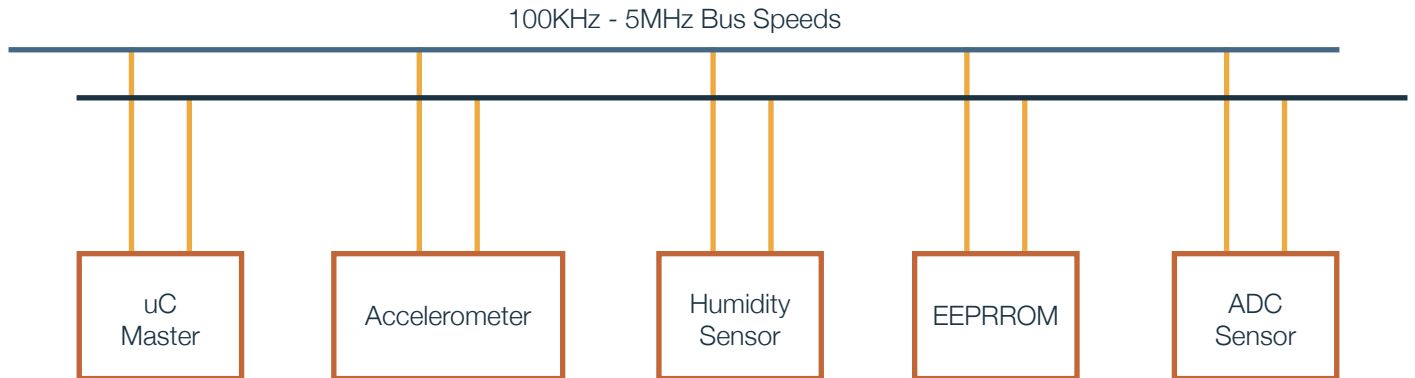
**The I2C bus is used to connect lower speed peripheral devices to the microprocessor.**

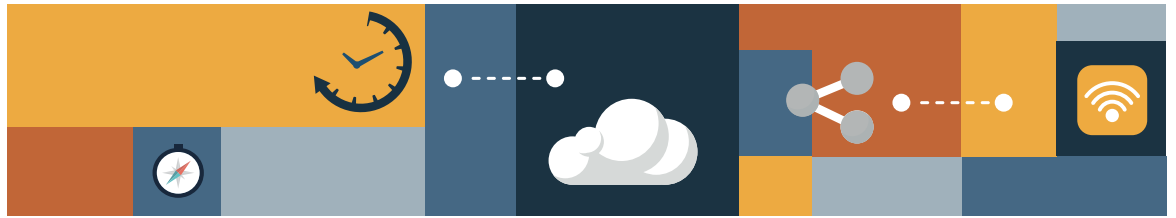
Many different systems use the I2C bus to address devices by using their ID and retrieving information from the device to use in an application.

The basic specification operates at 100KHz moving to advanced versions operating at 5MHz. The address space operates up to 10 bits offering a theoretical limit of 1008 devices

### Notes:

- Normal speed is 100kHz
- Maximum speed is 5MHz
- Theoretical limit is 1008 devices





## *I2C Bus used in Applications*

**The modem has an internal micro which implements the I2C interface.**

The micro processor implements a I2C uC Master.

uC Master implements and controls the I2C bus.

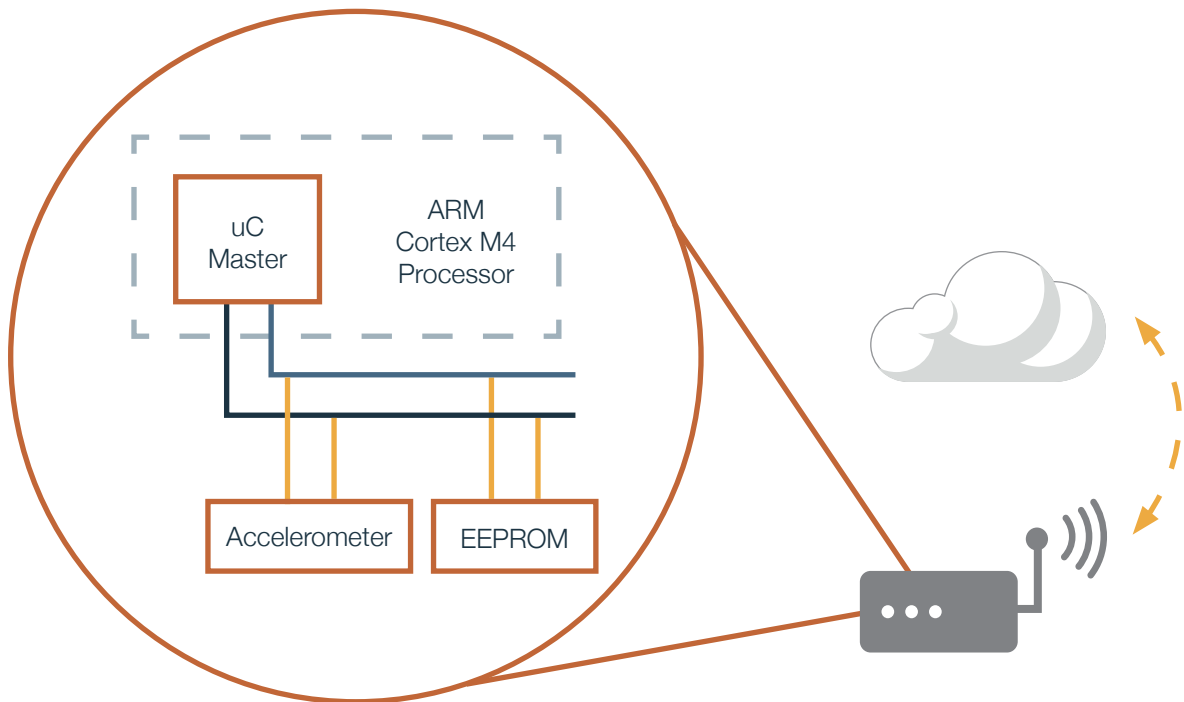
The uC Master sends a broadcast message.

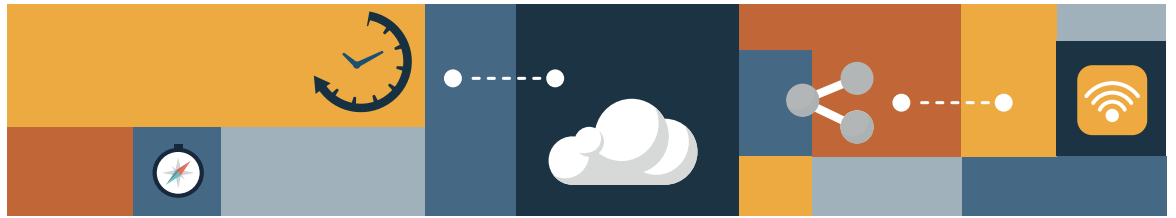
which returns all of the connected devices.

The uC Master reads the device values.

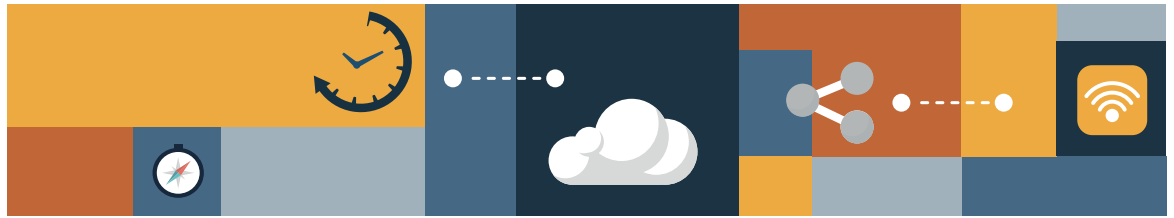
and uses them in the application.

The I2C device values are sent to a remote server.





# 1-Wire Bus



## 1-Wire Bus (Dallas Semiconductor)

**The 1-Wire bus is used to connect peripheral devices to single wire bus.**

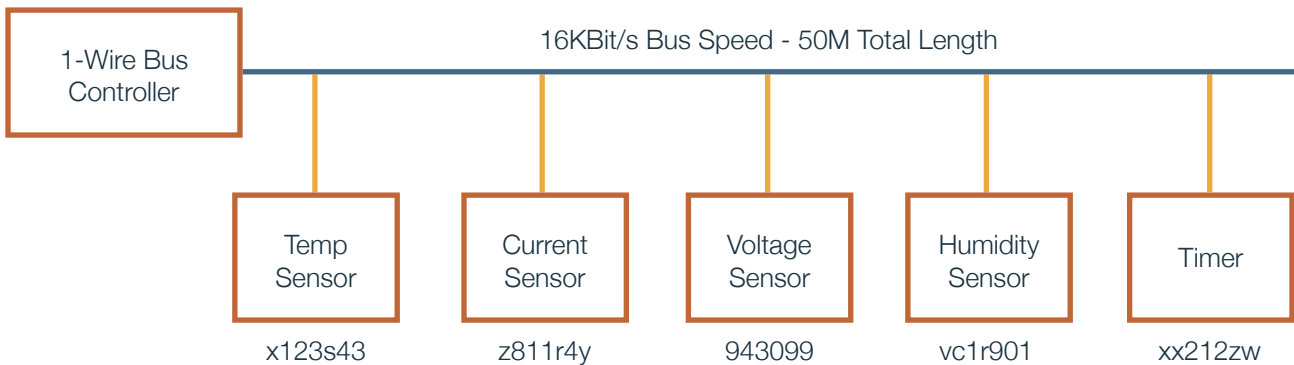
The 1-wire bus can be used for many practical applications such as temperature loggers, timers, voltage and current sensors to name but a few.

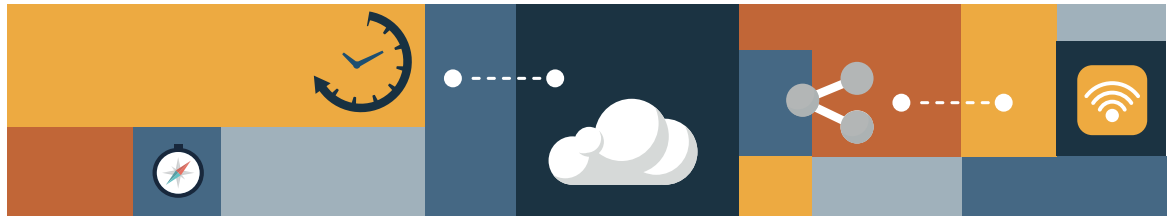
A device controller manages the communication to the bus and deals with timing  
Each device has a unique ID which can be used to identify both the type of device type and the device identity.

The total capacitance of the line must not exceed a set limit which means that the total wire distance must not exceed 50M in total length. Higher quality cable helps extend the total distance achievable.

**Notes:**

- 16 KBits/s Bus Speed
- 50M Total bus length

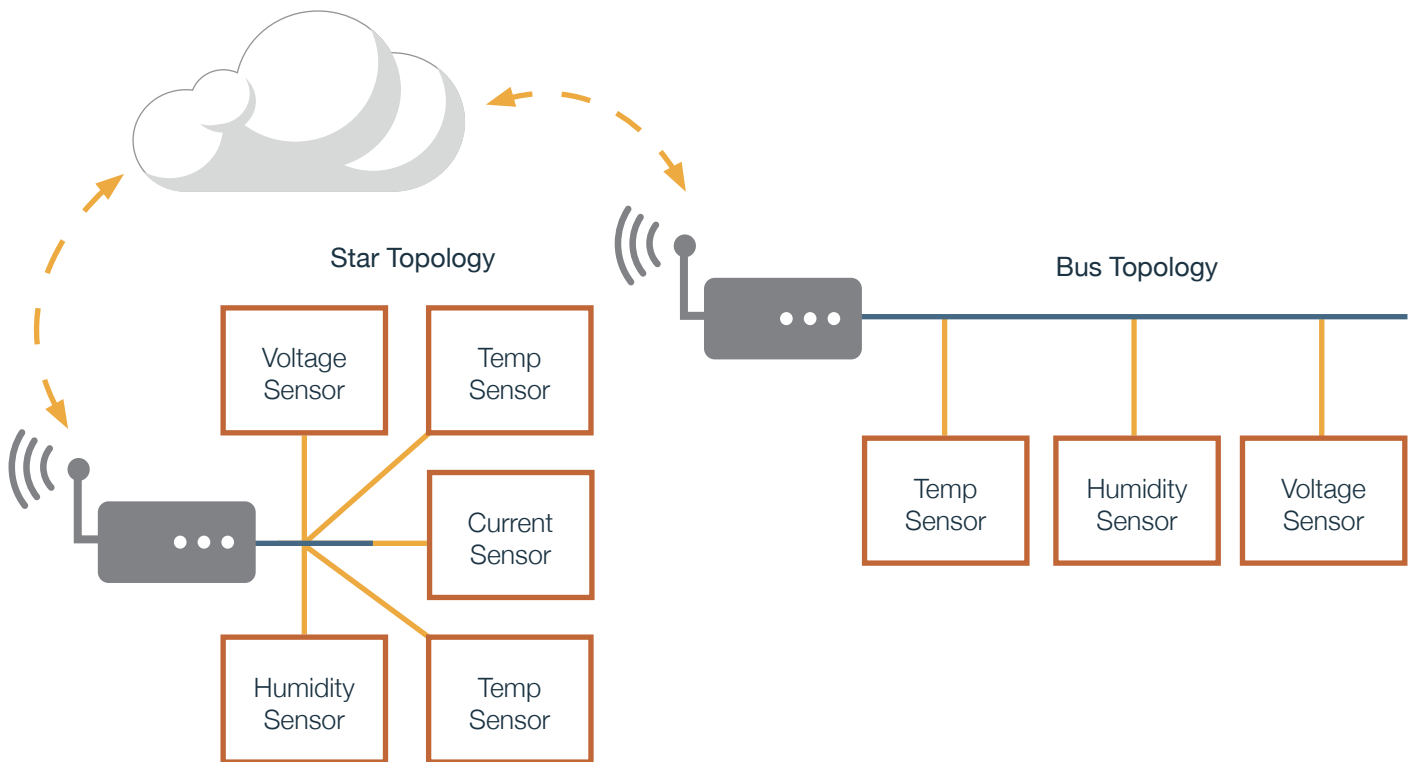




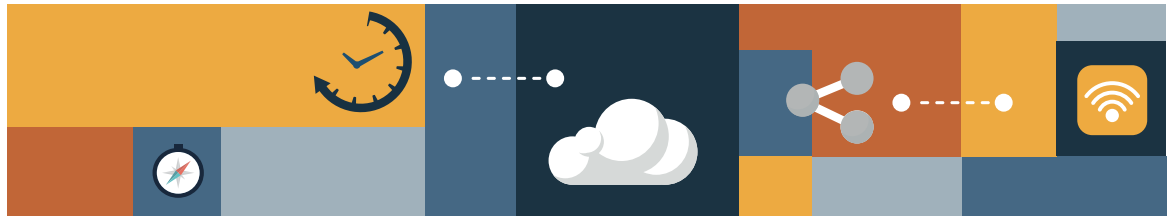
## 1-Wire Bus used in Applications

**The 1-Wire bus connects devices externally to a Siretta modem through a simple single wire bus interface.**

As the bus uses a single wire to communicate to attached devices it is very simple to setup in a number of different configurations and topologies.

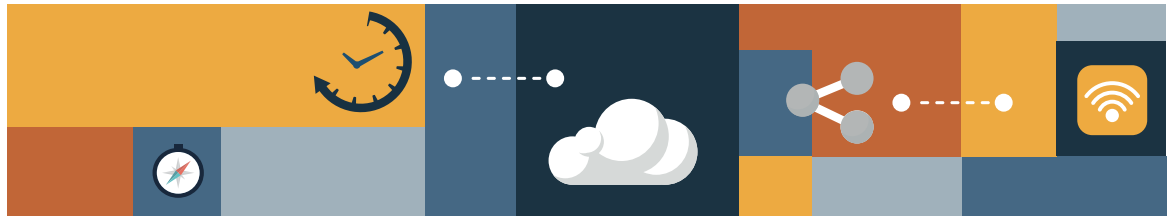


Captured data can then be sent to the cloud or a remote server.



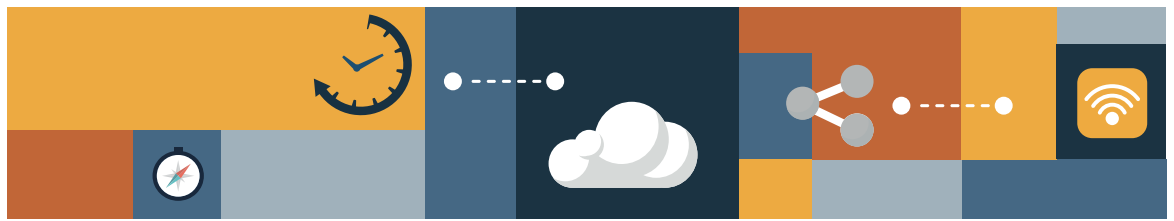
# Interfaces





## Interface Overview

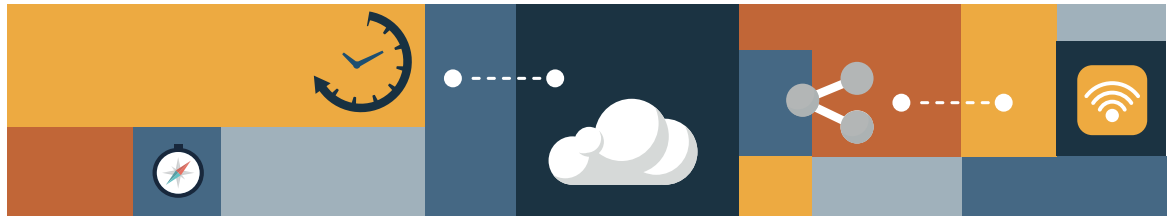
		Normal Speed	Max Speed	Max Distance	Max Connections
<b>I/O Interface</b>	Digital Input	Constant State	1KHz	1Km	1
	Digital Output	Constant State	1KHz	1Km	1
	Analogue Input	Constant State	100Hz	100m	1
	Analogue Output	Constant State	100Hz	100m	1
	Digital I/O	Constant State	1KHz	1Km	1
<b>BUS Interface</b>	CAN Bus	50kb	1Mb	1000m	<1000
	I2C Bus	100kb	5Mb	250m	<1000
	SPI Bus	1Mb	10Mb	2m	<1000
	1-Wire Bus	16kb	500kb	50m	<1000
<b>Comms Interface</b>	RS232	115kb	4Mb	300m	1
	RS485	115kb	35Mb	1200m	<100
	USB	1Mb	10Gb	5m	1
	Ethernet	100Mb	1Gb	500m	1
	WiFi	10Mb	100Mb	100m	<100



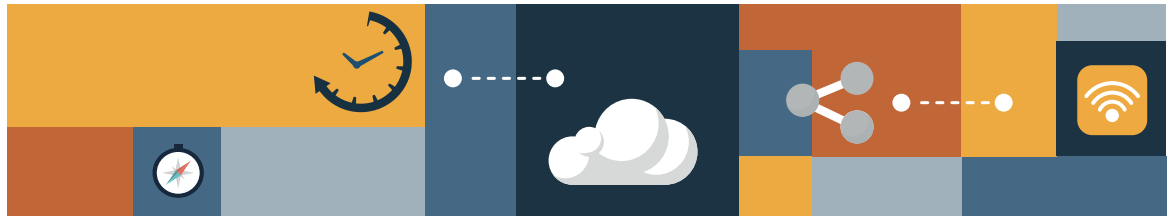
## Siretta Product Supported Interfaces

- Standard
- Optional

		ZEST	ZETA	ZOOM	ZULU	MICA	QUARTZ	ZIRCON
<b>I/O Interface</b>	Digital Input		2		5		1	1
	Digital Output		1		4		2	2
	Analogue Input		1	1	2			
	Analogue Output				2			
	Digital I/O		2	10				
<b>BUS Interface</b>	CAN Bus				●			
	I2C Bus				●			
	SPI Bus				●			
	1-Wire Bus				●			
<b>Comms Interface</b>	RS232	●	●	●	●		○	○
	RS485	○		○			○	
	USB	●	●	●	●			
	Ethernet					2	2	4
	WiFi					○	○	○



# AT Commands



## AT Command Reference

---

**AT Commands are used to interrogate the modem via a terminal interface. Below is a list of commonly used commands. This assumes that the terminal connection is already setup.**

### 1. Basic commands to check the system is working

#### Check Serial Port is Working

> AT<cr>

*Receive following when successful:*

< OK

#### Set Verbose Error Reporting

> AT+CMEE=2<cr>

*Receive following when successful:*

< OK

### 2. Commands for basic operation

#### Check PIN Registration

> AT+CPIN?<cr>

*Receive following when successful:*

< +CPIN: READY

< OK

*Receive following when SIM is not inserted:*

< +CME ERROR: SIM not inserted

*Receive following when SIM requires a PIN code:*

< +CME ERROR: SIM pin

#### Query Firmware Version

> AT+GMR<cr>

*Receive following when successful:*

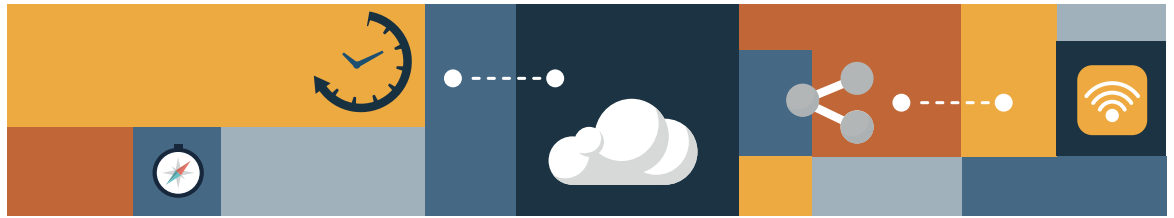
< Firmware version (make a note of this)

#### Query IMEI Number

> AT+CGSN<cr>

*Receive following when successful:*

< IMEI number (make a note of this)



### 3. GSM Network Operation

#### Set Network Registration to 'ALL'

> AT+COPS=0<cr>

*Receive following when successful:*

< OK

#### Check Network Registration

> AT+CREG?

*Receive following when registered to a local network:*

< +CREG: 0,1

*Receive following when registered to a roaming network:*

< +CREG: 0,5

*Receive following when not registered to a network:*

< +CREG: 0,0

*Receive following when not searching for a network:*

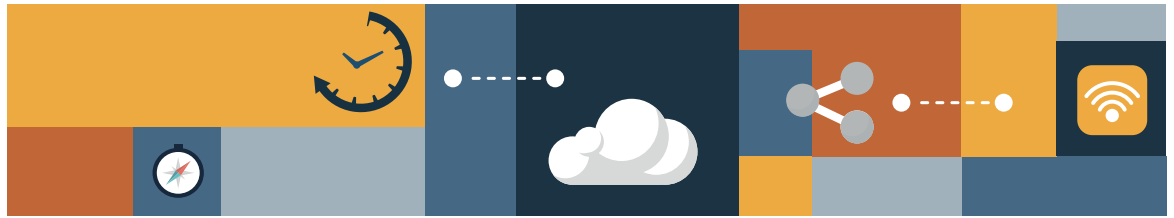
< +CREG: 0,2

*Receive following when registration is denied:*

< +CREG: 0,3

#### **Note - When experiencing problems, check the following:**

1. Antenna is connected and screwed in tightly to unit
2. SIM is valid and has credit / active
3. SIM is setup for 2G / 3G / 4G service
4. SIM is SMS enabled
5. There is signal available for the cellular network in use
6. Ensure more than 15 seconds has elapsed since power up



### Check Network Signal Strength

> AT+CSQ<cr>

*Receive signal value >9 when successful:*

< +CSQ: 23,1

*Receive signal value =99 when there is no signal:*

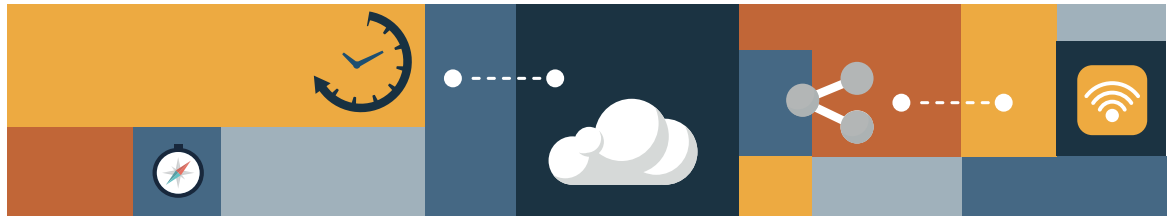
< +CSQ: 99,1

*Receive signal value <9 when there are network connectivity issues:*

< +CSQ: 3,1

### **Note - When experiencing problems, check the following:**

1. Antenna is suitable for network in use and is tightly screwed to unit
2. There is good signal available for the cellular network in the area
3. Move the antenna near a window or preferably outside
4. Move the antenna to an elevated position (> 3M high)
5. Use a high gain antenna
6. Ensure short



#### 4. GPRS Network Operation

##### Check GPRS Context Availability

```
> AT+CGATT?<cr>
```

*Receive following when successful:*

```
< +CGATT: 1
```

```
< OK
```

*Receive following when content is not available or not enabled:*

```
< +CGATT: 0
```

```
< OK
```

##### Set GPRS APN For Your Network

```
> AT+CGDCONT=1,"IP","APN Name"<cr>
```

*Receive following when successful:*

```
< OK
```

#### **Note - To configure APN name correctly, follow these steps:**

1. Navigate to the following link: <http://www.siretta.co.uk/apn.php>
2. Select the country you are in (If your country is not listed please contact Siretta)
3. Select the network from the list (If your network is not listed please contact Siretta)
4. Insert the APN name from the table in to the "APN Name" field in the 'AT+CGDCONT' command

##### Connect to a GPRS Context

```
> AT#SGACT=1,1,"APN Username","APN Password"<cr>
```

*Receive following when successful (Where x.x.x.x is your assigned IP address):*

```
< #SGACT: x.x.x.x
```

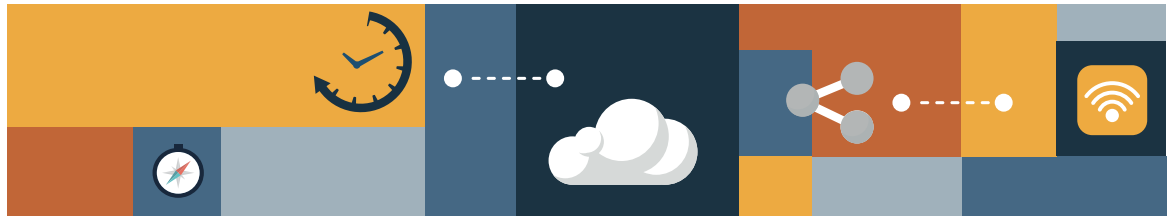
```
< OK
```

*Receive following when the APN Name / APN Username / APN Password is incorrect:*

```
< ERROR
```

#### **Note: To configure APN name correctly, follow these steps:**

1. Navigate to the following link: <http://www.siretta.co.uk/apn.php>
2. Select the country you are in (If your country is not listed please contact Siretta)
3. Select the network from the list (If your network is not listed please contact Siretta)
4. Insert the APN username from the table in to the "APN Username" field in the 'AT#SGACT' command
5. Insert the APN password from the table in to the "APN Password" field in the 'AT#SGACT' command



#### Setup TCP Socket Connection Parameters

```
> AT#SCFG: 1,1,300,90,600,50<cr>
```

*Receive following when successful:*

```
< OK
```

#### **Note: Use the following standard parame**

1. 300 bytes packet size
2. 2) 90 second no activity timeout
3. 3) 600 second connection timeout
4. 4) 50 millisecond packet timeout

#### Connect TCP Socket To Server IP Address

```
> AT#SD=1,0,xxxx,"y.y.y.y"<cr>
```

*Receive following when successful (Serial port connected directly to server socket):*

```
< CONNECT
```

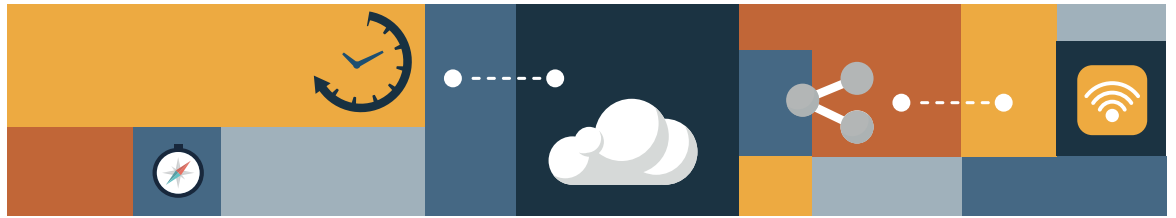
*Receive following when connection is dropped (Serial port no longer connected to server socket):*

```
< NO CARRIER
```

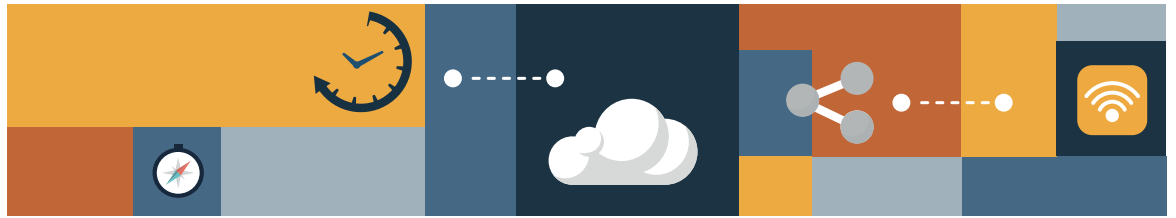
#### **Note - When connecting to a server socket the following should be considered:**

1. The IP address of the server should be fixed and capable of accepting an incoming socket connection.
2. The server port should be configured and capable of accepting an incoming socket connection.





Get In Touch



## Contact Us

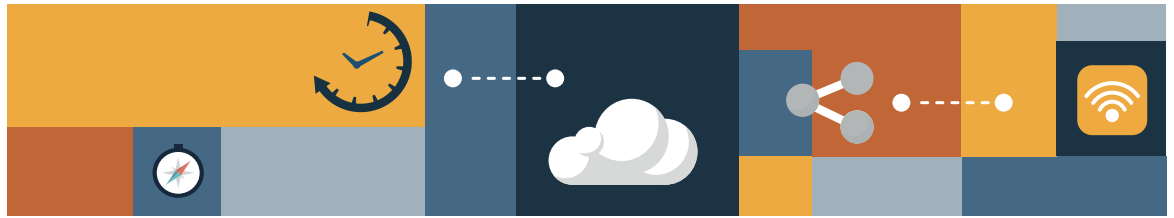
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**www.siretta.co.uk**



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