



INVICTUS 3G/GPRS MODEM

TECHNICAL INFORMATION

CIRRUS ENVIRONMENTAL
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Reference Number 06/14/MM247-Modem/1.3

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Introduction

Introduction

The Invictus Noise Monitor can be fitted with a cellular data packet modem that allows the instrument to communicate with the Noise-Hub² software remotely over a 3G/GPRS protocol and for the measurement data to be downloaded.

Versions of the Modem

The Invictus may be fitted with a different version of the Modem depending upon the region in which it will be used:

- MM:247/1 3G/GPRS Modem
- MM:247/10 3G/GPRS Modem for USA/Canada

The modem is fitted internally to the instrument and access for the SIM card is behind the access flap (see pages 12 & 15).

The modem must be fitted with a suitable SIM card that provides the data connection to the cellular network.

IMEI Number

The IMEI number of the Modem fitted to the Invictus is shown on a label located under the access flap.

This information may also be shown on the instrument serial number label on the front panel.

SIM Card Requirements

The Invictus has been designed to operate with a SIM card that provides a **Public IP Address** and outgoing internet access.

A standard SIM card from a cell phone **will not work** and cannot be used with the Invictus.

What type of connection is required?

There are two ways to connect to the Invictus. These are:

1. A connection with a **Public IP Address** & and outgoing internet connection.

This is the preferred method. Please note that a Public IP Address and a Static IP Address are not the same and the connection does not require a static IP address.

2. A VPN connection with an outgoing internet connection

What to ask for when sourcing a SIM card

The network providers in your region may be able to supply a suitable M2M (Machine to Machine) connection.

If your network provider does not provide M2M connections then you will need to locate a specialist M2M service provider.

Examples of such providers are shown in Appendix 2.

Public IP Address

When you have located a suitable M2M supplier, ask for a SIM card and connection with:

- a. **Public IP Address**
 - i. Where available, a preset APN is preferred but this is not essential
- b. Outgoing internet connection

What information to ask for

The provider of the SIM card should provide you with the following information:

1. The Public IP Address of the connection
2. Details of the APN where this is needed:
 - a. The APN Name
 - b. The APN Username
 - c. The APN Password

The APN information will be needed when you are configuring the Invictus (see page 23).

If a Public IP address is not available, the supplier may be able offer an alternative solution using port forwarding.

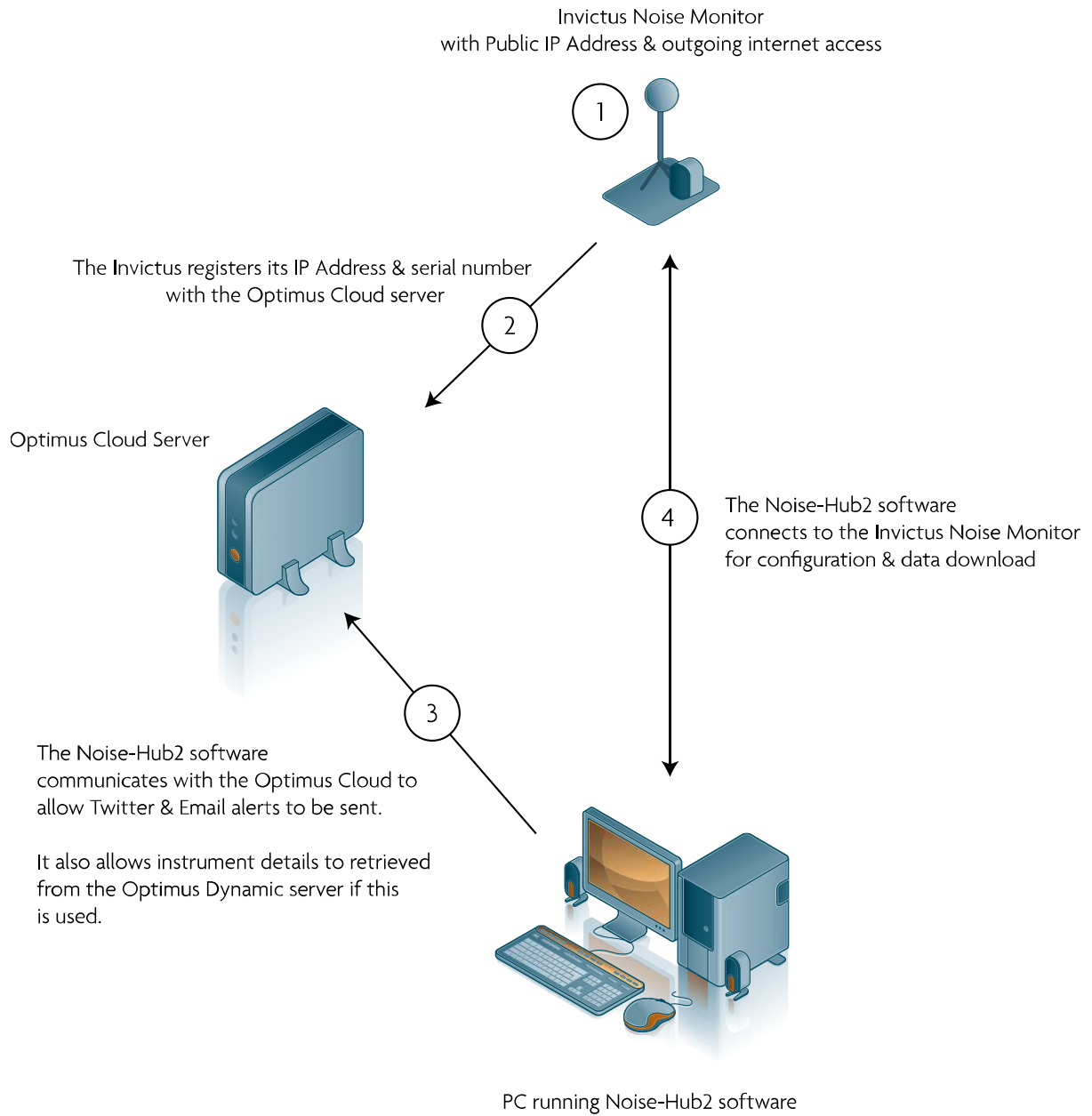
If you cannot get a connection with any form of public IP address, you should ask if a VPN connection is available.

How does a Public IP connection work?

The process for making a public IP connection is as follows:

1. The Invictus is fitted with a SIM card providing a public IP connection and out-going internet access
2. The Invictus will register itself with the optimus cloud server, with its IP address and serial number.
3. Run NoiseHub2 and enter the IP address & port for the SIM card
 - a. NoiseHub2 will talk to the Optimus Dynamic service for twitter & email alerts
4. Connect NoiseHub2

Invictus/Noise-Hub2 Public IP Address connectivity



VPN Connection

This type of connection will require a VPN client to be installed onto your PC and a connection made before Noise-Hub² will be able to access the instrument.

A VPN client is a small software program that allows a secure connection to be made between two devices, in this case the PC with the Noise-Hub² software and the Invictus.

The specific VPN client will be recommended by the service provider and they will give detailed instructions about how this can be configured for use on their network.

Please note that if the VPN option is used, this may require additional configuration of any hardware or software firewalls installed on your PC or network to allow the VPN connection to connect.

How does a VPN connection work?

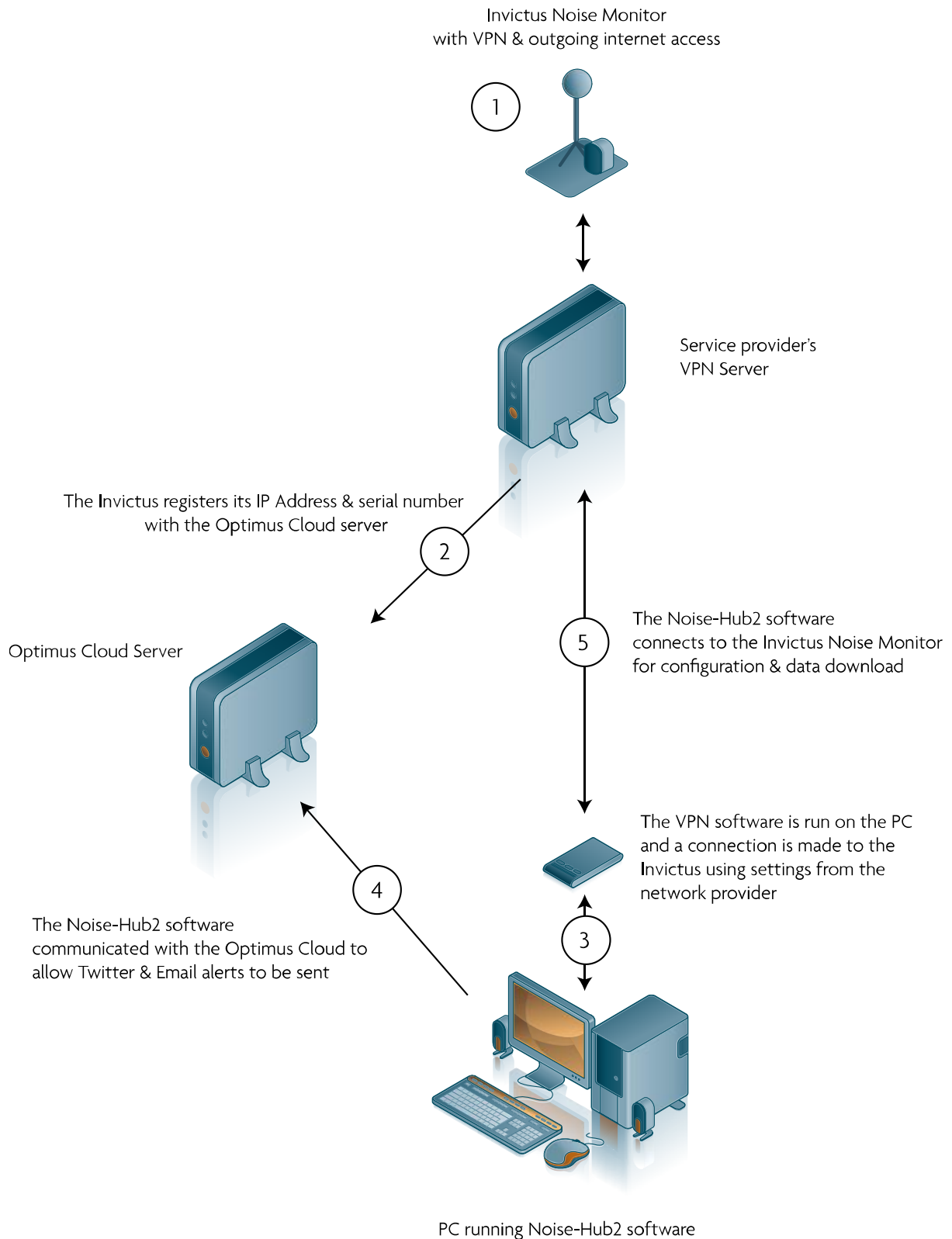
Using a VPN connection between the Invictus and the Noise-Hub² software requires an additional program to run on the host PC, known as a VPN Client. The VPN client software is usually specified by the supplier of the SIM card.

The VPN Client software program is used to make a dedicated connection between the host PC and the Invictus and must be run before the instrument can be connected to the Noise-Hub² software.

The process for making a VPN connection is as follows:

1. The Invictus is fitted with a SIM card providing a VPN connection and out-going internet access
2. The Invictus will register itself with the optimus cloud server, with its IP address and serial number.
3. The VPN client is run on the PC running NoiseHub2- This needs to be configured with settings from cellular network provider (SIM provider)
4. Run NoiseHub2 and enter the IP address & port for the SIM card
 - a. NoiseHub2 will talk to the cloud for twitter & email alerts
5. Connect NoiseHub2

Invictus/Noise-Hub2 VPN connectivity

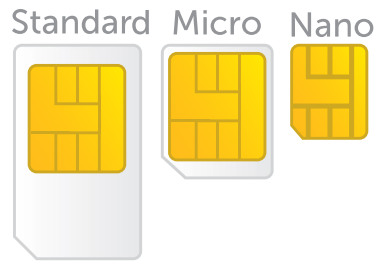


Please note that additional changes to firewalls and security software may be required to allow the VPN connection to be made.

What size of SIM card is required?

The physical SIM card itself is a standard Mini-SIM. This is a normal sized SIM card.

A Micro-SIM or a Nano-SIM , as shown below, will not work without a suitable adaptor.



Installation of the SIM Card

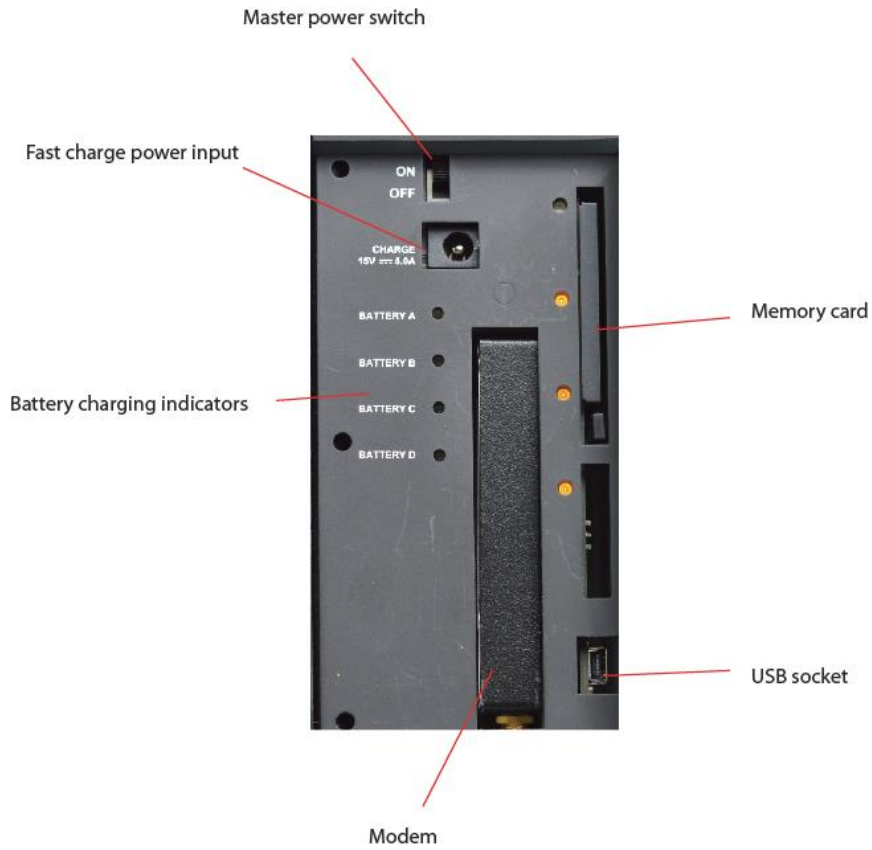
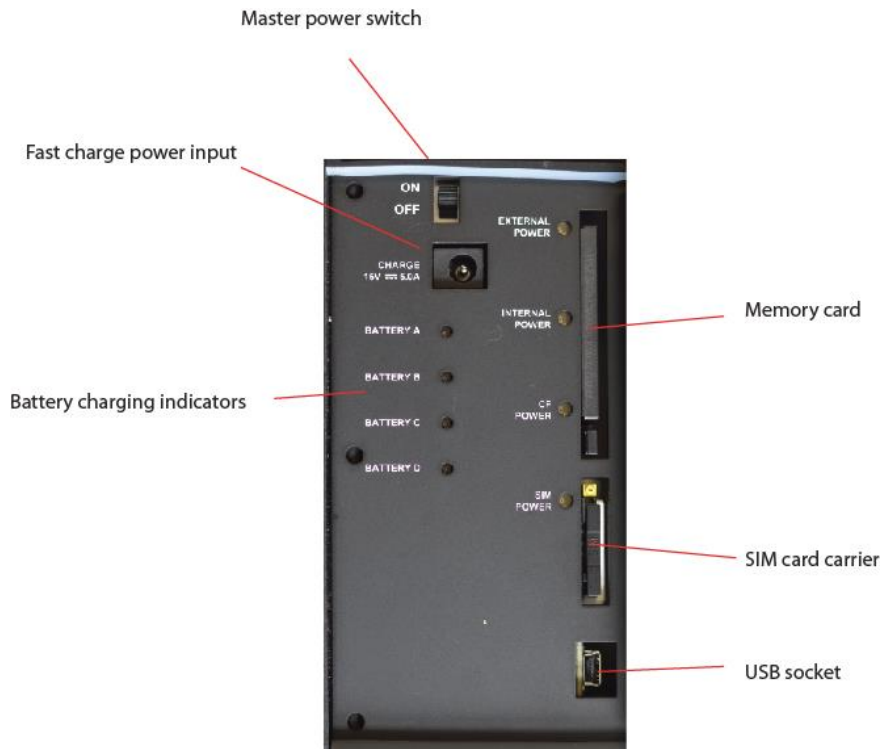
The method used to install the SIM card will be different depending upon the type of Modem fitted to the Invictus.

Please follow the instructions on the following pages.



WARNING - only remove or insert a SIM Card when the unit is powered down.





MM:247/1 3G/GPRS Modem

To install the SIM Card in an Invictus fitted with the MM:247/1 3G/GPRS Modem option:

1. Ensure that the Invictus is powered off
 - a. Power down the instrument from the touch screen
 - b. Lift the access flap and move the Master Power Switch to the Off position



2. Press the yellow button to release the SIM card carrier.





3. Install the SIM card and replace the SIM card carrier into the instrument.





4. Power on the Invictus unit.
 - a. Move the Master power switch to the On position
 - b. Press the Power button on the instrument.

MM:247/10 3G/GPRS Modem for USA/Canada

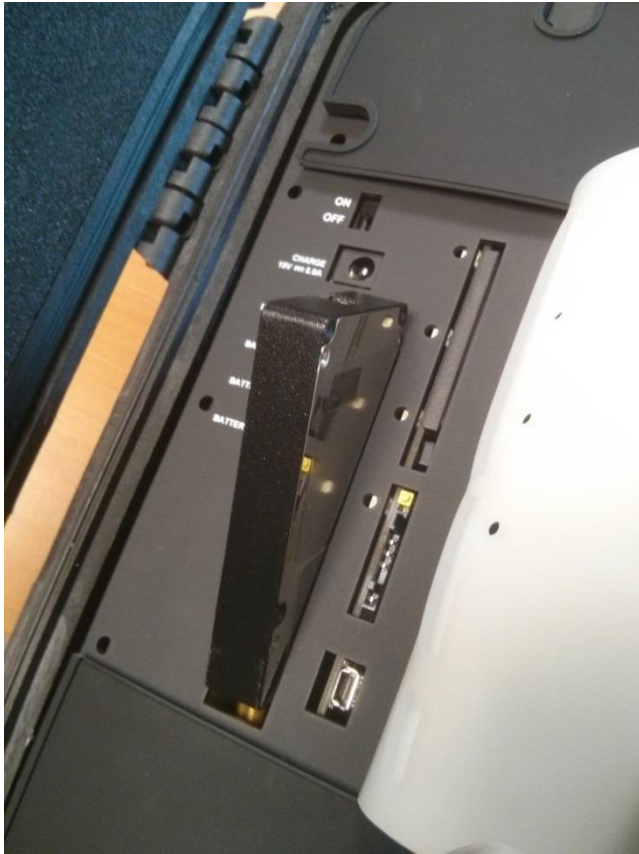
The MM:247/10 Modem option used a different location for the SIM Card.

In this option, the SIM card is not fitted into the SIM Card carrier but instead is installed into the modem directly.

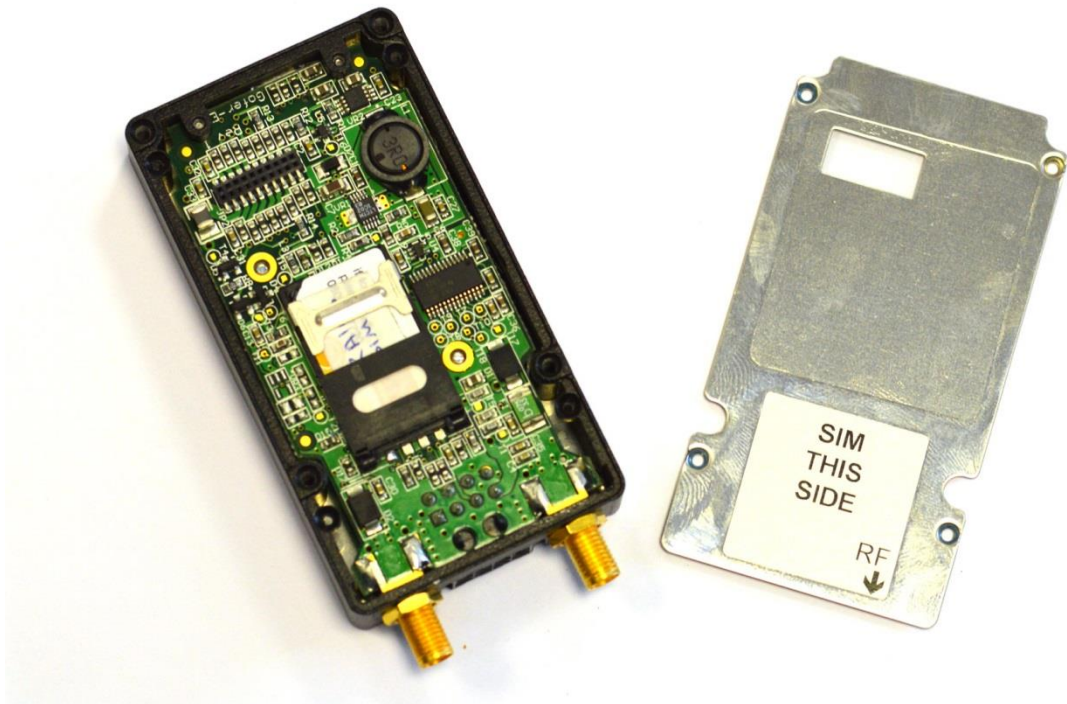
To install the SIM Card in an Invictus fitted with the MM:247/10 3G/GPRS Modem option:

1. Ensure that the Invictus is powered off
 - a. Power down the instrument from the touch screen
 - b. Lift the access flap and move the Master Power Switch to the Off position
2. Lift the Modem from the slot as shown below.





3. Disconnect the RF connector
4. Unplug the black power connector by pulling it away from the modem case
5. Remove the cover from the Modem as shown below



6. Insert the SIM Card into the carrier
 - a. Ensure that the contacts on the SIM card are facing the contacts in the SIM Card carrier.
7. Replace and secure the cover.
8. Reconnect the RF connector to the socket market RF.
9. Reconnect the black power connector.
10. Locate the Modem back into the slot.
11. Power on the Invictus unit.
 - a. Move the Master power switch to the On position
 - b. Press the Power button on the instrument.

Configuring the instrument & the Noise-Hub2 software

When the SIM Card has been installed, the instrument should be connected to the Noise-Hub2 software to complete the configuration.

Follow the steps below to add a new instrument to the Noise-Hub2 software and to configure the connection.

Run the Noise-Hub2 software

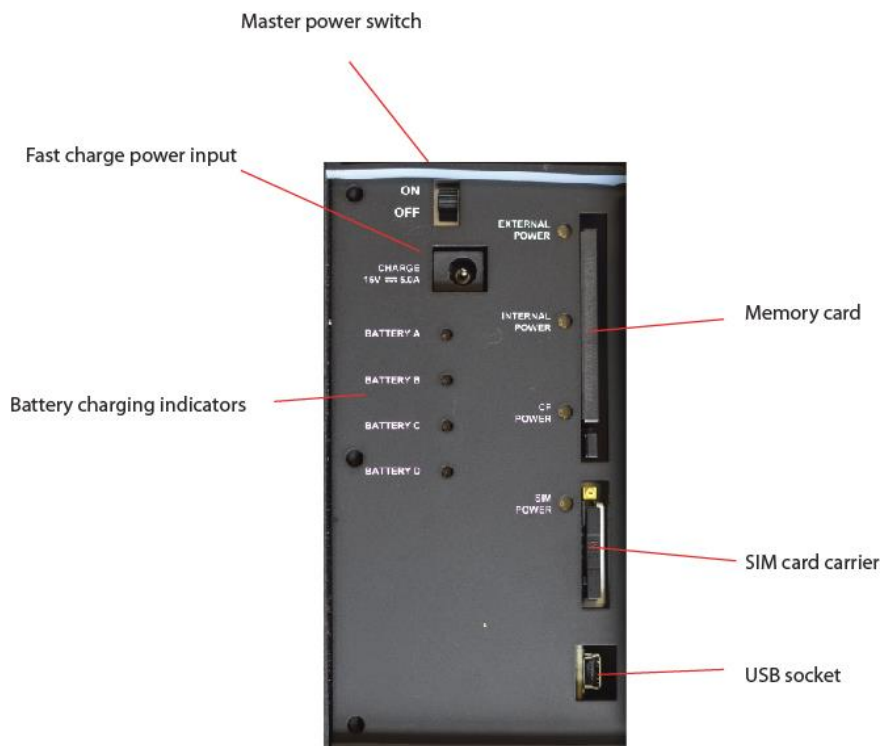
The Noise-Hub2 software should ideally be run on the PC that will be used to connect to, and download data from, the Invictus when it is deployed for use. This allows the PC to “register” the serial number of the Invictus which enables dynamic linking to the unit via the Optimus Dynamic service.

Start the Noise-Hub2 program.

Connect the Invictus to the PC using the USB connection

Connect the Invictus to the PC using the USB cable supplied with the instrument.

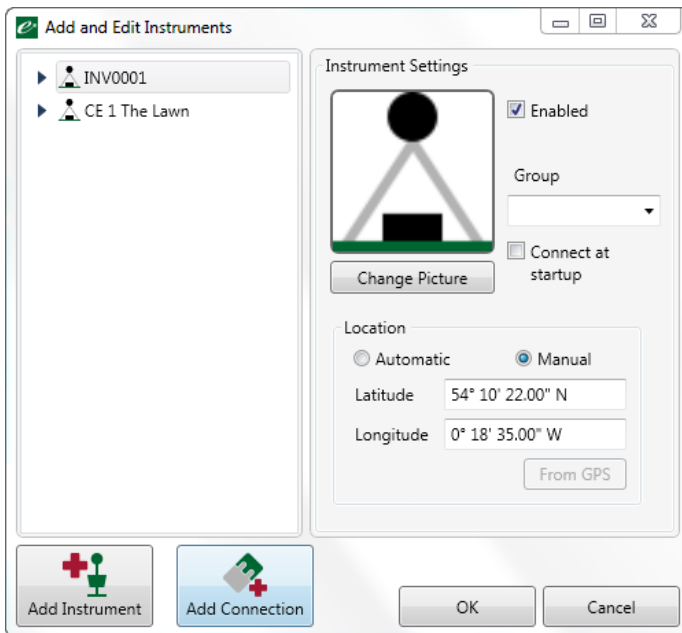
The USB connection under the access flap should be used as shown below:



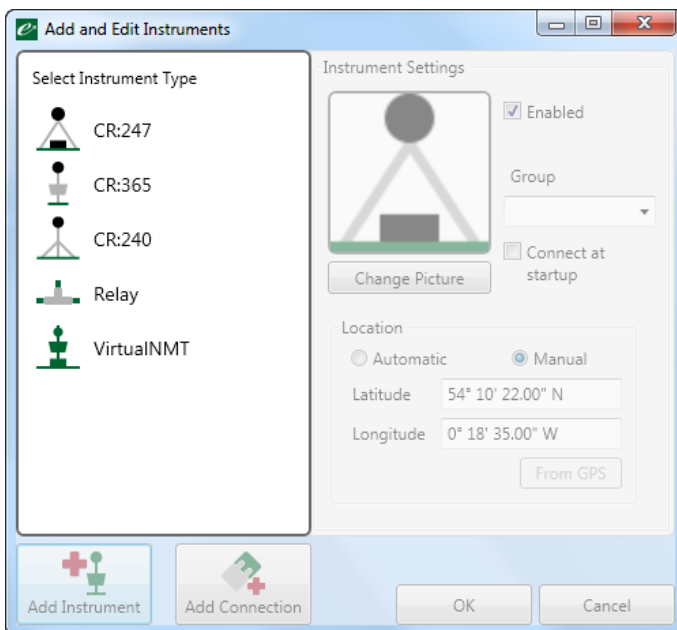
Add a new instrument

From the Tools menu, select manage instruments.

Click Add Instrument:

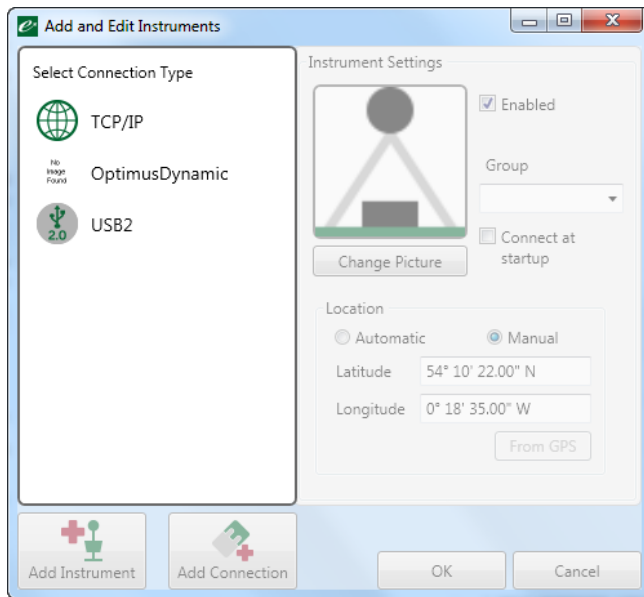


Select the instrument type required. In most applications select the CR:247 option.



Add a new connection - USB2

When the instrument type has been selected, the Select Connection Type window will show. Select USB2.



The new instrument will be shown with the name “New CR:247”. When the instrument is connected for the first time, the name that has been programmed into it will replace this temporary information.

Connect to the instrument

From the Noise-Hub2 home screen, click the Connect button and select the “New CR:247” instrument.

Noise-Hub2 will connect to the instrument over the USB connection.

Adding a new connection to the instrument

The connection from the Noise-Hub2 software to the Invictus can be made using one of two different methods.

These are:

Optimus Dynamic

The OptimusDynamic connection allows Noise-Hub2 to connect to the Optimus Dynamic server and see which instruments are available.

When an instrument connects to the Optimus Dynamic server, its serial number is stored along with its IP address, allowing Noise-Hub2 to connect.

This system allows for dynamic IP addresses to be handled easily.

TCP/IP

The TCP/IP connection type can be used if the IP address of the SIM card is static and will not change.

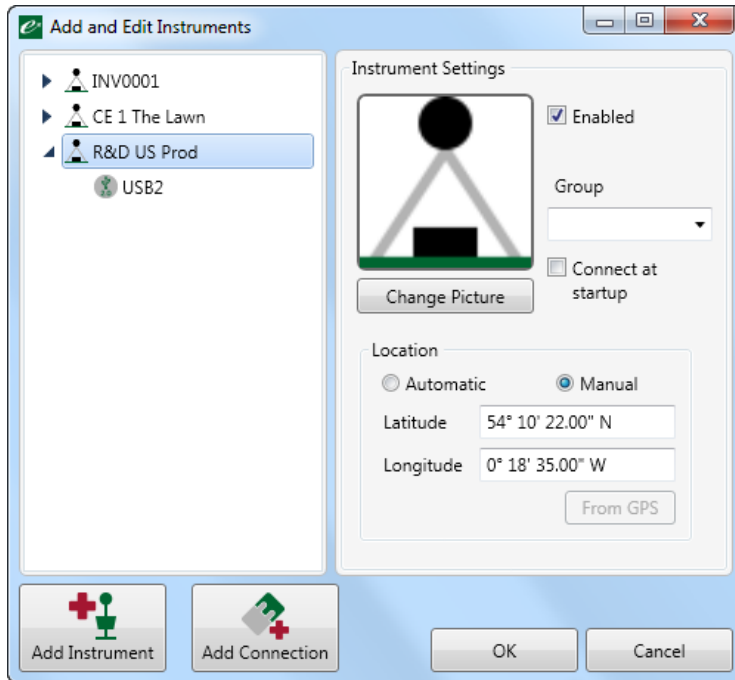
It is recommended that the Optimus Dynamic connection is used unless you have been advised otherwise by Cirrus Environmental or by your SIM card provider.

Add a new connection to the instrument - Optimus Dynamic

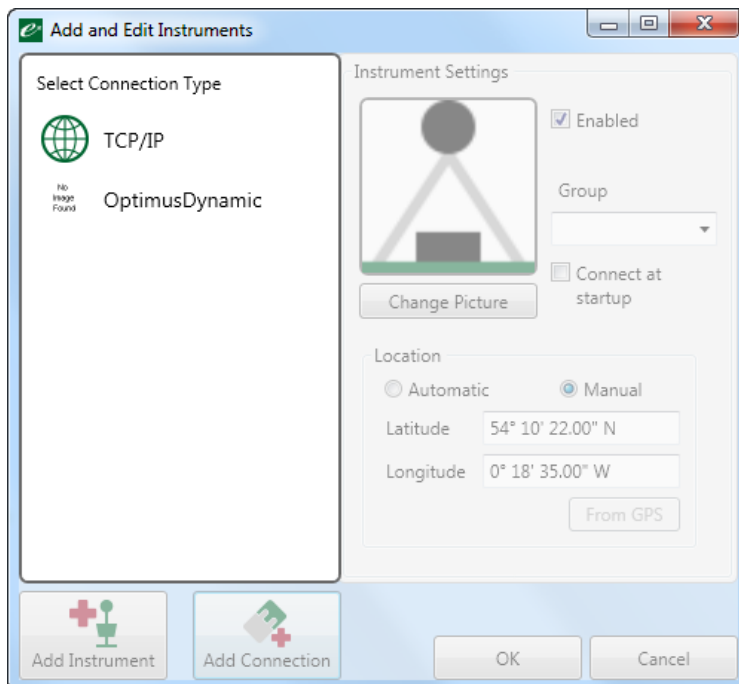
When the instrument is connected via USB2, click the Tools, Manage instrument menu and select the new instrument.

Please note that the name of the instrument may have changed from “New CR:247”.

In the example below, the name of the instrument changed to be “R&D US Prod”



Click Add Connection and select OptimusDynamic:

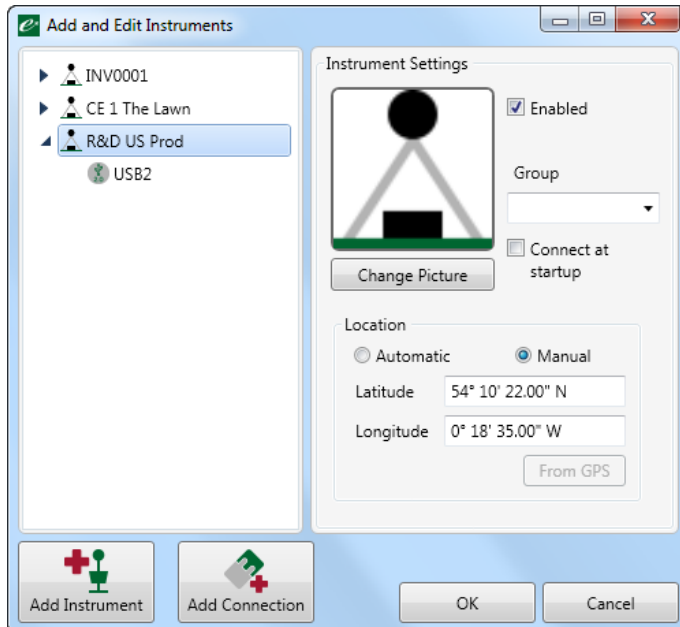


Add a new connection to the instrument - TCP/IP

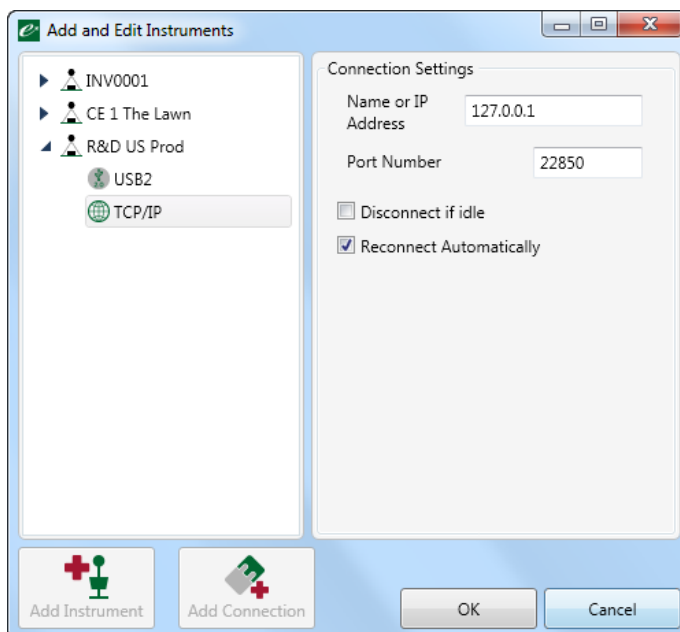
When the instrument is connected via USB2, click the Tools, Manage instrument menu and select the new instrument.

Please note that the name of the instrument may have changed from “New CR:247”.

In the example below, the name of the instrument changed to be “R&D US Prod”



Click Add Connection and select TCP/IP:



Enter the IP address of the SIM card. The port number should be left as 22850 unless you have been advised otherwise by Cirrus Environmental or your SIM card provider.

Click OK.

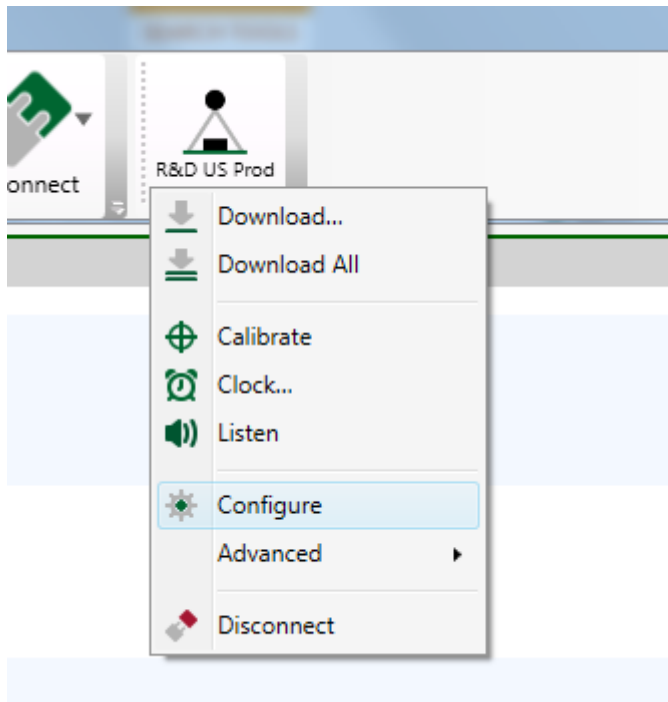
Configure the APN settings

Some connections may require the APN (Access Point Name) settings to be configured before the modem can connect to the cellular network.

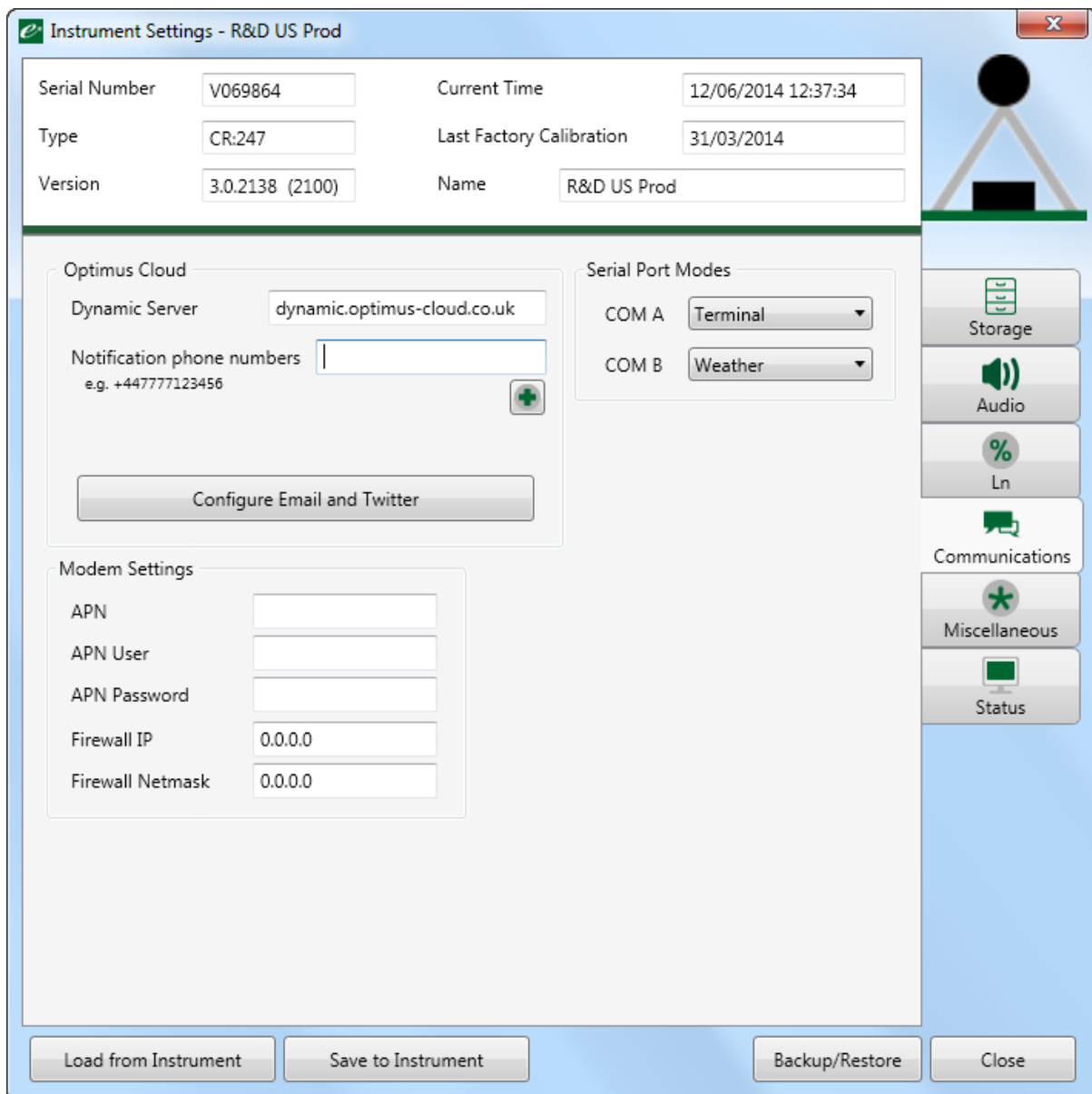
The provider of the SIM card will provide these details if they are required.

It is recommended that you ask your SIM provider if these details are needed.

From the instruments toolbar, select the instrument and click Configure:



Click the Communications tab to view APN configuration:



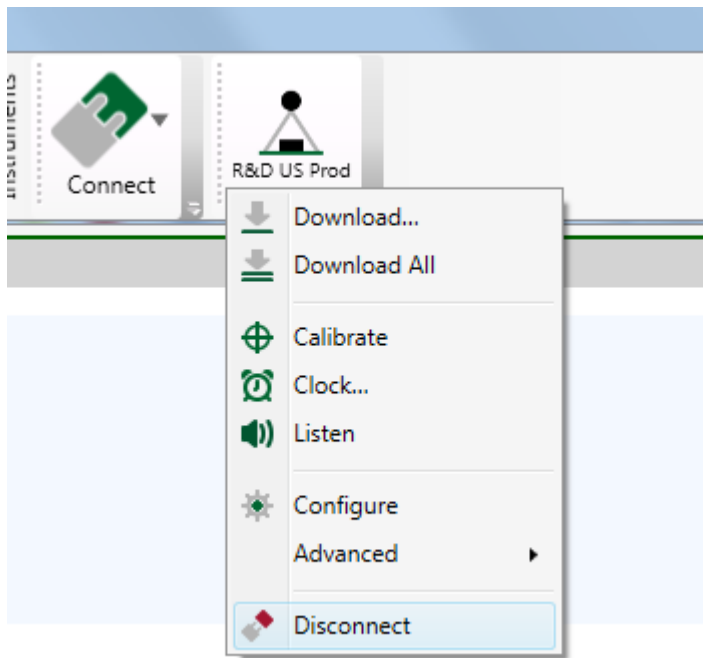
If this information is required, enter the APN Name, APN Username and APN Password. The Firewall IP and Firewall Netmask are not required and should not be changed.

Click Save To Instrument and click Close.

Note that the APN settings can only be changed when the Invictus is connected using a USB connection.

Disconnect the instrument

From the Instrument toolbar, select the instrument and click disconnect:



Disconnect the USB cable from the Invictus and the PC.

Connect using the Modem

To test the modem connection, click connect from the Instrument toolbar and choose the new instrument.

Please note that the instrument may take some time to register with the OptimusDynamic server which may prevent it from connecting initially.

If a connection error occurs, please wait for 30 minutes and retry.

Modem & GPS Status Information

When the Invictus powers up, it will go through a process to check the configuration of the SIM card. The instrument will then connect to the cellular network.

The following section shows the information that is displayed by the Invictus that relate to the status of the modem and the data connection.

The figure below shows a typical status display for an Invictus that has been successfully connected to the cellular data network and that has an accurate GPS location lock.

This information can be viewed by pressing the Status button at the top of the display.



Home



Live Data



Status



Settings

140




Battery

Remaining Battery Life: External



Modem

Status: Ready


Signal Strength: 

Network: T-Mobile UK

Connection Type: 3G



GPS

Signal Strength: 

Longitude: 54° 11' 23.30" N

Latitude: 0° 18' 33.79" W



Modules Connected

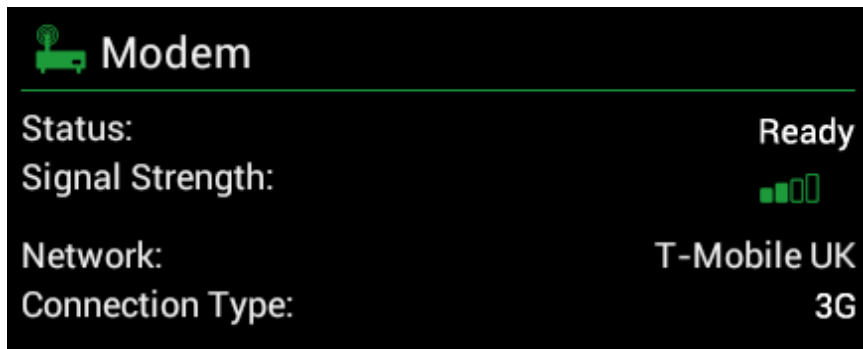
Port A: Terminal

Port B: Weather



Microphone/Pre-Amplifier

Modem status information



Status:

This shows the current status of the modem and its connection to the cellular network. The possible messages are:

- Modem Error (a number is shown. See the table below for more information)
- Connecting
- Ready
- Sending and Receiving
- Failed

Signal Strength

This shows the current signal strength from 1 to 4 bars.

Network

This shows the current cellular network that the modem is connected to. For example, T-Mobile

Connection Type

This shows the current data connection type that the modem is using. The possible messages are

- GPRS
- EGPRS
- 3G
- UMTS
- WCDMA
- Unknown

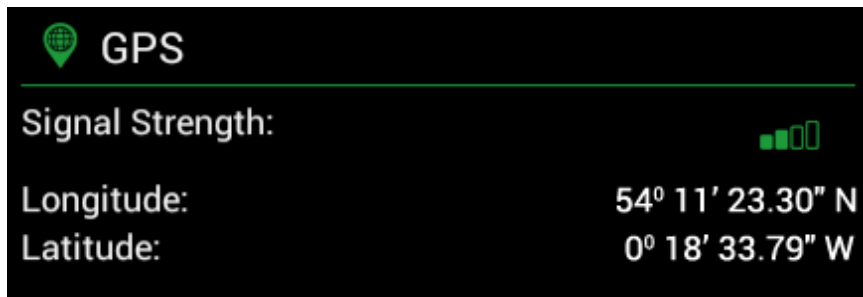
Modem error status information

The Status of the modem is shown in the instrument display. If an error occurs, the Invictus will show Modem Error (#) where # is a number listed below.

| Error code | Typical Cause | Solution | Notes |
|----------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 103000 | The modem not powered on. | Check power to the Modem from the battery pack. Power off the Invictus, wait 30 seconds and switch on the Invictus. | If the problem persists, please contact Cirrus Environmental or your local distributor. |
| 103001 | SIM missing / not inserted correctly / not active | Check that the SIM card is inserted correctly. Power off the Invictus, wait 30 seconds and switch on the Invictus. | If the problem persists, contact SIM provider to verify that the SIM is correctly provisioned. See page 4 for the requirements for the SIM card. |
| 103002 | Internal modem problem | Wait for the unit to automatically retry. Power off the Invictus for 30 seconds and then restart the instrument. | If the problem persists, please contact Cirrus Environmental or your local distributor. |
| 103003 | No cellular network signal is detected. | Check that the antenna connection is good. Check that the system is in a location where there is good signal availability. | Move the Invictus to a location where the signal strength is high. |
| 103004 | No Data (GPRS/3G) service detected | Check data service availability with the network operator. Check that the system is in a location where there is good signal availability. | |
| 103005-103007, | Unable to connect to the network | Wait for the unit to automatically retry. | If the problem persists, please contact Cirrus Environmental or your local distributor. |

| | | | |
|---------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 103009, 103010 | | Power off the Invictus for 30 seconds and then restart the instrument. | |
| 103008 | Unable to obtain IP address | Check that the SIM card is a supported 'M2M' card. See page 4 for the requirements for the SIM card. If custom APN settings are required, check that these have been set via NoiseHub2. | |
| 103011, 103012 | Unable to connect to Optimus Dynamic | Check the Optimus Dynamic server setting via NoiseHub2. | If problem persists, please contact Cirrus Environmental or your local distributor. |
| 103013- 103029 | Internal modem problem | Wait for the unit to automatically retry. Power off the Invictus for 30 seconds and then restart the instrument. | If problem persists, please contact Cirrus Environmental or your local distributor. |

GPS status information



The GPS receiver in the Invictus requires a number of different satellite signals before it can obtain an accurate location lock.

The optimum number of satellites is 12 although a location lock can be obtained with as few as 4. Please note that if the ambient temperature is low (less than 5°C/41°F) the GPS receiver may take longer to establish a signal lock.

Tall objects such as buildings and trees can block GPS signals and this may increase the time needed for the system to get an accurate GPS lock.

The information in the GPS status is shown as follows:

Signal Strength

This shows the current signal strength from 1 to 4 bars.

Longitude

The current longitude of the GPS receiver shown as Degrees, Minutes and Seconds.
For example, 54° 11' 23.30" N

Latitude

The current latitude of the GPS receiver shown as Degrees, Minutes and Seconds.
For example 0° 18' 33.79" W

If an accurate location cannot be obtained, for example when the GPS receiver is warming up or when insufficient signals are available, the GPS Status will display no information for the Longitude or Latitude.

Appendix 1 Regulatory Notices

US FCC Notice

The United States Federal Communications Commission (FCC Part 15) has specified that the following notice be brought to the attention of the users of this product.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Cirrus Research could void the user's authority to operate the equipment.

The equipment must only be used with the antenna supplied by the equipment manufacturer.

This device complies with Part 15 of the FCC rules.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Exposure Information to Radio Frequency Energy

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This could impair the quality of communications and cause the device to operate at a higher power level than necessary.

The antenna must be installed in a manner that provides a minimum separation distance of 20cm (8 inches) or more between the antenna and persons, and must not be co-located or operate in conjunction with any other antenna or transmitter to satisfy FCC RF exposure requirements for mobile transmitting devices.

Appendix 2 Examples of M2M Providers

The following list shows the providers who have supplied suitable M2M connections for the Invictus Noise Monitors. Please note that this list is not exhaustive and will be updated as necessary.

Please contact Cirrus Environmental or your local distributor for further details.

| Country | Provider |
|-----------|---------------|
| UK | Eseye |
| Germany | Mdex |
| Australia | Internode |
| USA | RACO Wireless |
| Uruguay | Entel |

Appendix 3 Glossary

| | |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3G | 3G, short for third Generation, is the third generation of mobile telecommunications technology. 3G networks support services that provide an information transfer rate of at least 200 kbit/s |
| APN | <p>An Access Point Name (APN) is the name of a gateway between a GPRS, 3G or 4G mobile network and another computer network, frequently the public Internet.</p> <p>A mobile device making a data connection must be configured with an APN to present to the carrier. The carrier will then examine this identifier to determine what type of network connection should be created, for example: what IP addresses should be assigned to the wireless device, what security methods should be used, and how or if, it should be connected to some private customer network.</p> |
| Dynamic IP address | A dynamic IP address is one that can change. This often occurs when an instrument is powered down and then switched back on. A new IP address is allocated when the device reconnects to the network. |
| EGPRS | Enhanced Data rates for GSM Evolution (EDGE) which is also known as Enhanced GPRS (EGPRS) is a digital mobile phone technology that allows improved data transmission rates as a backward-compatible extension of GSM. |
| GPRS | General packet radio service (GPRS) is a packet oriented mobile data service. GPRS provides data rates of 56-114 kbit/second. |
| GPS | <p>The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.</p> <p>The Invictus noise monitors incorporate a GPS system that provides both time and location data which is included with the noise measurement information.</p> |
| GSM | GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones. |
| IMEI | The International Mobile Station Equipment Identity or IMEI is a number, usually unique, that is used to identify 3GPP (i.e., GSM, UMTS and LTE) devices such as mobile phones and cellular modems. The IMEI is only used for identifying the device. The IMEI number includes information on the origin, model, and serial number of the device. |

| | |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Private IP Address | A private IP address is any number or address assigned to a device on a private TCP/IP Local Area Network that is accessible only within the Local Area Network. |
| Public IP Address | A public IP address is any valid address, or number, that can be accessed over the Internet. |
| Real World IP Address | A public IP address and a Real World IP address are the same thing and the terminology is often interchanged. |
| SIM Card | A subscriber identity module or subscriber identification module (SIM) is an integrated circuit that securely stores the international mobile subscriber identity. SIM cards have been made smaller over the years; functionality is independent of format. Full-size SIMs were followed by mini-SIMs, micro-SIMs, and nano-SIMs. The Invictus requires a standard mini-SIM card. |
| Static IP address | A static IP address is one that will not change from its original configuration even after a power cycle. |
| UMTS | The Universal Mobile Telecommunications System (UMTS) is a third generation mobile cellular system for networks based on the GSM standard. |
| VPN | A virtual private network (VPN) extends a private network across a public network, such as the Internet. It enables a computer to send and receive data across shared or public networks as if it is directly connected to the private network, while benefiting from the functionality, security and management policies of the private network. A VPN is created by establishing a virtual point-to-point connection through the use of dedicated connections, virtual tunnelling protocols, or traffic encryptions. |
| WCDMA | W-CDMA (Wideband Code Division Multiple Access) is an air interface standard found in 3G mobile telecommunications networks |

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