



Sentek™ PLUS All-in-One™ **&** **Sentek™ PLUS Compact DTU**



Hardware Manual
Version 1.1

All rights reserved. No part of this document may be reproduced, transcribed, translated into any language or transmitted in any form electronic or mechanical for any purpose whatsoever without the prior written consent of **Sentek Pty Ltd**. All intellectual and property rights remain with **Sentek Pty Ltd**.

All information presented is subject to change without notice.

© **2005-2015 Sentek Pty Ltd**

Sentek™, EnviroSCAN™, EasyAG™, TriSCAN™, IrriMAX™, IrriMAX Live™ and Drill& Drop™ are trademarks or registered trademarks of Sentek Pty Ltd that may be registered in one or more jurisdictions.

Bluetooth™ is a trademark of the Bluetooth Special Interest Group (Bluetooth.org)

Android is a trademark of Google Inc.

NextG is a trademark of Telstra Corporation

Sentek Pty Ltd

A.C.N. 007 916 672

77 Magill Road

Stepney, South Australia 5069

Phone: +61 8 8366 1900

Facsimile: +61 8 8362 8400

Internet: www.sentek.com.au

Email: sentek@sentek.com.au

All-in-One Rev 1.1 (2015-11-12)

SENTEK PLUS ALL-IN-ONE - STATEMENTS OF COMPLIANCE

FCC NOTE OF COMPLIANCE AND STATEMENT OF LIABILITY

Electro-Magnetic Compliance

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

- Reorientation or relocation of the receiving antenna.
- Connection of the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consultation with the dealer or an experienced radio/TV technician.

EMC approvals

The Sentek PLUS system complies with “EN61326:1997 Amdt 1:1998 Amdt 2:2001 Amdt 3:2003 EMC standard for equipment for measurement, control and laboratory use”.

The equipment complies with the following specifications:

- FCC Part 15 Class B.
- EN55011:1998, Amendment 1:1999 (Radiated and conducted emissions)
- EN61000-4-2:1995 (Immunity to Electrostatic Discharge (ESD))
- EN61000-4-3:2002 (Immunity to Radiated Fields (RF))
- EN61000-4-4:1995 (Immunity to Electrical Fast Transients (EFT))
- EN61000-4-5:1995 (Immunity to Surges)
- EN61000-4-6:1996 (Immunity to Conducted RF)

Marking

The above EMC approvals allow the product to be marked CE, C-tick and FCC.

Modifications

Any modifications to any part of the equipment or to any peripherals may void the EMC compliance of the equipment.

Radio Interference

The probe is not to be operated in free air as it may cause interference to radio communication devices

SENTEK BLUETOOTH MODULE

Product: PARANI-BCD210 Sena Technologies, Inc.

FCC

FCC Rule: Part 15 Subpart C Section 15.247

FCCID: S7AIW03

Compliance Statement

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.

Information to User

This equipment has been tested and found to comply with limits for a Class B digital device, Pursuant to Part15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generate(s), uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver-Connect the equipment into an outlet a circuit different form that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CE

Certification No: 1177

Declare under our own responsibility that the product Bluetooth Module

Brand name: SENA

Model No.: Parani-BCD210DU / Parani-BCD210DC / Parani-BCD210DS

Parani-BCD210SU / Parani-BCD210SC

To which this declaration refers conforms with the relevant standards or other standardizing documents

EN 60950-1

ETSI EN 301 489-1

ETSI EN 301 489-17

ETSI EN 300 328

According to the regulations in Directive 1999/5/EC

IC

Radio Cert. No.: IC: 8154A-IW03

KC

Type Registration

Certification No: KCC-CRM-SNA-IW03

TELEC

Technical Regulations for Specified Radio Equipment Article 2, Section 1 (19)

Certification No:

Parani-BCD210DU: 010WWBT0144

Parani-BCD210DC: 010WWBT0146

Parani-BCD210DS: 010WWBT0145

QDID: B019536

Model Name: Parani-BCD210

Core Version: 2.0+EDR

Product Type: Component

Declared Specifications: Baseband Conformance, Radio, Service Discovery Protocol, Logical Link Control and Adaption Protocol, Generic Access Profile, Link Manager, RFCOMM,

Serial Port Profile, Host Controller Interface, Summary ICS, Product Type

TABLE OF CONTENTS

Sentek PLUS All-in-One - Statements of Compliance	ii
FCC note of compliance and statement of liability	ii
EMC approvals	ii
Sentek Bluetooth Module	ii
FCC	ii
CE	iii
IC	iii
KC	iii
TELEC	iii
SIG	iv
Introduction.....	1
Background	1
Features	1
Hardware Requirement Lists For Sentek PLUS All-in-One and Compact DTU	2
Required parts to assemble a complete All-in-One System	2
Required parts to assemble a complete Compact DTU System	3
Referenced Documents.....	5
System Setup.....	6
Internet Provisioning	6
Data Transfer and Hosting	6
Buying a SIM card and data packet plan for the modem	6
Hosting Set-up and Recommendations	8
Satellite firmware – Creating an email account.....	9
Satellite firmware – Registering modem with Iridium	10
Sentek PLUS All-in-One and Compact DTU Setup	11
Sentek All-in-One Probes.....	13
Introduction.....	13
Sentek EnviroSCAN Sensors.....	13
Assemble and Normalise	13
Install access tube and the probe	14
Connecting External Antenna	14
Compact DTU Installation	15
Configuring the Probe with PConfig	16
Verifying Probe Configuration with Sentek Android App.....	23
Modem Configuration	30
Testing.....	32
Verifying Test Upload was Successful	33
Viewing Data	34
Downloading.....	34
Viewing	34
Maintenance.....	36
DTU	36
Probe	36
Lithium battery Life	36
Firmware and Board Type.....	37
Changing the Modem	38
Firmware	38
Appendix A – Modem information.....	40
Compatible Modems	40
SIM Card Pin codes	40
Useful AT Commands	40
Extra Frequency Band information.....	42

Appendix B – Network page explained.....	44
Appendix C – Upload Operation Diagram	45
Appendix D – PConfig Response Fields.....	46
Last Response	46
Test/Upload Result Codes	46
Upload log	48
Appendix E - Technical Specifications	49
EnviroSCAN Series II 232 interface	49
Appendix F - Glossary of Terms.....	51
Appendix G - Configuring the Probe using Bluetooth on a Laptop	53
Appendix H - Sentek PLUS Quick Reference Guide	57
Product Set-up Checklist.....	57
Preparation.....	57
Field Installation	57
Software	57
Troubleshooting Guide	58
Recommended Maintenance Schedules	62
Daily.....	62
6 months (or each time access tube is opened)	62
12 months.....	62
3 years.....	62

TABLE OF FIGURES

Figure 1 Block Diagram of the Sentek All-in-One in use	1
Figure 2 Exploded All-in-One probe block diagram.....	3
Figure 3 Sentek PLUS All-in-One (GPRS, 3G/NextG & Satellite).....	12
Figure 4 All-in-One connected to an EnviroSCAN Probe	12
Figure 5 Probe connector All-in-One	12
Figure 6 Bluetooth board and connections	12
Figure 7 EnviroSCAN Moisture/ TriSCAN sensor addressing.....	13
Figure 8 EnviroSCAN Temperature & Humidity Sensors (Showing address 1).....	14
Figure 9 EnviroSCAN interface and wiring diagram	14
Figure 10 External Antenna connector	14
Figure 11 External Antenna connector	15
Figure 12 PConfig connected to probe with default settings	17
Figure 13 Auto-detected sensors.....	17
Figure 14 Setting depths.....	18
Figure 15 Air counts and then Water counts	19
Figure 16 Clock page.....	19
Figure 17 Edit screen.....	20
Figure 18 Completed Logger page	21
Figure 19 Network settings (with SIM Pin number)	22
Figure 20 Power settings	23
Figure 21 Android App Home Screen.....	24
Figure 22 Bluetooth settings	24
Figure 23 Enabling Bluetooth	24
Figure 24 All-in-One Magnet switch position	25
Figure 25 Pairing with an All-in-One Probe	26
Figure 26 Connection Successful prompt.....	26
Figure 27 Probe Utility information screen	26
Figure 28 Connection lost prompt.....	27
Figure 29 Sensor test tab	28
Figure 30 Time tab.....	29
Figure 31 Sending modem settings (Response from a GPRS modem).....	31
Figure 32 Sensor testing.....	32
Figure 33 Successful Test	32
Figure 34 Get Server files.....	33
Figure 35 Logger ID screen	34
Figure 36 Lithium Battery Discharge Characteristics	37
Figure 37 EnviroSCAN RS232 logging interface.....	37
Figure 38 Checking probe type and firmware versions	39
Figure 39 Upload result codes from most recent upload attempt.....	46
Figure 40 EnviroSCAN RS232 probe interface board layout	50

INTRODUCTION

BACKGROUND

The Sentek PLUS All-in-One probe and Compact DTU option combine the scientifically and commercially proven sensor technology of EnviroSCAN, EasyAg probes and Drill & Drop probes, with web enabled, wireless communication.

In addition to this, Sentek PLUS also has the ability to continuously track fertiliser / salinity data through the use of TriSCAN sensors, and additionally on EnviroSCAN probes temperature and Humidity Sensors. Sentek All-in-One can utilise GPRS, NextG, CDMA (Verizon North. America) or Satellite communications to send soil water, fertiliser / salinity, Temperature humidity and voltage data from the probe to the user's PC via the internet. It also is equipped with Bluetooth which is used for wireless testing and configuration, using a laptop with the Probe Configuration Utility or an Android Device (phone or Tablet) with the Sentek Probe configuration utility. Alternatively, it provides for direct in-field download when services become unavailable in regional areas.



Figure 1 Block Diagram of the Sentek All-in-One in use

The Sentek PLUS Compact DTU expands the type of probes supported to include:

- Connection cable with standard connector
- EnviroSCAN RS232 probes (moisture, salinity, temperature and humidity which is equivalent to All-in-One)
- EasyAG RS232 probes (moisture, salinity), and
- Drill & Drop RS232 probes (Moisture, Salinity, Temperature)

FEATURES

Sentek PLUS All-in-One Probe

- Utilises Sentek Soil Moisture & TriSCAN sensors, tubes and rod (optional temperature and humidity sensors)
- Available to be retrofitted to EnviroSCAN screw cap probes and upgrade Diviner Sites
- Cable Free, easy installation
- Bluetooth configuration and testing
- Interface can store over 2000 samples (~21 days @ 15 minute sampling intervals)

Hardware Requirement Lists For Sentek PLUS All-in-One and Compact DTU

- GPRS, NextG, CDMA or Satellite Communication Module
- Internal Antenna or connector for an external antenna
- Hi-capacity Lithium battery allowing 12 months of usage (based on Sentek standard configuration)
- Facilitates direct communication from probe to a server computer via the Internet
- Probe can come preconfigured for IrriMAX Live viewing

Sentek PLUS Compact DTU (Data Transmission Unit)

An assembled Sentek PLUS Compact DTU has all of the features of All-in-One, and additionally:

- Integrated cable and connector for connection to EasyAg RS232 probe, EnviroSCAN screw cap or Flat cap RS232 probe or Drill & Drop RS232 Probe

Sentek PLUS sensor configurations

- All-in-One and Compact DTU EnviroSCAN Screw-cap and Flat-Cap probes can be up to 1.2m long and contain one to 12 moisture/TriSCAN sensors, with optional Temperature & humidity sensors
- Compact DTU can be configured with Drill & Drop probes which are available in 30cm to 120cm, containing 3, 6, 9 or 12 moisture or TriSCAN sensors. Each sensor also incorporates a temperature sensor
- Compact DTU also supports EasyAg 30cm and 60cm probes containing 3 or 6 moisture/TriSCAN sensors.
- The standard configuration contains 5/6 moisture or TriSCAN sensors, sampled each 30 minutes and uploaded to the Internet every 3 hours.

Note:

Probes with large sensor configurations may shorten battery life and will send more data on each upload. This can heavily impact monthly costs for Satellite uploads.

Sentek PLUS with IrriMAX software suite

- Seamless download via Internet with Sentek IrriMAX Software
- Network feature allows flexible modem configuration
- Optional IrriMAX Live subscription which allows you to view your data on any Web enabled device (smartphone, Tablet and PC)
- IrriMAX 9.1 or later is required to support Temperature and Humidity sensors
- IrriMAX 10.0.3 or later is required to support Temperature/Humidity sensors on Satellite systems and Drill & Drop probes.

CDMA Support

All-in-One is supported for use with the Verizon CDMA network in North America. Probes are available pre-configured with CDMA modems and firmware and will work provided they are in an area with CDMA network access and Probe Configuration Utility Network tab has been appropriately setup.

HARDWARE REQUIREMENT LISTS FOR SENTEK PLUS ALL-IN-ONE AND COMPACT DTU

Required parts to assemble a complete All-in-One System

- All-in-One External plastics
- Assembled All-in-One Internal holder including Bluetooth module
- GPRS, NextG, CDMA (USA) or Satellite Modem
- 14V 14Ah Battery

Hardware Requirement Lists For Sentek PLUS All-in-One and Compact DTU

- Internal antenna or Antenna with cable
- RS232 EnviroSCAN or EasyAG Probe
- Torch Magnet

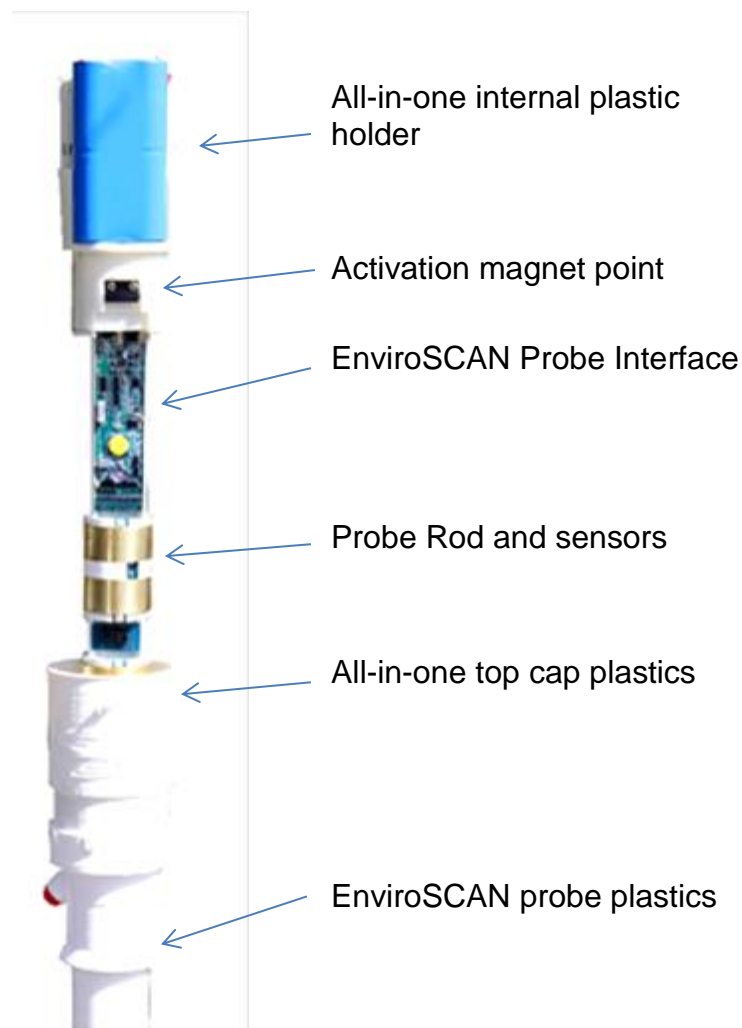


Figure 2 Exploded All-in-One probe block diagram

Required parts to assemble a complete Compact DTU System

- Compact DTU base and integrated cable with connector
- Assembled All-in-One Internal holder including Bluetooth module
- GPRS, NextG, CDMA (USA) or Satellite Modem
- 14V 14Ah Battery
- GPRS, NextG, CDMA (USA) or Satellite Modem
- Internal antenna or Antenna with cable
- RS232 Probe (EnviroSCAN, EasyAG or Drill & Drop)
- Torch Magnet

Hardware Requirement Lists For Sentek PLUS All-in-One and Compact DTU

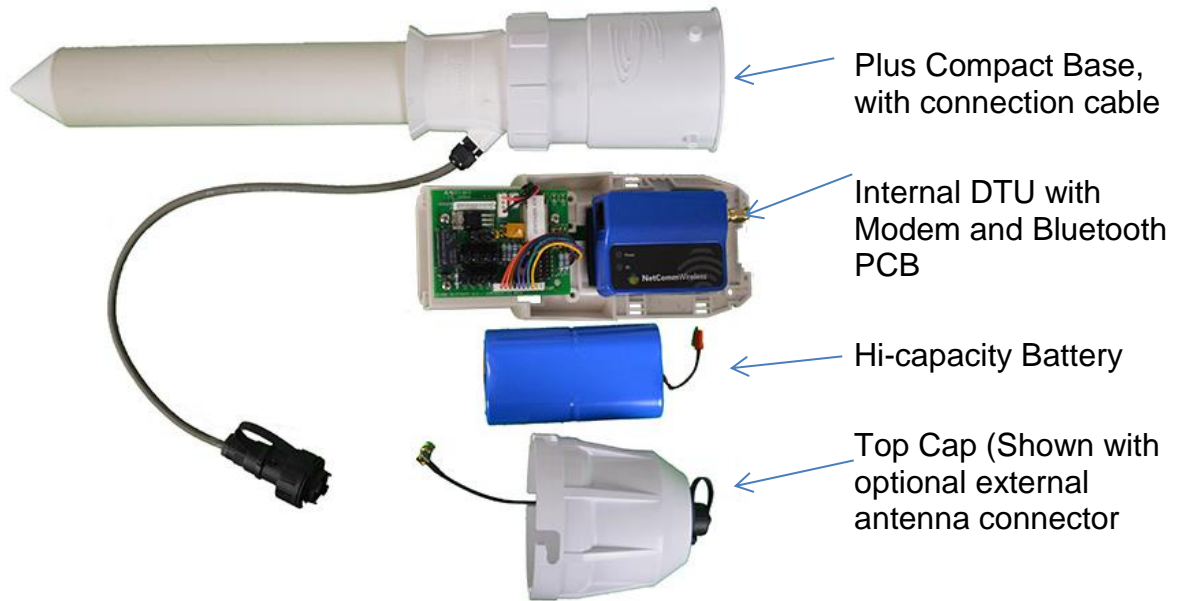


Figure 3 Exploded Compact DTU block diagram

REFERENCED DOCUMENTS

- Access Tube Installation Guide
- Sentek Drill & Drop Installation Guide
- Sentek Flat Cap Installation Manual
- Sentek Drill & Drop Probe Interface Manual
- Android Probe Utility App User Guide
- Irrimax Data Exchange User Guide – Sentek PLUS Module
- Probe Configuration Utility Manual 1.9.1 or later
- Sentek Technical Brief - TB064-ESPlus NextG Fails Network Selection
- Sentek Technical Brief - TB065-ESPlus NextG SIM PIN

SYSTEM SETUP

INTERNET PROVISIONING

Preparation, assembly and installation should generally be completed in the order of the steps in this section. Efficiencies might be gained by experienced installers altering the order of the steps taken.

The All-in-One when purchased as a complete probe has been normalised, preconfigured and tested to allow an easy and fast installation process. If purchased with the optional IrriMAX Live the probe will be pre-configured so that the probe Data will be transferred automatically to Sentek's servers. Once the first upload has occurred the probe data will be available for viewing on an internet enabled device e.g., smartphone, tablet, etc.

Data Transfer and Hosting

A Sentek All-in-One probe must have access to the internet and somewhere to send its data. It needs a SIM card that will allow the modem to connect to the internet and a computer that is set up as an FTP server which can be accessed via the internet. The probe will make a connection to the internet at each upload interval, log in to the FTP server and copy the data files to the computer directory specified.

Sentek All-in-One probes with Satellite firmware* must have a satellite modem which is registered with the Iridium satellite network and it will also need an email account to which Iridium can forward the probe's data. At each upload interval, the probe will power the satellite modem, which searches for satellites and then sends an -Iridium SBD file containing the readings to the satellite. The satellite will forward the SBD file as an email attachment to the email address/es that are registered for that modem.

Note: The internet access and FTP server should be set up prior to assembling and installing the hardware.

Buying a SIM card and data packet plan for the modem

Each Sentek All-in-One system will require a SIM card for the modem. This SIM card must have a data plan associated with it and must have reasonable coverage in the area where the probe will be installed. This data plan is similar to what is needed for accessing the internet on your mobile (cell) phone.

It is not necessary to get a plan with cheaper voice calls, SMS rates, voice mail options or other such features, as the probe will only use the data features of the plan, thus the GPRS or NextG data part of the plan must be the cheapest aspect.

When sourcing the SIM card and data plan make certain of the factors detailed below:

No Session Fees

Every time data is uploaded to the internet from the probe the network provider may charge what is called a session fee or flag fall. For systems uploading frequently this can become very expensive.

A typical session fee is around 25 cents. If uploads occur every 3 hours (8 uploads/day) this would cost around \$60 per month, on top of data usage charges. Therefore, it is advised that a plan with no session fees be used.

Low Data Rates

To keep costs down, it is important when choosing a plan that you try to assess how much data you will be uploading, and how often you will be uploading it before choosing a plan accordingly.

Most data plans work in much the same way as a voice plan, costing a certain amount each month for a certain volume of data, and once this has been exceeded a charge for the excess data is applied.

Example plan:

- Base cost of \$5 per month
- No session fees
- 2,000 KB included per month
- 1 cent per excess KB

If 1,800 KB is used, this plan will cost \$5 per month, if however 2,200 KB is used in a month that month's usage will come to \$7.

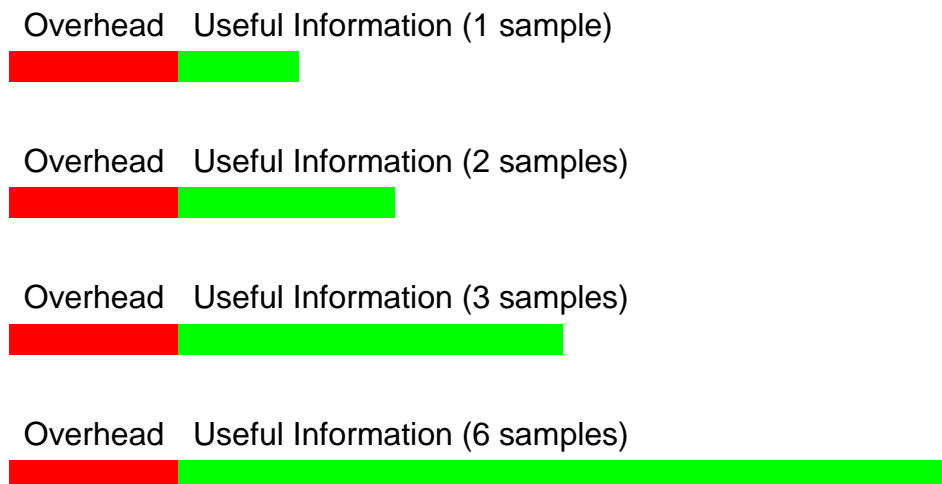
A probe logging every 15 minutes and uploading every 90 minutes will use roughly 1,000 – 1,500 KB each month.

Uploading less often (**which is recommended for power savings**) will reduce data usage more than sampling less often (within certain limits), however a system that samples every 30 minutes, and uploads every 3 hours would transmit half as much data as the system described previously.

Note: Due to variable coverage, internet congestion or other circumstances, uploads may fail. The data will be available after the next successful upload, but in areas where these issues occur, more frequent uploads may help ensure that data is accessible when required.

As every upload has a fixed overhead containing configuration information, it is advisable to maximise the number of samples per upload to reduce overhead data usage.

Table 1 Data Usage for different numbers of samples per upload



Naturally, the requirement for up-to-date data being available also needs to be considered. Sentek recommends that the All-in-One be set to sample every 30 minutes and upload every 3 hours. This gives a good balance between battery life and up to date data being available.

Data subscriptions are available with IrriMAX Live in some areas. Please contact your Account manager for more information.

Available Service

When choosing a service provider you should make certain that GPRS or NextG coverage is available in the area that you intend to install your system. It may also be useful to check the quality of service available. Unfortunately this is something that can

only be determined using local knowledge, as service providers' estimates of their coverage are often overly optimistic, particularly in rural areas.

Hosting Set-up and Recommendations

When choosing or setting up a web server, there are a number of requirements that should be considered. These are outlined below.

FTP Server

It is essential that the host server support FTP access using port 21. FTP is the protocol used by the probe to upload data to the internet and without it the system cannot function. Port 21 is standard for FTP on the internet, and very few servers do not use it.

Fixed Address

Because the probe stores the address of the server in its internal memory the address for the server must be fixed. The server address should be associated with a static IP address or a domain name as it is essential that the address does not change or the probe will need to be reconfigured each time a change occurs.

Supporting Multiple Users

It is important that a server supports multiple users connecting at a time. It is possible in the case of multiple probe owners that more than one probe will try to upload at once, or that one or more users may attempt to use IrriMAX Data Exchange to log on and download from the server whilst a probe is uploading.

Although uploads can be staggered using the sample origin setting (see section *Connecting External Antenna*), it is desirable that the chosen server can support multiple FTP sessions connected at one time and potentially more than one session at a time using the same log in username and password.

File Storage Limits

Whilst the total amount of data uploaded by a single probe is not significant, there are a number of factors that may increase the required amount of storage well beyond what is expected.

A single probe is unlikely to upload more than 2000KB of data per month to be stored on the server. Data Exchange can be set to remove files older than a configurable number of days (the default is 90 days).

However, the cluster size of the server must be considered - this is the minimum size each file counts as on the hard disk. On most servers, this will be 4 or 8KB. This would mean, for example, that a directory containing 1500 files of 200 bytes each, would count for approximately 5.9MB on a server with a 4KB cluster size or 11.7MB on one with an 8KB cluster size, despite the total amount of data stored being less than 300KB. **A server may therefore require at least 20MB of storage space per probe, depending on configuration.**

The number of files allowed on a chosen FTP server may also cause problems. It is known that some servers restrict the total number of individual files to a maximum of around 50,000 or less, and many will truncate file lists at 2000 files.

A probe uploading every hour will produce 732 files in a month. Over 3 months, this amounts to around 2200 files. If the file list is truncated at 2000 files, even if Data Exchange is set to delete files older than 90 days, data from the most recent 8 days will appear to not be available to download, despite being on the server and the probe saying that it has been uploaded successfully.

Domain Registration

A static IP address can be used for the upload destination, but it is preferable to have an actual domain name.

When choosing between using a domain name or IP address, consideration must be given to the fact that when using an IP address, a change of this address will result in probes and download settings needing to be reconfigured, often on site by a trained technician.

When a server is attached to the internet it is given what is called an IP address. An IP address is a unique number to identify a machine connected to the internet - for example the original Sentek FTP server at <ftp.enviroscanplus.com> had an IP address of 72.9.224.170, but this has now changed. Provided that it is static (i.e. permanently assigned to that server), it is possible to configure a Sentek PLUS system to upload to an IP address.

However, this can be difficult to remember and is prone to error. When choosing a server you should also ask the host company about registering a domain name for that server. This way when setting up probes and downloading data, a normal URL (web site address or name) can be used instead of an IP address.

Data Allowance (Bandwidth)

Most web hosting agreements include a limit to the amount of data traffic (bandwidth) a server can receive during a month. Most companies offer around 500 MB a month as standard. Unless the server is hosting an extremely large number of probes, or is likely to have a large number of users downloading the data, this should be quite sufficient.

Regular Backups

Whilst it is not essential, it is strongly recommended that the host of your FTP server has a good backup strategy. This should include daily backups and some form of off-site data store. All reliable hosting companies will have something like this.

HTTP

Irrimax Data Exchange has the ability to retrieve a directory listing and download the probe files over HTTP.

The main advantage of downloading over HTTP is that it is generally quicker when compared to FTP.

It should be noted that some servers, by default, do not enforce password protection for HTTP access, but can be configured with it. Also note that while some servers do not allow file alteration or deletion over HTTP, others do.

Note: FTP access is still required, as probes are only able to upload using FTP

HTTP is required for viewing Webified Irrimax data. Having HTTP and FTP access to the server allows for it to be used for uploading and viewing of both probe and Webify data. For more information about Webify, see the Irrimax Help.

Where to Buy

Numerous web hosting providers are available that offer packages that are suitable for use with Sentek PLUS. Due to the nature of the internet it is not essential that the hosting company be based in your home country. Many US based companies offer very competitive deals.

Alternatively, with your own IT support you can set up your own server machine to host the data. Provide your IT support person with this section of the manual when asking them to set up the server.

Satellite firmware – Creating an email account

Sentek PLUS (Satellite firmware) probes require an email account for the probe data to be forwarded. The emails must be on a POP mail server which is accessible to the PC on which Irrimax will be downloading the data.

Where to buy

Some distributors may have their own mail servers with a personalised domain name. In this case the IT support person responsible for managing this mail server should be contacted and asked to create the new account/s. Remember to request the POP server address, account user name and password and information on whether SSL connection is needed.

Alternatively, there are many free mail account providers, such as Gmail, Yahoo and Zoho Mail which can provide the service needed. These accounts can easily be set up online and IrriMAX download settings be viewed in the providers' settings area of their web site.

How many email accounts are needed?

There is no limit to how many probes' data can be stored in one email account, however it is recommended that careful consideration be given to how many accounts will be required and what the addresses will be.

For example, consider that each PC downloading the data will require the mail account password and will have access to all emails in that account. So it would make sense to have a minimum of one account per customer or farm/site manager.

The total number of emails in the account inbox will only make a noticeable difference to the download speed the first time a Windows user downloads the data. Emails are cached on the user's PC after each download to save having to download old emails again.

Storage

The email account will need a minimum of 1MB of storage per probe. This would be sufficient for approximately one years' worth of data. However, Data Exchange will automatically delete emails older than 28 days.

The size of storage required in the email account will depend on the number of probes uploading into it, the value stated above is a guide only, but would be enough for a probe uploading relatively large amounts of data.

Backup

For extra data security, it is recommended that emails be forwarded to a second 'backup' account that is not used for downloading data. IrriMAX will automatically delete emails from the account that are older than 28 days (at the time of download).

Satellite firmware – Registering modem with Iridium

The Sentek PLUS (Satellite firmware) probe will send data to the satellite in the form of an Iridium SBD file. This file will only be forwarded on as an email attachment if there is an agreement in place with Iridium to do so. The Iridium network will identify the files by the modem IMEI. The modem IMEI must be matched to an email address in a contract with an Iridium reseller.



Figure 3 Satellite Modem IMEI number location

Sentek currently has an agreement with an Iridium reseller which allows distributors to easily and cost effectively set up data forwarding contracts for their modems. Sentek distributors can request a copy of the partially completed order form from Sentek. This is the registration method recommended and supported by Sentek.

Alternatively, a distributor may arrange their agreement with an Iridium reseller, but Sentek is not obliged to provide assistance with this.

Note:

Sentek have a data estimation program that can calculate approximate expected monthly Satellite fees based on number of sensors and the upload interval. Please contact Sentek Technical Support for further information.

SENTEK PLUS ALL-IN-ONE AND COMPACT DTU SETUP

The Sentek All-in-One uses a modular plastic holder which is capable of holding various different modems. Below in Figure 4, this shows complete All-in-One internal plastic holders which have been configured as GPRS, 3G/NextG & Satellite.

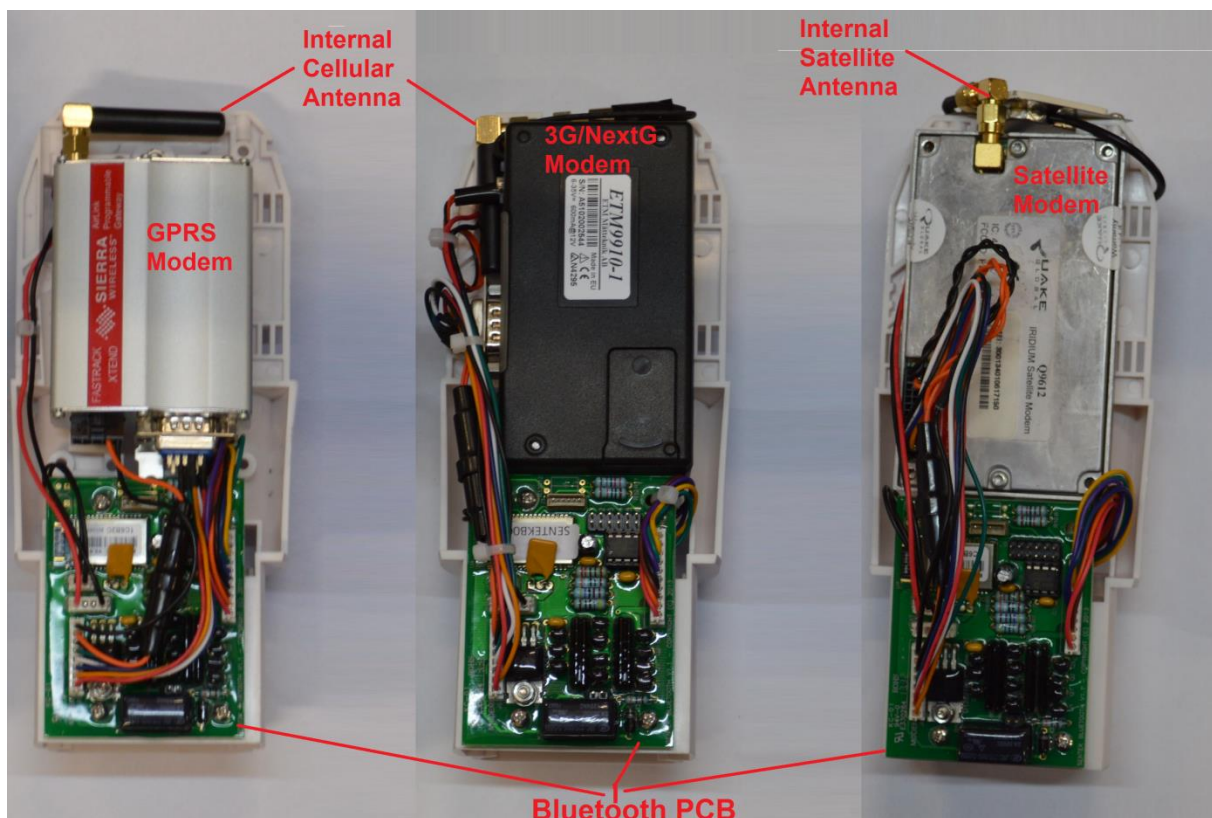


Figure 3 Sentek PLUS All-in-One (GPRS, 3G/NextG & Satellite)

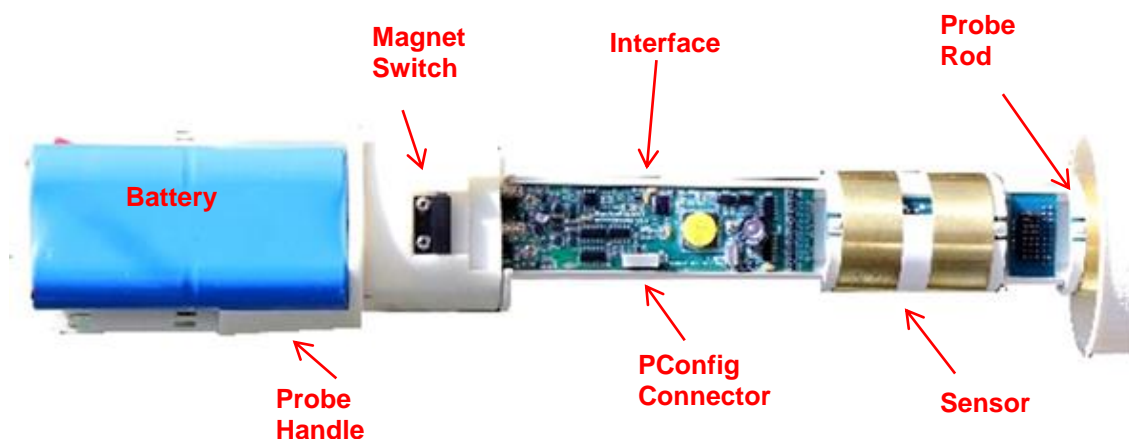


Figure 4 All-in-One connected to an EnviroSCAN Probe

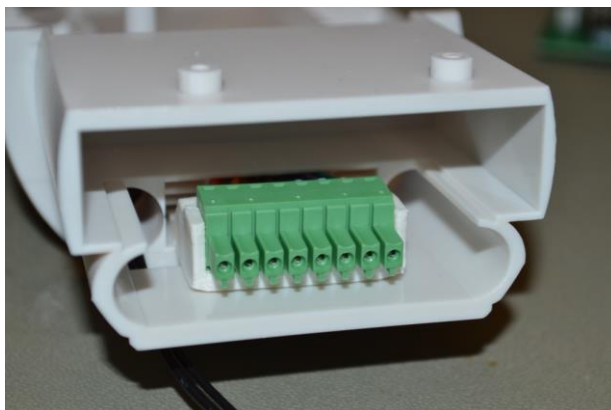


Figure 5 Probe connector All-in-One

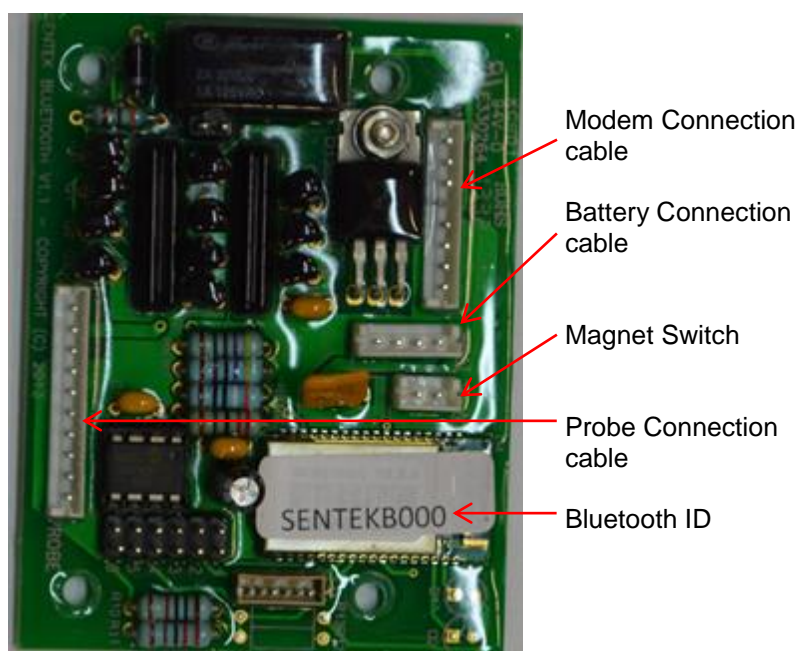


Figure 6 Bluetooth board and connections

Note: All cables are pre-manufactured and plug into connectors

SENTEK ALL-IN-ONE PROBES

Introduction

Sentek All-in-One probes are configured using the Sentek software Probe Configuration Utility (PConfig) version 1.9.1 or later. The most recent version of PConfig is always available for download on the Sentek website. This hardware manual should be used in conjunction with the PConfig Help file.

EnviroSCAN Screw Cap probes can be used in a Sentek PLUS All-in-One system.

The Sentek All-in-One has been designed with the Sentek upgrade path in mind. It has built on the Modular type design of the EnviroSCAN probe, allowing rapid cost effective upgrade from Diviner or Solo sites to continuous data offered by the Sentek All-in-One.

Sentek EnviroSCAN Sensors

The Sentek All-in-One is compatible with all EnviroSCAN sensors such as Moisture, TriSCAN and Temperature and Humidity sensor. Moisture and TriSCAN sensors have been in use for many years now providing best in class measurement accuracy, and have been independently verified by numerous published research papers.

The Temperature and Humidity sensor has been a new addition to the Sentek sensor lineup, and gives accurate temperature measurements at the depths they are installed. The humidity measurement is used to track the humidity inside the access tube to help ensure the probe has been installed correctly. It will alert the user to potential excess moisture problems within their probes.

Assemble and Normalise

1. Assemble EnviroSCAN probes according to the EnviroSCAN Screw Cap assembly guides and as demonstrated during official distributor training. No assembly is required if a Complete All-in-One probe is purchased.

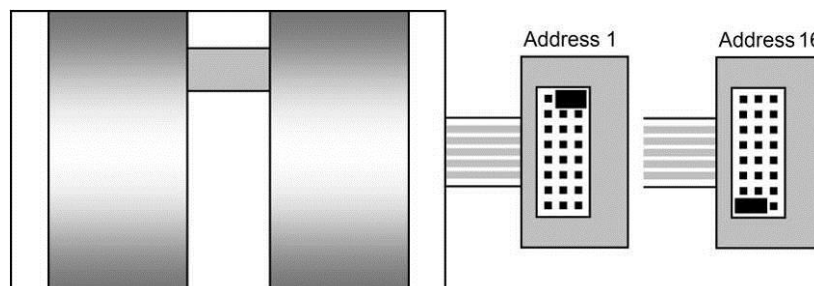


Figure 7 EnviroSCAN Moisture/ TriSCAN sensor addressing

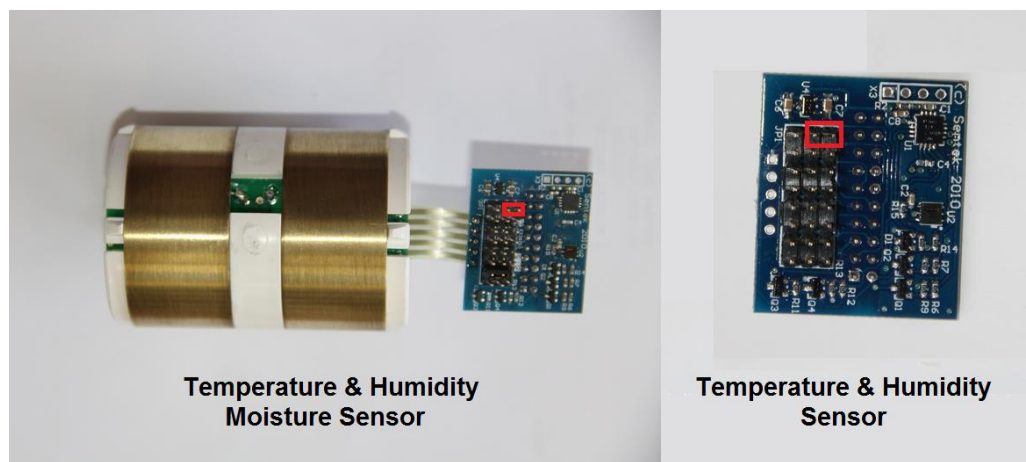


Figure 8 EnviroSCAN Temperature & Humidity Sensors (Showing address 1)

2. Use PConfig to normalise each sensor on the probe. For detailed normalization instructions, refer to the “Normalizing the Sensor Air & Water Counts” section of the PConfig Help file. More basic step-by-step instructions can be found further down in the section *Connecting External Antenna*.
3. Temperature and Humidity sensors do not require calibration/normalization.
4. Label the probe and save back-ups of the normalization on your computer.

Install access tube and the probe

1. Install access tube as per the Sentek installation manuals and as demonstrated during official distributor training.
2. All-in-One probes are available in Standard install (undisturbed) and Slurry installation methods.

Probe Cable

Red
Orange
Brown
Black
Blue
Purple
Green
Yellow

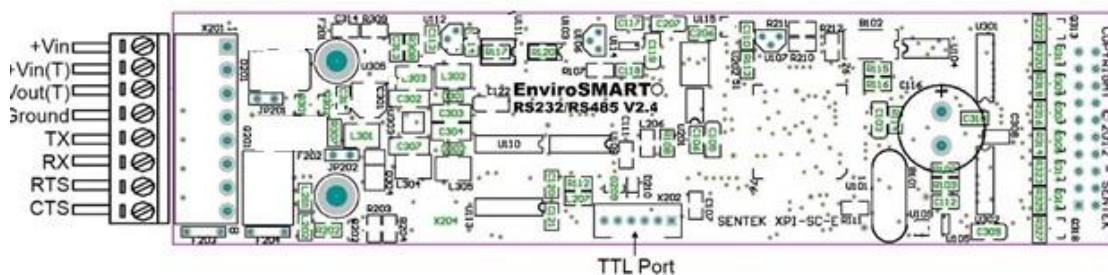




Figure 11 External Antenna connector

The patch cable can be routed through one of the two holes in the internal plastic holder or around the holder whichever is easier. This can then be connected to the antenna cable on the installed modem.

Note: The connector must be disconnected from the modem prior to removal of the plastic internal holder. The internal antenna patch cable must be clear of the sensors as the probe rod is removed. Failure to do this will cause the antenna cable to be damaged.

Compact DTU Installation

1. Install Sentek RS232 Probe into the ground (EasyAg, EnviroSCAN Flat cap, Drill & Drop Installation guides)
2. Install Plus Compact DTU into the ground so that the access tube is in the soil and the DTU is stable in the soil. This can be done using a 56mm auger from an EnviroSCAN installation kit, or using a hand trowel. Please ensure the distance between the DTU and probe is less than 6 meters (20ft) so that the cable is long enough.



3. Connect the probe cable connector ensuring they are clean and free of any Dirt or debris.
4. Connect battery to internal Plastic holder
5. Slide the internal plastic holder into DTU Compact ensuring it is lined up correctly.
6. If the unit is fitted with an internal antenna ensure that this is fitted and tightened adequately. If it has provision for an external antenna ensure this is connected to the modem antenna connection.

7. Check cap to see that the seal is free of any dirt, apply a coating of silicon grease to seal.
8. Place cap on Compact ensuring the cap has locked onto the lugs correctly.
9. If using an external antenna ensure the antenna of extension cable is tightened onto cap.

CONFIGURING THE PROBE WITH PCONFIG

Introduction

Caution:

Drill & Drop probe come preconfigured sensors and normalized, so you should backup the configuration before making changes.

Before installing a Sentek All-in-One system in the field, the probe must have the following configured:

- number of sensors detected and depths set
- air and water counts normalised
- sampling interval set
- clock synchronised
- Internet Destination URL
- Sentek All-in-One specific settings (explained in detail below)

Some applications may also require configuration of the Calibration Equation constants and Power settings, although the default settings are usually sufficient.

Each of these procedures will be explained in the order that they should be performed. Additional information can be found in the Probe Configuration Utility manual.

Connecting to probe

The Sentek probe can be configured the using the probe interface TTL port. Ideally this would be done prior to installing the in the field. Once the probe is installed the Bluetooth connection can be utilised to check and test the probe. PConfig with laptop Bluetooth gives full functionality. The Android App can be used to query sensors and adjust the time and perform Modem test upload.

Note: The USB Probe Programming Cable for Drill & Drop probe has a different connector

The USB Probe Programming Cable (PConfig Cable) is used to communicate through the TTL port. Drivers for this cable must be installed before the cable is connected to the computer. Instructions on how to install the cable drivers can be found in Sentek Technical Brief TB069-PConfig USB cable driver installation instructions.

1. Use the Probe PConfig Cable to connect the TTL port of the interface to your computer.
2. Open PConfig,
3. Select the serial port that has been assigned to the cable
4. Select the baud rate of the interface TTL port (default = 9600)
5. Ensure that the Battery is connected and press **Connect**. The PConfig software should now establish communications with the probe.

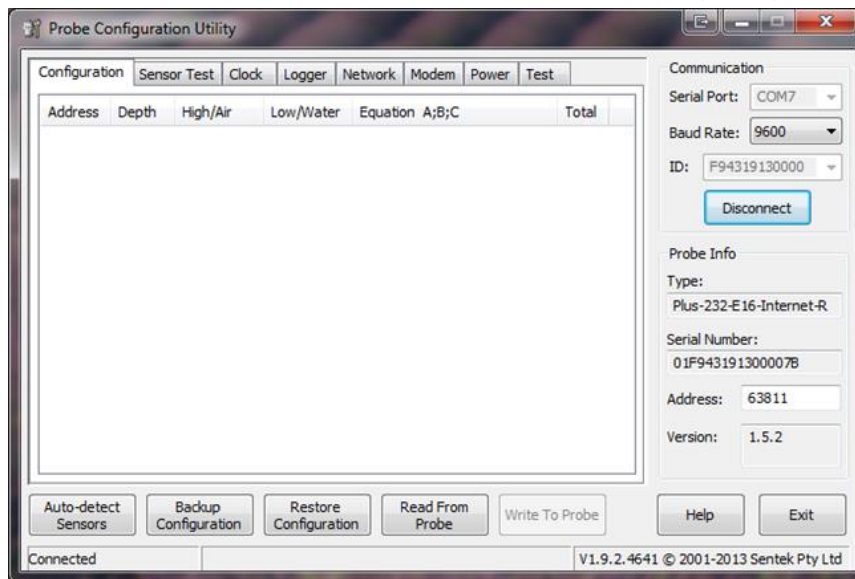


Figure 12 PConfig connected to probe with default settings

Configuration page

Caution:

Drill & Drop probe come with sensors preconfigured and normalized so Auto-detect Sensors, setting depths and normalization is not required.

1. Use the **Auto-detect Sensors** button to populate the sensor list in the Configuration page.

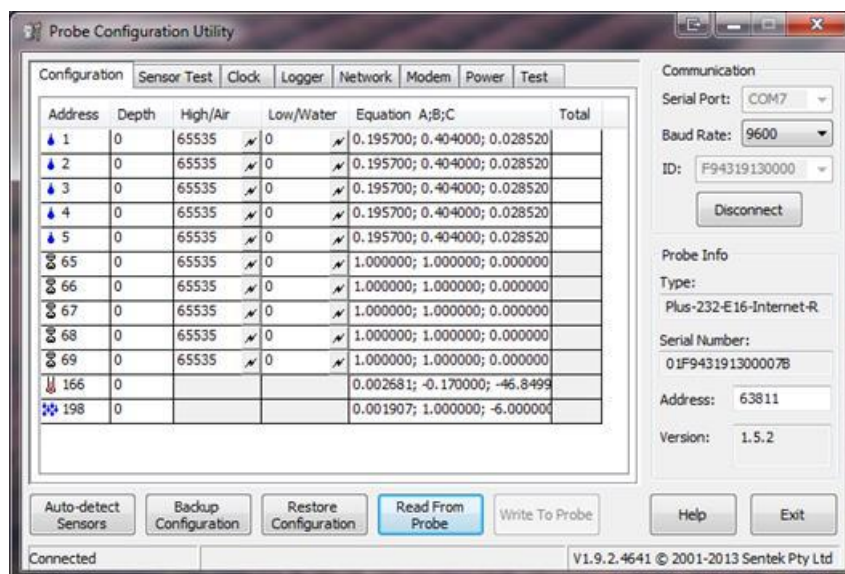


Figure 13 Auto-detected sensors

2. Set the depth of each sensor by clicking inside each cell within the Depth column and changing the number by either clicking the up and down arrows or by typing it on the computer keypad. Sensors with addresses from 65 – 80 will automatically update depths once all other configuration information has been entered and written.

Note: TriSCAN sensors display as two sensors in the Configuration page. The moisture sensing function will be addressed according to the jumper settings on the sensor (i.e. 1-16). The VIC function also depends on the physical addressing of the pins, but range from 65 to 80 (where physical address 1 = 65 and 16 = 80)

Temperature and Humidity Sensors when supplied with Moisture or TriSCAN sensors will take the sensor depth of the sensor. If a sensor is standalone, the depth will need to be set. The temperature and humidity sensors do not need to be calibrated/normalised. Temperature sensor addresses start at 161, Humidity Sensors start at 193.

Configuration *						
Sensor Test Clock Logger Network Modem Power						
Address	Depth	High/Air	Low/Water	Equation A;B;C	Total	
1	10	65535	0	0.195700; 0.404000; 0.028520		
2	20	65535	0	0.195700; 0.404000; 0.028520		
3	30	65535	0	0.195700; 0.404000; 0.028520		
4	40	65535	0	0.195700; 0.404000; 0.028520		
5	50	65535	0	0.195700; 0.404000; 0.028520		
65	0	65535	0	1.000000; 1.000000; 0.000000		
66	0	65535	0	1.000000; 1.000000; 0.000000		
67	0	65535	0	1.000000; 1.000000; 0.000000		
68	0	65535	0	1.000000; 1.000000; 0.000000		
69	0	65535	0	1.000000; 1.000000; 0.000000		

Figure 14 Setting depths

- To obtain the High (Air) counts for each sensor; place the probe inside its access tube. Then ensure that there are no obstacles (i.e. hands, cables, soil, tables etc.) within the sensor's sphere of influence (keep >20cm radius clear) and click on the header row of the High/Air column so that the interface takes a reading from each sensor.

Note: Alternatively, the Air counts can be taken one sensor at a time by clicking on the lightning bolt next to each sensor

- To obtain the Low (Water) counts, fill your Normalization Container with water, slide the probe into the access tube until the first sensor is in the middle of the container. In the Low/Water column click on the lightning bolt in the corresponding row of the sensor being read. Repeat for each sensor, and remember to take a water reading for both moisture and VIC when normalizing TriSCAN sensors.

Important: VIC water counts must be taken in reverse osmosis (RO) water (EC less than 300 μ S/cm-1). Always normalise sensors under the same conditions to ensure maximum repeatability.

Configuration						
Sensor Test Clock Logger Network Modem Power						
Address	Depth	High/Air	Low/Water	Equation A;B;C	Total	
1	10	40104	20108	0.195700; 0.404000; 0.028520		
2	20	40124	20119	0.195700; 0.404000; 0.028520		
3	30	40131	20124	0.195700; 0.404000; 0.028520		
4	40	40136	20127	0.195700; 0.404000; 0.028520		
5	50	40140	20129	0.195700; 0.404000; 0.028520		
65	10	24700	8101	1.000000; 1.000000; 0.000000		
66	20	24822	8307	1.000000; 1.000000; 0.000000		
67	30	25203	8211	1.000000; 1.000000; 0.000000		
68	40	24991	8299	1.000000; 1.000000; 0.000000		
69	50	24850	9010	1.000000; 1.000000; 0.000000		

Figure 15 Air counts and then Water counts

5. If required, enter custom calibration coefficients for each moisture sensor. Each coefficient should be separated by a semicolon (i.e. A;B;C). See the Calibration Manual for more information.
6. Save (write) these settings to the probe by clicking **Write to Probe**. The Configuration page is complete

Clock page

1. Click on the Clock tab to display the clock settings. Decide how often the probe should take a reading and set the desired sampling interval accordingly.
2. Set the probe clock to the desired time (usually probe local time) by either typing it in or synchronizing it with your computer clock.

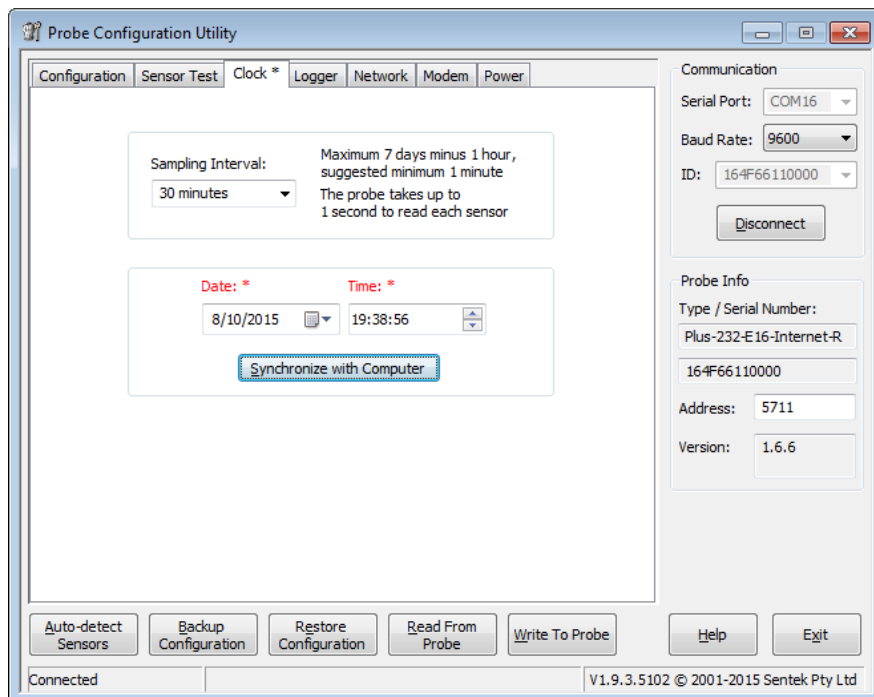


Figure 16 Clock page

3. Write to Probe

Logger page

In PConfig versions earlier than 1.8.1, the “Logger” page was named “Plus/Solo”. If the “Logger” page does not appear when you are connected to the probe, either you do not have the latest version of PConfig, or the interface does not have the correct firmware loaded on it.

1. Click on the **Logger** tab to display identification, uploading, and modem communication details.
2. Type in a **Logger ID** specific to the probe so that the data can be identified later. This name is used to supply the IrriMAX database Logger ID. The default is the probe's serial number. The logger ID can be up to 16 alpha-numeric characters and underscores and cannot contain any spaces.
3. Set your desired **Sample Origin**. This determines when the first reading will be taken by the interface. All subsequent readings will use the Sample Origin as a starting reference. i.e. if the Sample Interval is 1 hour, and the Sample Origin is midnight, but the probe is only switched on at 7:05am, the first reading will occur at 8:00am, then 9am, 10am etc.

Note:

When you have many probes accessing a single mobile/cell phone tower, it is useful to stagger the Sample Origin across the probes by 5 minutes each to prevent congestion, if all probes try to upload at the same time.

4. Set the **Sample Count**. For a Sentek All-in-One probe, this is the number of samples taken before an upload is initiated. A value of zero disables the upload process. For information on minimizing data costs, see the section *Buying a SIM card and data packet plan for the modem*.
5. Dial-in is disabled (Uptime set to 0) with the All-in-One probe. If enabled this will cause the probe to prematurely flatten the battery.
6. To complete the **Destination URL** field, click on the **Edit** button and enter in the FTP server details. Alternatively, the full URL can be typed in without going into Edit. The format of the URL is:

ftp://<user name>:<password>@<host/Internet address>/<url-path>

Your FTP server administrator should provide this information. If the URL is blank the upload process is disabled. For more information, see the section *Hosting Set-up and Recommendations*.

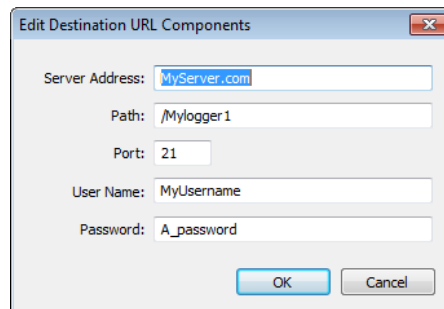


Figure 17 Edit screen

7. Set the **Connection Timeout**. This is the maximum time (in seconds) allowed from the start of an upload until communications with the FTP server are established. If this time is exceeded the upload attempt is abandoned. The default of 60 seconds is generally sufficient. Altering the Network settings may affect this.
8. Set the **Response Timeout**. This is the maximum time in seconds before the probe abandons waiting for a reply confirming that data has been transferred to the server. The default of 30 seconds is generally sufficient, but some connections (e.g. slow server responses) may require a larger value.
9. Set the **Baud Rate** and **Parity** to match the modem port communication settings. GPRS and NextG Modems supplied by Sentek are preconfigured to the default of 9600 baud and no parity, the probe settings must match this for them to communicate with each other.
10. Press the **Delete Readings** button to delete any unwanted data that may have been recorded before the probe was installed.

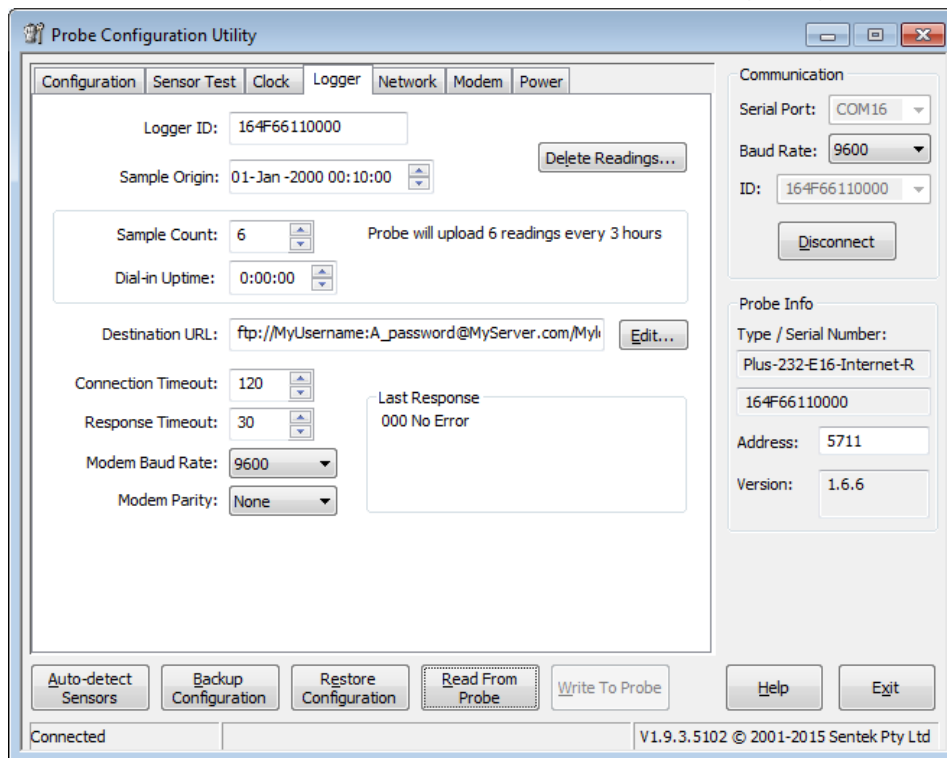


Figure 18 Completed Logger page

11. Write to Probe

Note: the Last Response field is explained in section *Appendix D – PConfig Response Fields*.

Network page

Caution:

Sentek probe Network settings come preconfigured for the type of modem ordered. Those setting should only be changed when modem is changed or special phone network changes are needed.

The Network settings page contains command strings needed to prepare the modem, connect to the internet and shut the modem down properly.

The Network Access fields allow entry of a Username and Password if this is required by the mobile network service provider.

The Command Strings fields dictate the communications sent between the probe and modem. The fields on the left contain commands that will be sent to the modem (AT... commands), as well as command switches that control the behaviour of the probe (\... & |). The fields on the right are the responses expected from the probe. When a Response from the modem matches any of the expected responses the probe will move to sending the next command.

For more information on the upload process and how the Network settings are used, see section *Appendix B – Network page explained*.

1. Ensure that you are using the latest available Network settings for the modem that is on the DTU.

Note: Latest Network settings are available on the official Sentek web site underneath the PLUS product category in the Downloads section.

Distributors will be notified whenever there is a change made to the recommended settings and are encouraged to keep copies of each settings file on their field computer.

- Ensure that you have written any unsaved changes to the interface and then press the Restore Configuration button at the bottom of the screen.
- Browse to the folder on your computer where you have saved the Network configuration files.
- Select the file which matches your modem and press Open. The files will be named by the modem type and have the file extension “.cfg”.
- PConfig will display a warning, saying that there are no sensors in the configuration file, press OK.

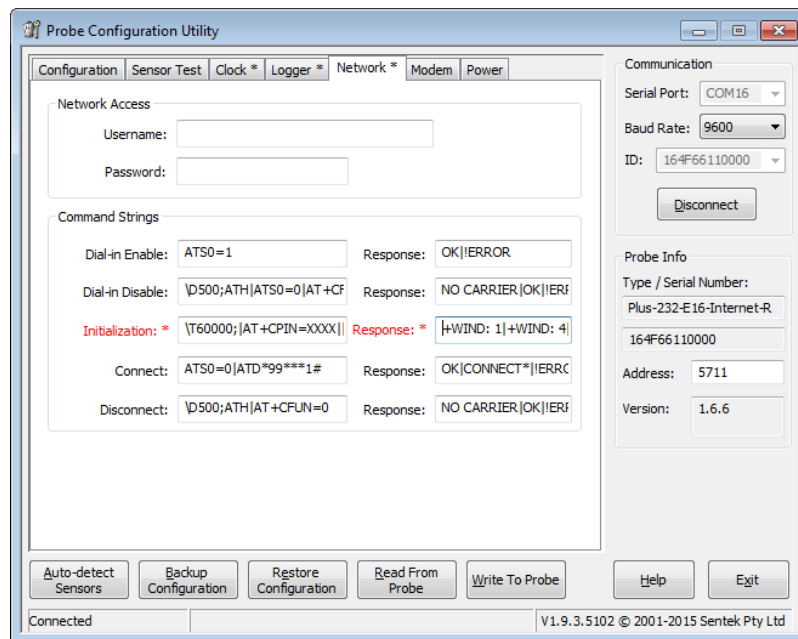


Figure 19 Network settings (with SIM Pin number)

- If there are any changes, **Write to Probe**.

Power page

- Click on the Power tab to display the power related settings on the interface.

Operating Thresholds do not need to be changed from the default values. For advanced users, each field is explained below.

Disable Probe is the voltage at which the probe will shut down and stop logging.

Enable Probe is the voltage at which the probe will start up and begin logging again, after the voltage has previously dropped below the Disable Probe level.

Disable Telemetry is the voltage at which the probe will stop attempting to use the modem.

Verifying Probe Configuration with Sentek Android App

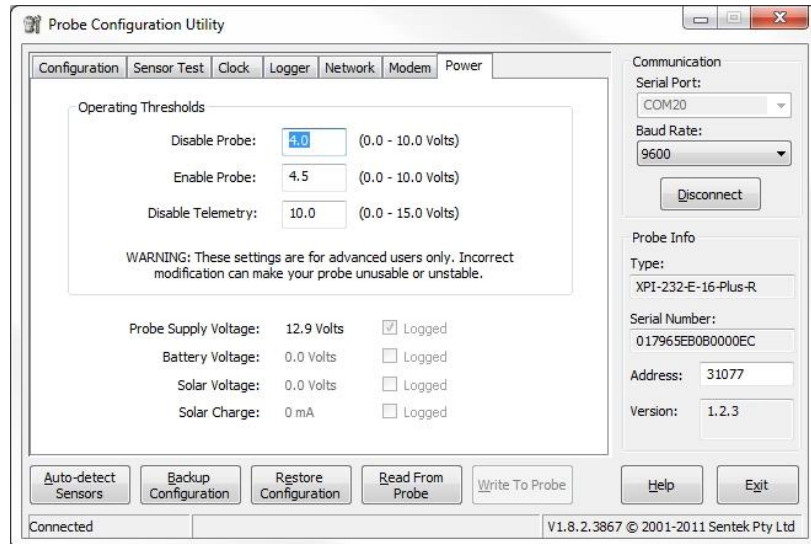


Figure 20 Power settings

2. If there are any changes, **Write to Probe**.

VERIFYING PROBE CONFIGURATION WITH SENTEK ANDROID APP

Note:

See the *Android Probe Utility App User Guide* for App installation steps. It is also possible to use a laptop that has a Bluetooth interface See *Appendix G - Configuring the Probe using Bluetooth on a Laptop*.

Once the App is installed the following screens are available:

- Start Sentek App
- Scan for Devices
- Information summary
- Sensor Test (retrieve sensor configuration and Query All Sensors)
- Clock
- Modem Upload and Test

You can navigate between screens using the App function buttons and the Back button. The Home button can also be used to suspend viewing the App. You then re-enter the app by tapping the App icon.

Start Sentek App Screen

After installing the App, your list of All Apps will have the icon for the Sentek App. Tap this App and the Start screen will appear.

Note: If you press **Home** while the App is running, you can re-enter the app by tapping this icon again.

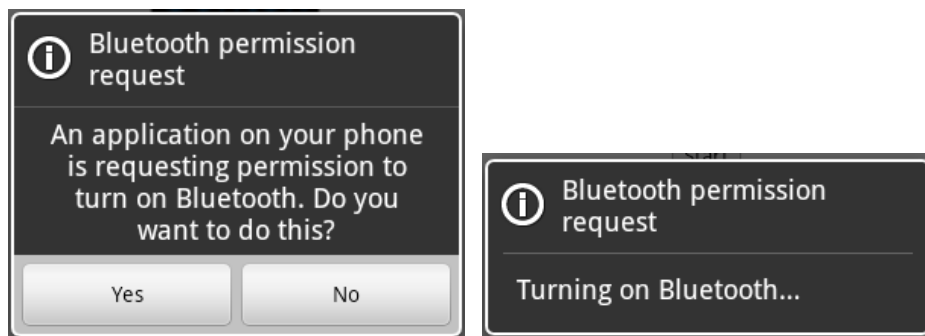
Verifying Probe Configuration with Sentek Android App

**Figure 21 Android App Home Screen**

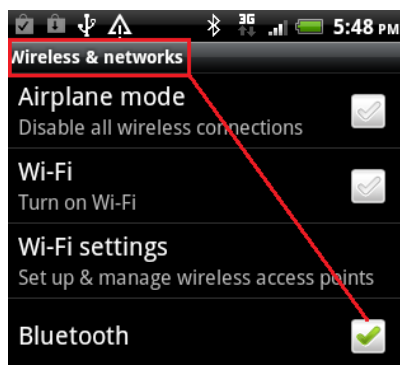
Tap **Start** and the Scan for device screen appears. You may need to tap Yes to turn on Bluetooth.

Caution:

Enabled Bluetooth may shorten the time before a battery recharge is necessary.

**Figure 22 Bluetooth settings**

Later you can disable Bluetooth from the Settings App by untick/disable Bluetooth.

**Figure 23 Enabling Bluetooth**

Scan for Devices Screen

This screen appears after you tap Start. This app does not require pairing of devices and only displays Sentek devices.

Note:

After activation the Bluetooth module internal buzzer sounds until a successful connection is made.

Turn on the All-in-One Bluetooth module by touching the magnet torch for one second to the All-in-One top cap. The activation point is above the red plug or external antenna point (see *Figure 24 All-in-One Magnet switch position*). Until the Bluetooth module is connected an internal buzzer sounds (it will wait 2 minutes for a connection).



Figure 24 All-in-One Magnet switch position

After approximately 10 seconds tap **Scan for Devices** and all Sentek probes (within range) will appear on the screen.

Note: You can setup a paired device for all of your probes but this may result in unnecessary scrolling to find the correct probe.

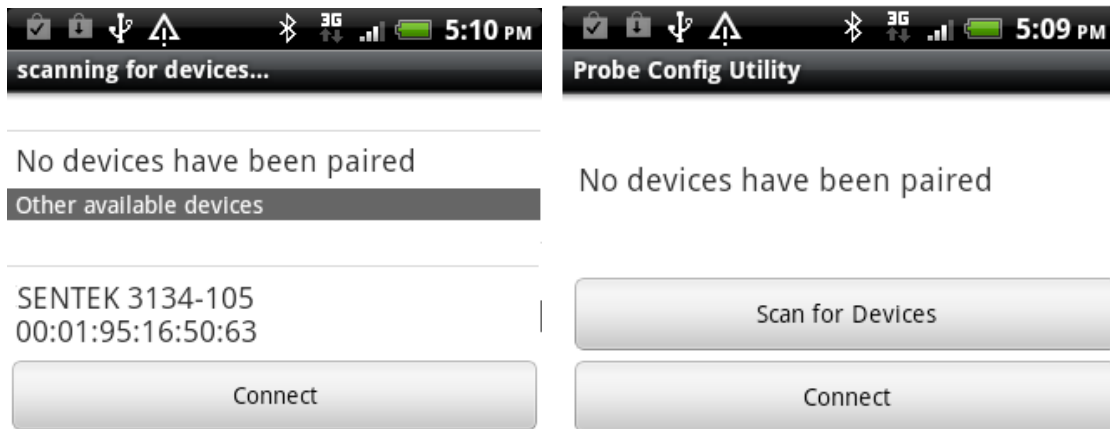


Figure 25 Pairing with an All-in-One Probe

Tap the desired probe name then tap **Connect**. The Information screen will appear, with a quick message similar to this:



Figure 26 Connection Successful prompt

Note: If this message does not appear, tap **Back** and again tap **Scan for Devices**.

Information screen

This screen displays information held in the probe. It also has three buttons to navigate to the other functions of the App.



Figure 27 Probe Utility information screen

The information displayed is preconfigured by Sentek and cannot be changed without PConfig. It is important in trouble shooting problems.

Type

All-in-One probes have the same type

Serial Number

Unique serial number of probe, not to be confused with Serial number label on the Interface

Version

Version of the firmware in the probe

Logger ID

This name is used to supply the Irrimax database Logger ID. The default is the probe's serial number.

Sample Interval

Time between readings taken by probe (typically 15 minutes)

Upload Interval

Time between uploads to the internet (typically 1 to 3 hours)

Next Sample Time

Time of the next reading.

Caution:

Automatic scheduled samples and uploads do not occur while the App is connected to the probe. If a scheduled sample interval occurs while the App is connected the sample will not be taken and an invalid reading (gap in the graph) will be recorded. Sampling will not reoccur until at least 60 seconds after the App is disconnected.

Next Upload Time

If the App is still connected at this time the upload will not occur and the upload will not occur until the next sample time

Note: This value may be offset (sample origin) by a few minutes from other local probes, to prevent congestion caused by multiple probes uploading to the Internet at the same time.

Pressing **Back** button from this screen terminates the App, with the quick message:



Device connection was lost

Figure 28 Connection lost prompt

Tapping the **Sensor Test**, **Clock** or **Modem** buttons take you to those appropriate screens

Sensor Test Screen

This screen initiates the retrieving of sensors in the probe then allows querying of all sensors. It is similar to the Sensor test tab in PConfig.

Verifying Probe Configuration with Sentek Android App

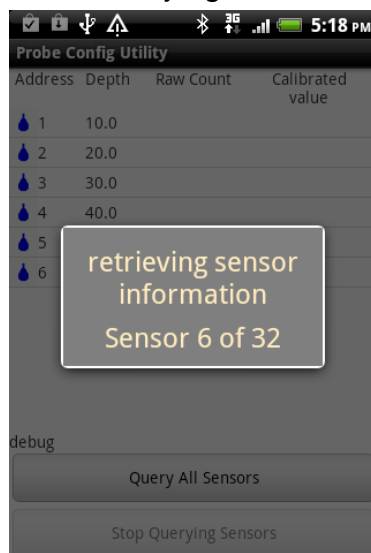






Figure 29 Sensor test tab

The table contains four columns of information for all sensors in the probe. Sensors are displayed in the order of each sensor type then depth within each type.

Sensors symbols and addresses:

-  Moisture sensor addresses start at 1
-  TriSCAN Salinity sensor addresses start at 65, they are linked to corresponding moisture sensor at same depth
-  Temperature sensors start at 161
-  Humidity Sensors start at 193

Sensor Depth

- Multiples of 10cm
- Depth of zero for moisture or salinity mean that the sensor was incorrectly configured by PConfig.
- Raw count
- Updated about once per second while Query All Sensors is active
- Correctly operating when value is not zero and not 65534 or 65535)

Calibrated Value

- Updated about once per second while Query All Sensors is active
- Correctly operating when the value is not zero and not "Invalid"
- Value of "invalid" when in soil indicates the sensor is not operating correctly, or sensor was incorrectly configured by PConfig.

Note: You can drag to scroll the sensor list if there are more sensors than will fit on one screen.

The two buttons Query All Sensors and Stop Querying Sensors, start and stop sensor querying respectively. During sensor querying the raw count values and moisture values are continuously retrieved from the probe and displayed in the list.

Press the Back button to return to the Information screen.

Clock Screen

The clock screen shows the probe's date and time.

Verifying Probe Configuration with Sentek Android App

The probe's time/date and the Android time/date should be within a few minutes of the current local time. The Android time is shown at the top of the Android screen in the indicator items area.

If the times do not closely match, tap the **Synchronise with Device** and the probe time will be within a few seconds of the Android's.

Caution:

The probe's time may be wrong if it has been unpowered for an extended time (about 1 week).



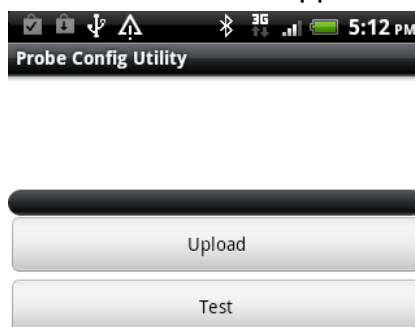
Figure 30 Time tab

Press the **Back** button to return to the Information screen.

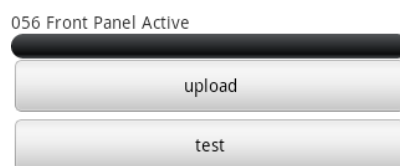
Modem Test and Upload Screen**Warning:**

In the App version 1.1 **Upload** and **Test** buttons cannot upload while the App is connected. They only tell the probe to schedule the test or upload, one minute after the App has been exited. The upload takes about 2 minutes or longer if a lot of data must be uploaded.

This screen appears when the **Modem** button is tapped on the Information screen.



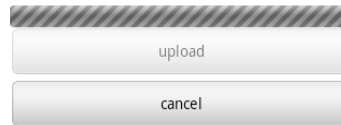
1. The result of any previous operation (App, PConfig or periodic upload) will appear above the progress bar.



2. Tap the **Test** button to schedule an upload of attest file. Usually the **Test** button is sufficient to confirm the Internet is accessible. Tap the **Upload** button to schedule an

upload of all reading currently in the probe.

While the **Test** or **Upload** button is in operation an animated progress bar shows the operation is still running.



Above the progress bar is the probe's last response:

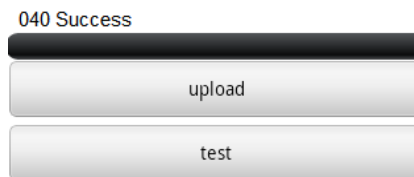
- 041 Success (No Data)
There is no data in the probe, so no upload of readings will occur (upload is not exercised, so use the **Test** button)
- 081 Deferred Upload [190s after disconnect]
The test or upload has been scheduled and will occur 1 minute after you exit the App. The upload will not be completed until at least 190 seconds (3 minutes 10 seconds) have passed.
- No server in probe
The probe has been miss-configured because the Destination URL field is blank. Use PConfig to correct the probe's URL

3. You must then press the **Back** button until the App exits and you get the message:

A screenshot of a dark grey message box with white text that reads "Device connection was lost".

4. Wait for the 190 seconds after this message.

5. Reenter the App and tap the **Modem** button.



Above the progress bar is the probe's last response:

- 081 Deferred upload
You reconnected before the upload commenced - go back to *step 3*
- 040 Success
The Test or Upload showed the probe successfully uploaded to the Internet.
- 053 Connection Failure(...) or Other numeric codes
The modem could not successfully upload to the Internet.
- Consult the Sentek PLUS Hardware Manual
When you find the probe is unsuccessful in uploading, you should contact the dealer who configured the probe or use PConfig to connect to the probe. The last response indicates the failure point in the communication process.

Press the **Back** button to return to the Information screen.

MODEM CONFIGURATION

The Modem page in PConfig is used to communicate with the modem, test the upload functionality, and manually upload any data that may be on the probe interface.

The steps below include instructions on how to configure the modem for your chosen service provider. To ensure smooth operation, these steps should be followed during every Sentek PLUS set up;

Note: Modems are programmed and tested in Australia. This testing can only be done with a local network service provider. Therefore modems are sold with settings specific to that service provider

1. Whilst still connected in PConfig, click the Modem tab to display the modem communications and upload options.
2. Click **Open Session** to initiate communications with the modem. This will power the modem and allow you to send communications directly to it. Commands can be sent to the modem by typing in the AT Commands field and pressing send. The commands will be echoed in the Modem Response field as well as any communications received from the modem. Sending a simple "AT" should get a response of "OK", indicating the probe can successfully communicate with the modem. Some messages will be preceded by a "*" - these are messages generated by the probe, during communication with the modem.

Note: Modems can take up to a minute after power up before they are ready to process commands. Sentek configured modems will display a message (i.e. +WIND: 4 for GPRS modem) when the modem reaches this stage of readiness.

Note: If a SIM is PIN enabled (that is if the modem requires a PIN upon start-up), the PIN must be entered in the modem before some commands are accepted by the modem. To enter the PIN, send "AT+CPIN=XXXX".

3. Set the correct frequency band for the service provider.
By default, Sentek supplied ETM modems are set to auto select, and should not need to be changed.
The GPRS modem is set with the command "AT+WMBS=n" (where n = the band select value). For all possibilities of "n", see section *Appendix A – Modem information*. For information about which frequency band to use, consult your service provider.
4. Set the service provider's Access Point Name (APN).
This is set with the command AT+CGDCONT=1,"IP",<APN>, where <APN> is replaced with the correct APN supplied by the service provider. For details about which APN to use, consult your service provider.

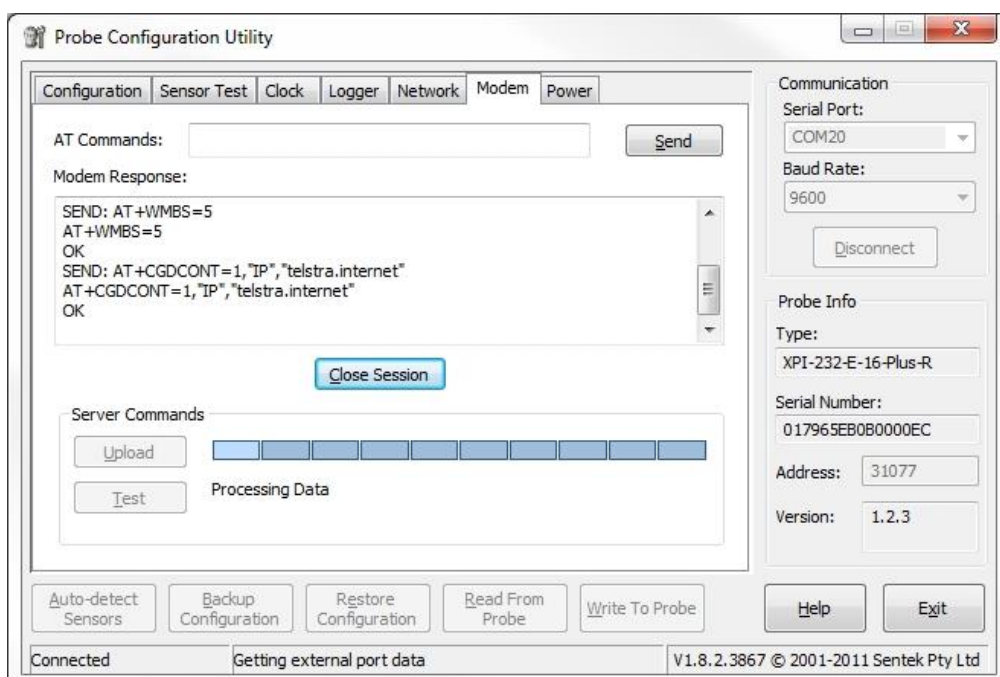


Figure 31 Sending modem settings (Response from a GPRS modem).

TESTING

This is the most important stage of the setup process. If successful it will indicate that all preceding steps have been completed correctly.

1. Whilst still connected in PConfig, test the operation of the Sentek probe sensors by clicking **Query All Sensors** on the Sensor Test page. With the probe correctly **configured and installed** there should be no INVALID readings for Calibrated Values of individual sensors (Ignore the "Total" column and "Total Moisture" row "INVALID VALUE" at the bottom).

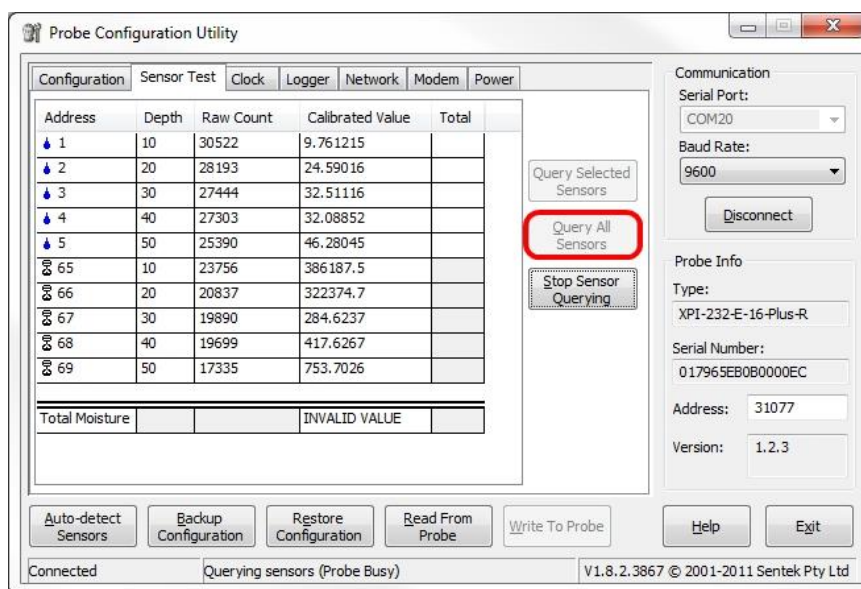


Figure 32 Sensor testing

2. On the Modem page, press **Test** to initiate a test upload. This will simulate an upload, but instead of sending data in the form of .esp files, it will send a .txt file to the server. The end response in the Server Commands field should be "040 Success". This test will check all settings related to the modem as well as communications between it and the probe.

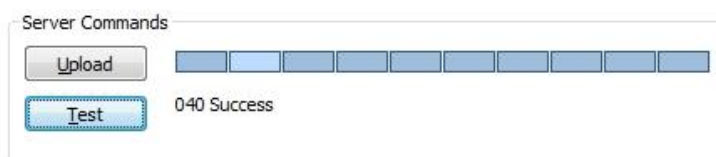


Figure 33 Successful Test

Note: when using Sentek **Satellite** firmware, "040 Success" only indicates that the file has been sent to the satellite. This does not guarantee that the file will be forwarded to the email server. See next section.

3. Create a backup of the probe settings on your computer by pressing the **Backup Configuration** button and then selecting a folder and file name for it. The backup will be saved with a ".cfg" file extension.

Caution: The backup files contain the destination URL and do not have any form of coding on the password. Please keep the files in a safe place if data security is a concern.

4. In PConfig, press **Disconnect**. Physically disconnect the cable from the DTU and shut the lid on the enclosure.

If setting up downloads and graphs on the customer's computer immediately after testing, it may be beneficial to upload any data stored on the probe to the server by pressing the **Upload** button. Any readings taken since the last upload (scheduled or user initiated) will be uploaded.

Note: Once readings have been uploaded to the FTP server, they are deleted from the probe memory.

VERIFYING TEST UPLOAD WAS SUCCESSFUL

Note:

This optional step requires IrriMAX and access to the Internet, so will probably be performed in the office. It confirms the end-to-end transmission of data.

Even if PConfig reported "040 Success" The data may not appear at the expected location. This can happen when:

- For Internet firmware: FTP URL in the probe does not match the Edit Sentek PLUS/Multi Server detail specified in Data Exchange
- For Satellite firmware: IMEI is not registered and linked to an email address by the Iridium reseller, or
- Sentek PLUS/Multi (Satellite) source email parameters are wrong for POP Server, User, Password and Logger ID in Data Exchange.

Internet Upload verification

1. In Data Exchange select Source "Sentek PLUS/Multi", then select Server & Path previously setup for this probe, or set it up now to match the destination URL in PConfig.
2. Click "Server Files". Inspect the list of ".txt" files and find the one for the appropriate Logger Id, and optionally click "Get...".

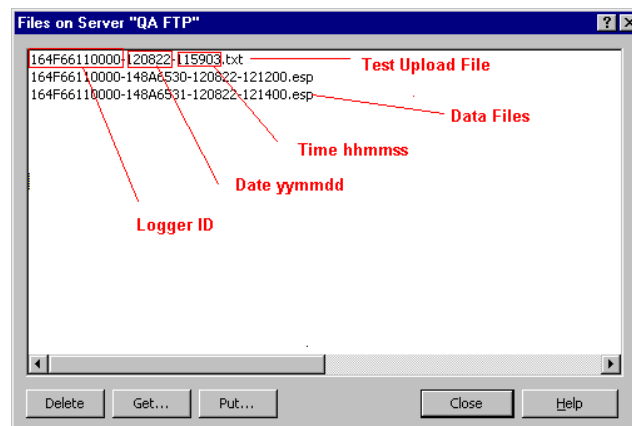


Figure 34 Get Server files

3. If the expected filename (<logger Id>-<yymmdd>-<hhmmss>.txt) is not present, check the URL in Data Exchange against the URL in the saved PConfig file from Backup configuration.

Satellite Upload verification

1. In Data Exchange Select Source "Plus/Multi (Satellite)", enter the email account details, and in the Logger Id field Select "Get List....".
2. The appropriate Logger Id should appear.

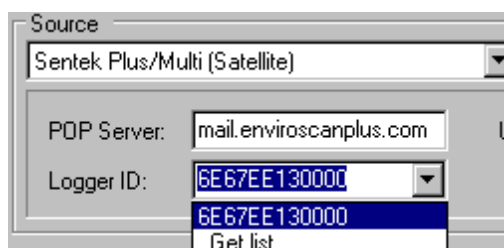


Figure 35 Logger ID screen

3. Select an appropriate Destination and Click Start to run a download
4. If the Logger Id is not present in the list box or not in the Data Exchange Log file, check the Data Exchange POP server details match the email details registered with Iridium.
5. When the download completes there should be a Test upload message, in the log file (default is DEX.Log). View Data Exchange log file for a message confirming "Last Response: 040 Success Connection". e.g.

```
2012-07-11 18:38:12 300134010219510_003700.sbd - Logger ID:
6E67EE130000 Board ID: XEPI-485 (16/SAT) (RMT) Version: 1.1.5
Build: Apr 20 2012 12:00:28 Serial: 6E67EE130000 Last Response:
040 Success Connection: +CSQ=05
```

VIEWING DATA

At this stage data should already be uploading, in the form of ".esp" files, to the ftp server specified in the probe configuration. To view the data it must first be downloaded to a local drive available to the computer. This is done using the IrriMAX utility program Data Exchange (DEX). The data can be downloaded directly into ".csv", ".txt" or ".xls" format for viewing with a text editor or within Microsoft Excel. However Sentek recommends that for maximum benefits to be achieved from the data, Sentek's IrriMAX software should be used for viewing data. To view the data in IrriMAX it must be downloaded into ".sdb" format.

Downloading

Each probe will require a separate download and database.

Any computer which is required to download the data must have IrriMAX installed. (see section *Features* for required minimum versions of IrriMAX).

It is recommended that the installer configures the downloads in a way that the end user can easily repeat them without risk of download settings being changed and/or data being stored in the wrong location. FTP server settings are saved in Data Exchange (DEX). Command line switches allow the DEX download process to be run from a script (or batch file).

Please refer to the Data Exchange Help file for information on downloading and running operations from command lines.

Hint: IrriMAX (using DEX) requires the details of the FTP server where the data is being stored. These details will be the same as what is entered in the probe, in the Destination URL field. Copy the details before leaving the probe site.

Viewing

Graphs can be created with the IrriMAX software, using the information stored in the databases (.sdb files).

It is recommended that the data is made easily available for the end user. Graphs should be organised into IrriMAX Workspaces that can be accessed by the end user without requiring them to know where the graph and workspace files are saved on the computer. To do this, shortcut icons for the workspaces (.sws files) should be created on the customers desktop.

It is also recommended use IrriMAX to graph battery voltage (V1, V2) to identify when the battery voltage is degrading.

For further information on how to create, manipulate and save graphs, refer to distributor training notes and the IrriMAX Help documentation.

MAINTENANCE

Sentek PLUS Distributors can provide a regular maintenance program which consists of regular visits by an authorised installer to test and ensure correct operation of the system. A regular maintenance program such as this will ensure that the Sentek PLUS system functions properly and continues to give worry free operation.

DTU

Regular maintenance of the Sentek All-in-One or Compact DTU system should consist of cleaning of the DTU to ensure dust and grime is kept to a minimum, especially around all seals.

Silica Gel bags should be changed annually.

The DTU and probes should be checked regularly for insect infestation. Some insects can cause low resistance between wiring tracks on the circuit boards which can cause intermittent or unreliable operation.

PROBE

Each time the top cap is removed, the top cap and gasket seal should be checked for cracks, breakage or misalignment.

Neutral cure silicon sealant should be used to prevent vapours affecting humidity sensors. If humidity sensor gets wet or Relative Humidity goes above 80% the humidity value may be inaccurate.

Machinery should be kept well away from the probes. This will avoid damage to the probe rods as well as avoid compaction of the soil around the probe, which can give a false indication of the soil moisture content.

If problems are experienced, running tests may assist in determining any system faults. Consult the section *Appendix H - Sentek PLUS Quick Reference Guide* for further details.

LITHIUM BATTERY LIFE

The Lithium battery supplied should last 12 months when using Sentek's standard configuration (five sensors sampling every 30 minutes and upload interval of three hours). The battery pack uses primary cells which CANNOT be recharged. Recharging the battery pack may cause an explosion.

It is recommended to use an IrriMAX graph to display Battery Voltage (sensors V1, V2). This can be either a standalone graph or an addition pane above the primary moisture/salinity graph. Replace the battery when voltage starts to degrade.

The modem use, during upload, is the major use of battery power. Sampling at intervals less than 15 minutes or with a large number of sensors will also affect battery life.

Caution:

Probe dial-in after every up upload (see section *Logger page*) is not recommended with a lithium battery as it will significantly shorten battery life.

Example1: five minutes of dial-in (every 3 hours) could reduce battery life by 40%

Example 2: Increasing samples count (per upload) from 6 to 12 could increase battery life by 40%.

The following IrriMAX graph (*Figure 36*) demonstrates Lithium battery usage from July 2014 to October 2015. It is an IrriMAX bar graph displaying the minimum voltage each week. The upper bars (black) are the supply voltage (V1) and the bottom bars (red/light color) are the upload voltage (V2). Budget lines are set to "Good" (14V) and "Low" (12V).

It is recommended to replace the battery when the Upload Voltage (V2) is consistently in the red i.e. below "Low".

Note: January to August is not shown, to fit graph image within in the page width.

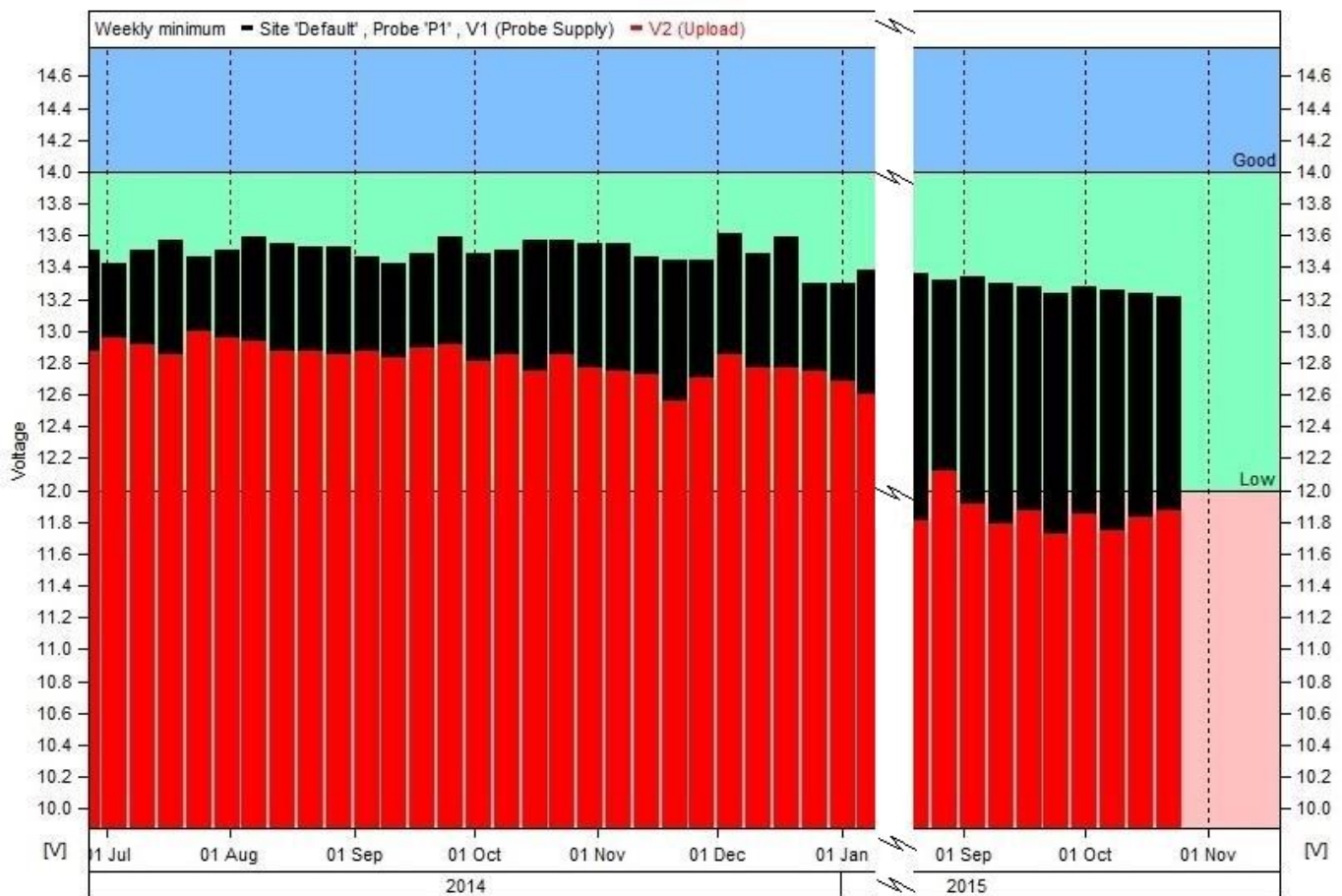


Figure 36 Lithium Battery Discharge Characteristics

Sentek Technical Support is developing a battery life estimator program. You may need to contact them to calculate the battery life for your specific configurations.

FIRMWARE AND BOARD TYPE

Firmware and board type Sentek PLUS requires a Sentek RS232 logging probe with Sentek PLUS/MULTI firmware installed on it.

Some variations of Sentek interfaces (boards) are very similar in appearance, but it is important to use the correct interface board for the application. Only RS232 logging interfaces can be used in Sentek PLUS systems. *Figure 37* shows how a suitable EnviroSCAN interface can be identified.



Figure 37 EnviroSCAN RS232 logging interface

Logging interfaces can be identified by the Super Cap (C116) at the bottom of the interface, only the logging versions of the interface have this component installed. RS232 interfaces will have the RS232 (U202) chip installed. Appropriate Drill & Drop probes are labeled RS232.

CHANGING THE MODEM

Systems preconfigured by Sentek have an appropriate cable from modem to Bluetooth module. If the modem is changed it may have a different cable connector. Early versions of Bluetooth modules (Less than version 3.1) have different order of pins on the onboard connector. Consequently the modem cable plug must be modified.

Cable Color	Current Modules Pin number	Early Modules (<V3.1) Pin number
Yellow	1 Tx	2 Tx
Red	2 Rx	1 Rx
White	3 RTS	4 RTS
Blue	4 CTS	3 CTS
Green	5 DTR	5 DTR
Black	6 Gnd	6 Gnd
Orange	7 +ve	7 +ve
Black	8 -ve	8 -ve

Please contact Sentek Technical Support if you are unsure of the method to swap the cable wires.

FIRMWARE

It is recommended that the latest firmware version available from Sentek be used where possible. This means that when installing a new probe or servicing an existing probe, the firmware on the probe interface should be checked and updated if there is a newer version available.

Different versions of firmware have different default Network and Logger settings. This is important to remember when performing troubleshooting and/or replacing components on a system.

The current version of firmware will always be available on the Sentek web site; in the download section. For instructions on how to update the probe firmware, please read the Readme file included in the firmware download, as this contains full instructions.

The most accurate method of determining whether you have the correct type of interface and firmware is by using the PConfig software to connect to and read the interface.

Figure 38 shows where this information is displayed in PConfig.

Note: Temperature and Humidity sensors must use firmware of 1.5.2 or later to function, and PConfig 1.9.1 or later.

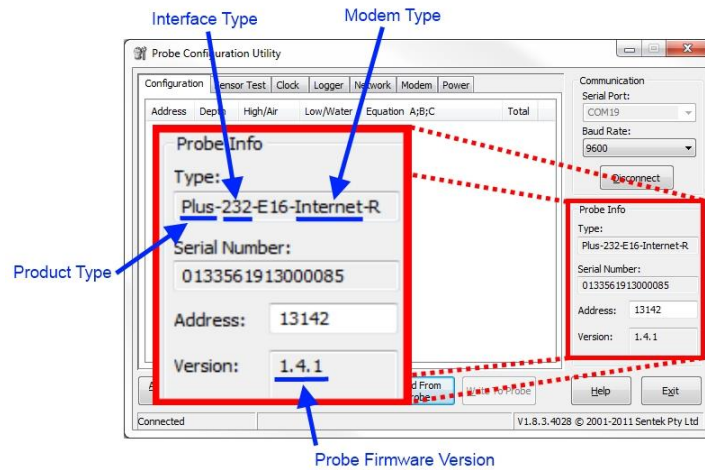


Figure 38 Checking probe type and firmware versions

APPENDIX A – MODEM INFORMATION

COMPATIBLE MODEMS

Sentek PLUS firmware version 1.2.3 and later have the ability to customise the various strings used to control the modem. As well as allowing certain parameters to be re-configured to suit the area in which a system is installed, this has the potential to allow any device that has a serial port and supports dial-up networking to be used with Sentek PLUS systems.

Sentek currently supplies and supports one modem for GPRS networks and one for Telstra's NextG network and pre-configures Sentek PLUS interfaces for their use. The recommended modem specific settings for the probe can change and it should not be assumed that the settings in the probe interface are correct. Files which contain the most recently recommended settings can be downloaded from the Sentek website. For more information on how to restore these settings, see section *Connecting External Antenna*.

Sentek is not obliged to provide support for modems which it has not supplied or agreed to support.

SIM CARD PIN CODES

If the SIM card to be used in the modem is PIN locked, it can be unlocked using a mobile phone or by asking your provider to do so.

Alternatively, the Sentek PLUS interface may be set up to with the PIN in the Initialization string. This is the same as having to enter a PIN into a mobile phone when it is turned on, and gives some added security. To do this, when selecting the Network settings (.cfg) file to restore to the probe, select the file name which matches your modem and has the "PIN" identifier at the end of the file name (e.g. GPRS_NextG_SierraWireless_PIN.cfg). Then, in the Initialization string on the Network page, replace the "XXXX" with the four digit PIN that is locking the SIM. Write the changes to the probe.

For example;

Initialization string for a GPRS modem, with no SIM PIN enabled:

```
\T80000;|AT+CREG=2||\T9000;AT&D2|AT+CSQ|AT+CCED=0,1|AT+ADC?
```

With PIN enabled configuration file restored:

```
\T80000;|AT+CPIN=XXXX||AT+CREG=2||\T9000;AT&D2|AT+CSQ|AT+CCED=0,1|AT+ADC?
```

For SIM with PIN of "1234":

```
\T80000;|AT+CPIN=1234||AT+CREG=2||\T9000;AT&D2|AT+CSQ|AT+CCED=0,1|AT+ADC?
```

Note: The response string would also need to change in this example, because after power up, the modem does not report the "+WIND: 4" indication until after the PIN has been entered. So for the initialization process to begin, "+WIND: 1" must be added as an acceptable response.

USEFUL AT COMMANDS

Below is a list of modem commands and descriptions on how to use them. These are just a small selection of the possible modem commands, but have proven to be most useful for use in the Sentek PLUS and MULTI systems. For full lists of commands, please contact the modem manufacturers.

These commands can be sent to the modems in the PConfig program, by pressing **Open Session**, typing commands in the **AT commands** field and pressing **Send**. The sent commands and the modem responses will appear in the Modem Response field.

Note:

Some NextG commands are specific to ETM9xxx Modems.

Table 2 Modem Commands

Command	ETM9xxx	Wavecom, Fastrack, Netcomm	Satellite	Response
AT	Yes	Yes	Yes	Should return "OK"
AT+CSQ	Yes	Yes	Yes*	Shows the current signal strength and service quality in the form "+CSQ: 22, 0". The first number shows the signal strength. A result of 99 indicates no signal, anything else over 14 is good. This number can vary considerably, and two or three readings should be taken to get a good indication. Consistent results of 99, or below 10 may indicate antenna problems or other connection issues. The second number can be ignored.
AT+CPIN?	Yes	Yes	N/A	Shows the PIN status of the SIM card. A response of "READY" indicates that the PIN has been correctly entered, or the card is not PIN locked.
AT+CGDCONT?	Yes	Yes	N/A	Used to query the APN currently set in modem. Response should be in the form AT+CGDCONT=1,"IP", "<APN>",0,0 A value of 1,"IP",,,,0,0 indicated the APN has not been set.
AT+CGDCONT=1,"IP", "<APN>"	Yes	Yes	N/A	Used to set the APN for your service provider. Where <APN> is replaced with your service provider's APN. e.g. AT+CGDCONT=1,"IP", "telstra.internet"
AT^SCFG="Radio/Band"	Yes	N/A	N/A	Used to query the frequency band on which the modem will operate. See set band command below.
AT^SCFG="Radio/Band",n	Yes	N/A	N/A	Used to set the band on which the modem will operate. Where n has the following possibilities; <input type="checkbox"/> 127 - auto select (from GSM 900, GSM 1800, WCDMA 2100 & WCDMA 850Mhz) <input type="checkbox"/> 64 - UMTS 850Mhz (NextG) <input type="checkbox"/> 1 - GSM 900 e.g. AT^SCFG="Radio/Band",127 See also section <i>Extra Frequency Band information</i> .
AT+WMBS?	N/A	Yes	N/A	Used to query the band on which the modem will operate. See set band command below.

Appendix A – Modem information

Useful AT Commands

Command	ETM9xxx	Wavecom, Fastrack, Netcomm	Satellite	Response
AT+WMBS=n	N/A	Yes	N/A	Used to set the band on which the modem will operate. Where n is replaced by one of the following possibilities; 0 - mono-band 850MHz 1 - mono-band mode 900 extended MHz (900E) 2 - mono-band mode 1800 MHz 3 - mono-band mode 1900 MHz 4 - dual-band mode 850/1900 MHz 5 - dual-band mode 900E (extended) / 1800 MHz 6 - dual-band mode 900E (extended) / 1900 MHz You must power cycle to modem after sending this command. e.g. AT+WMBS=4 See also section Extra Frequency Band information.
AT+CIER=1,0,1,0	N/A	N/A	Yes	Enables unsolicited indicator event reporting for service availability. Each time the service state changes, the modem will put out one of the following: +CIEV:1,1 – Service available +CIEV:1,0 – No service
AT+CEER	Yes	Yes	N/A	returns error report for the last unsuccessful call setup
AT+CMEE=1	Yes	Yes	N/A	Change error report message to verbose. Type this command then the the AT Command giving an error., then reset AT+CMEE=0
AT+COPS=?	Yes	Yes	N/A	Displays networks available in the area
AT+CGSN	N/A	N/A	Yes	Returns modem IMEI
AT+CGMR	N/A	N/A	Yes	Returns modem firmware version

* SIM must be present to process these commands

*+CSQ results from Iridium Satellite modems range from 0 to 5 and do not give a good indication of signal strength. However, consistent results of zero may give a reasonable indication that there is a problem with the modem or antenna.

Extra Frequency Band information

Modems will need to be power cycled (turned off and back on) before frequency changes will take effect. In PConfig, pressing Close Session, waiting a few seconds so that the modem can close down properly and then pressing Open Session will achieve this.

NextG (ETM9xxx)

ETM9910-1 modems are preconfigured to AT^SCFG="Radio/Band",211, which covers all bands supported by the modem.

GPRS Modem bands

GSM 900 / GSM 1800 MHz are used in most parts of the world, including: **Europe, Asia, Australia, Middle East, Africa.**

GSM 850 / GSM 1900 MHz are used in the **United States, Canada, Mexico** and **most countries of South America.**

There are some exceptions to this, so please consult your service provider if unsure.

Information sourced from worldtimezone.com, viewed at 26 July 2011,
<<http://www.worldtimezone.com/gsm.html>>

APPENDIX B – NETWORK PAGE EXPLAINED

Username and Password (Not used in Dial-in mode): These are for the GPRS or NextG network that the SIM card connects to – they are related to the APN server, not the FTP server. Many network providers allow these to be blank. For correct settings, contact your network provider.

The **Command strings** are used to control the modem during each stage of the Sentek PLUS system upload process. Sentek provides configuration files on the Sentek website to restore the network strings for modems sold by Sentek. Generally, the settings should not be altered from the default settings provided by Sentek in these files.

Dial-in Enable: In Dial-in mode, after every Sample Count interval has been reached the telemetry power is turned on and this string (up to 80 characters) is sent to the modem. The telemetry remains powered for the time specified in Dial-in Uptime, and then the Dial-in Disable string is sent.

In normal (not Dial-in) mode, this string (up to 80 characters) is sent upon completion of an upload unless the Dial-in Uptime is set to zero – in this case, the dial-in feature is inactive.

This field can be used to command the modem to auto-answer incoming calls, for the uptime period, after the sample count scheduled time.

Dial-in Disable: In Dial-in mode, after a Dial-in Enable is sent, and when the end of the Dial-in Uptime has been reached, this string (up to 80 characters) is sent, and then the power is removed from the telemetry.

This field can be used to prevent the modem auto-answering incoming messages at times other than the sample count scheduled time.

In normal (not Dial-in) mode, this string (up to 80 characters) is sent before starting an upload. The Dial-in Enable is sent at the completion of the upload. The telemetry remains powered for the time specified in Dial-in Uptime, and then the Dial-in Disable string is sent.

If the Dial-in Uptime is zero the dial-in feature is inactive.

Init String: This string (up to 80 characters) configures the modem for communication, after it has been powered on.

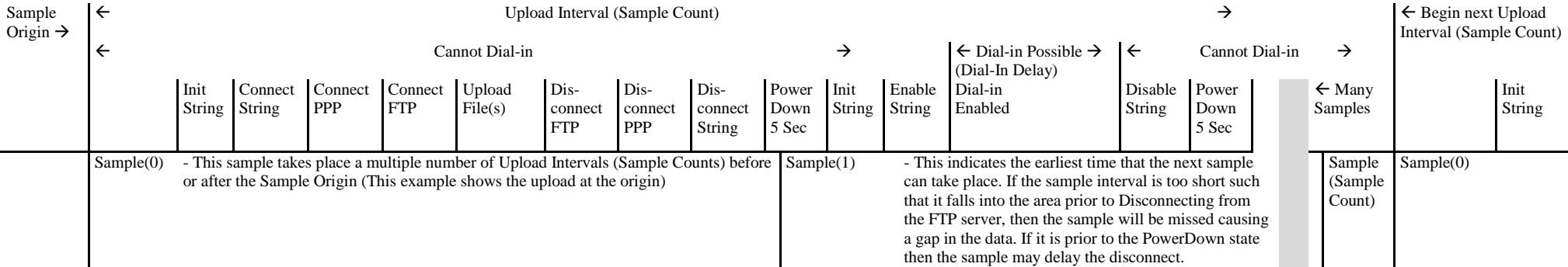
Connect: (Not used in Dial-in mode) This string (up to 80 characters) supplied by your Network provider, is the command needed to connect to the network. It generally initiates the dialing of a specific telephone number.

Disconnect: (Not used in Dial-in mode) This string, up to 80 characters, is sent to the modem after the probe has sent the data to the network. It will disconnect the modem from the network.

Response(s): After being sent a command the modem replies with a response. If the specified response string is not received within the timeout period (\T...) set in the corresponding Network field, the probe will abandon communication until the next scheduled time. This includes responses that do not match the response string. The Dial-in Enable and Disable timeout is not dependent on the Connection Timeout value. A reply is considered matching when the start of the reply exactly matches the response string (up to 40 characters).

APPENDIX C – UPLOAD OPERATION DIAGRAM

Table 3 upload operation diagram



APPENDIX D – PCONFIG RESPONSE FIELDS

LAST RESPONSE

The **Last Response** shown on the Logger page of PConfig is the result of the last attempt by the probe to upload to the destination URL. This upload attempt can be a scheduled upload (triggered by the **Sample Origin**), or a user initiated **Test** or **Upload** from the Modem page of PConfig. See below for more detail on these Responses.

TEST/UPLOAD RESULT CODES

The 053 error in the example picture below was a result of the Connection Timeout period being reached before the connection to the FTP server was established (i.e. if the modem power cable was unplugged).

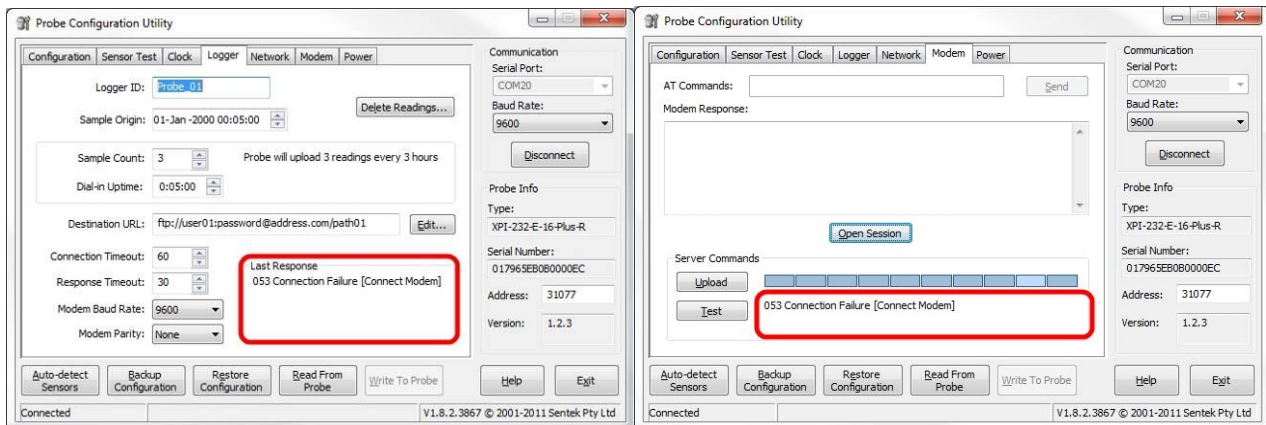


Figure 39 Upload result codes from most recent upload attempt

The table below shows a list of the response codes that may be seen during or after an upload attempt. The codes are separated into two sections; Progress codes indicate which stage of the upload process the probe is at. Upload response codes are used to show the result of an attempted upload.

Table 4 Last Response and uploading response codes

Code	Message Detail	Description
Progress codes		
000	No Error	Only occurs after first ever power on (No upload has been attempted)
001	Initializing Interface	Initialization and connect strings being sent
002	Initializing FTP	Connecting to FTP server
003	Transferring	Transferring data
004	Uploading to Server	Uploading file/s to FTP server
005	Disconnecting from Server	Disconnecting from FTP server, APN server and shutting down modem
006	Transfer Failure	Satellite communication failed, attempting retry
Upload response codes.		

040	Success	Upload was successful (file transferred to FTP server)
041	Success (No Data)	No new data to upload
042	User Cancel	Pressed Cancel in PConfig
043	043 Success	WARNING: Clock needs to be synchronized. Probe clock has not been set. Uploaded data will have a date of 2000/01/01.
051	Clock Not Set	Clock needs to be reset (modify date and time or Synchronize with Computer and Write to probe)
053	Connection Failure	Modem not responding to commands, or could not connect to internet (see note below)
054	Server Error	Problem communicating with FTP server
055	Internal Error	Corrupt file in probe memory. Need to clear memory (Delete Readings).
056	Front Panel Active	Attempt to perform modem function while connected through Dial-in or Front Panel
057	Supply voltage too low	Voltage below Telemetry Disable voltage level
058	Invalid URL	Destination URL invalid
060	Satellite Error	Could not communicate with satellite. Check antenna and registration of the satellite modem.
061	Transfer Failure	Lost communication with satellite. Will be retried at next sample time
063	Transfer Timeout	Lost communication with satellite. Will be retried at next sample time
080	Modem In Use	Cannot do an Open session from front panel.
081	Deferred Upload	Upload will commence when PConfig/Android App is disconnected. Reconnect after 3 minutes (180 seconds) and check Last Response for 040 Success.

Note: If test upload fails with the error “053 Connection Failure: "Error timeout" [Connect Modem]”, go to the Network tab of the Probe Configuration Utility and check the Initialization string. It should begin with “\T” followed by a number. This number indicates the time in milliseconds that the interface will wait for the initial modem response. Increasing it may correct this error – for example, changing it from “\T30000” to “\T60000”.

Note: If test upload fails with the error “053 Connection Failure: "Error timeout" [Connect Modem]”, it could be caused by the probe not seeing any of the acceptable responses within the timeout period set at the beginning of the Initialisation string (see section *Network page*).

In PConfig, measure the time it takes after clicking Open Session for each message to appear in the Modem Response field. The timeout at the beginning of the Initialisation string should exceed the time it takes for the first expected response to appear.

For example; the first expected response could be “+WIND: 4”, and this commonly takes anywhere from 15 to 40 seconds to appear after modem power up. So the initialization string should start with “\T50000;|”. This would mean that the modem has 50 seconds to display the +WIND: 4, if it's seen the probe continues through to the Initialization string. If it takes longer than 50 seconds (or doesn't appear at all), the probe will timeout and abort the attempt.

UPLOAD LOG

It is possible to retrieve from the probe, a log of the codes from the last upload attempt. Only the information from the previous upload test, whether it was a scheduled upload or user initiated Test, is kept in the log. To retrieve the logged upload information from the probe;

1. Connect to the probe in the PConfig software.
2. Go to the Modem page of PConfig
3. Press Open Session
4. Wait until the modem has finished sending the Unsolicited Result Codes and then, using the AT Commands field, send the command below:

```
\showdetails
```

The log information should be displayed in the Modem Response field. Copy all text in this field into a text editor program (i.e. Notepad). Save the information.

This manual does not attempt to explain how to interpret the \showdetails information. Sentek Distributors can send a copy of the response to Sentek for interpretation and troubleshooting help.

APPENDIX E - TECHNICAL SPECIFICATIONS

ENVIROSCAN SERIES II 232 INTERFACE

PCB Revision: REV 2.4
Identification Label: XPI-SC-E-RS232
Interface connector type: Brand: Phoenix Contact
MC 1,5/8-ST-3,5 (Plug)
MC 1,5/8-G-3,5 (Socket)

RS232 Interface pin configuration:

1. +Vin
2. +Vin(T)
3. +Vout(T)
4. Ground
5. TX – RS232 Data
6. RX– RS232 Data
7. Request to send (RTS acts as DTR in the Plus systems)
8. Clear to Send (CTS)

Voltage Supply (RS232 +Vin): 4 – 15 Volts (12 V DC @ >200mA recommended)

Fuse specifications: F201 Vin (300mA) Resettable (not replaceable)
F202 Vout (1.1A) Resettable (not replaceable)
(Both remain open circuit while the fault condition exists)

Output port baud rate: 9600 bits per second

TTL Interface connector type: Brand: JST
B 6B-PH-K (Socket)
PHR- 6 (Plug), SPH-002T-P0.5S (Crimp connectors)

TTL Interface pin configuration:

1. +Vcc
2. Transmit data (Tx)
3. Receive data (Rx)
4. Reserved
5. Reserved
6. Ground

Voltage Supply (TTL +Vcc): 5 Volts, supplied by the EnviroSCAN probe interface

TTL baud rate: 1200, 2400, 9600 (default), 19200 and
38400 bits/second (user configurable)

Total current consumption: 400µA standby @ 12V DC
105mA sampling (Moisture) @ 12V DC
130mA Sampling (TriSCAN) @ 12V DC

Time to sample 1 sensor: 45 milliseconds maximum (Moisture only)
90 milliseconds maximum (TriSCAN)

Maximum sensors supported: 16 Moisture Sensors or
16 TriSCAN Sensors and
16 Temperature Humidity sensors

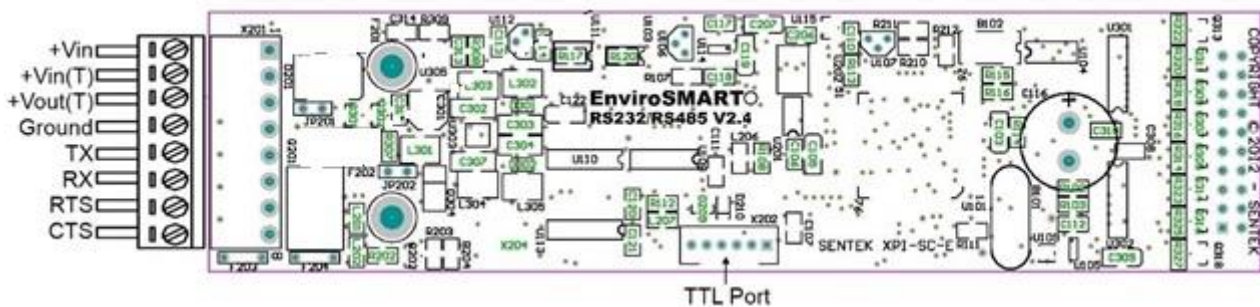


Figure 40 EnviroSCAN RS232 probe interface board layout

APPENDIX F - GLOSSARY OF TERMS

3G	Third Generation mobile phone network
All-in-One	All-in-One Probe
BW	Bandwidth, the amount of traffic allowed in a set period
CDMA	Code Division Multiple Access (Used by selected Modems)
Domain name	Name given to web location e.g. www.sentek.com.au
DTU	Data Transmission Unit (housing containing modem, battery and solar charger board)
FQDN	Fully qualified domain name
FTP	File Transfer Protocol – used to upload / download files
GPRS	General Packet Radio Service (Used by selected Modems)
Host	Web site / data storage provider
HTTP	Hyper Text Transfer Protocol - Used to download files
IP Address	Internet Protocol address – Numbered address of host
NextG	Telstra Australia implementation of 3G
PIN	Personal Identification Number
SIM Card	Subscriber Identity Module, required for GSM/GPRS/NextG Access
Storage Capacity	Available space on server to store data files
URL	Universal Resource Locator

APPENDIX G - CONFIGURING THE PROBE USING BLUETOOTH ON A LAPTOP

Note:

While the Bluetooth module is active an internal buzzer sounds.

Every All-in-One probe or Compact DTU has a unique Bluetooth identifier which, when configured in Windows, has its own COM port. This identifier e.g. "SENTEKB00205" is shown on the compliance label on the All-in-One top cap. Once configured, the device is shown in the Devices list and it has an associated COM port.

When the COM port is known, you can run PConfig without going through the configuration steps e.g.



The device remains in the list of devices until it is deleted. It is not necessary to delete it unless the number of devices becomes unmanageable.

The following steps describe configuring the Bluetooth device and finding its COM port.

1. If the Sentek Device is already installed, for this serial number, it will appear in the list of Bluetooth Devices. There is no need to follow these steps. If the list gets too long, select unwanted Sentek devices and press Delete. Step 7 shows how to get the COM port if you did not take a note of COM number.



2. Select windows menu option for Devices
 - a) Windows XP, 7 and Vista - Devices and Printers or
 - b) Windows 8 - Settings > change PC Settings (or Control Panel > Hardware and Sound

3. In Control Panel (Settings > PC and devices) select **Bluetooth** and turn it on

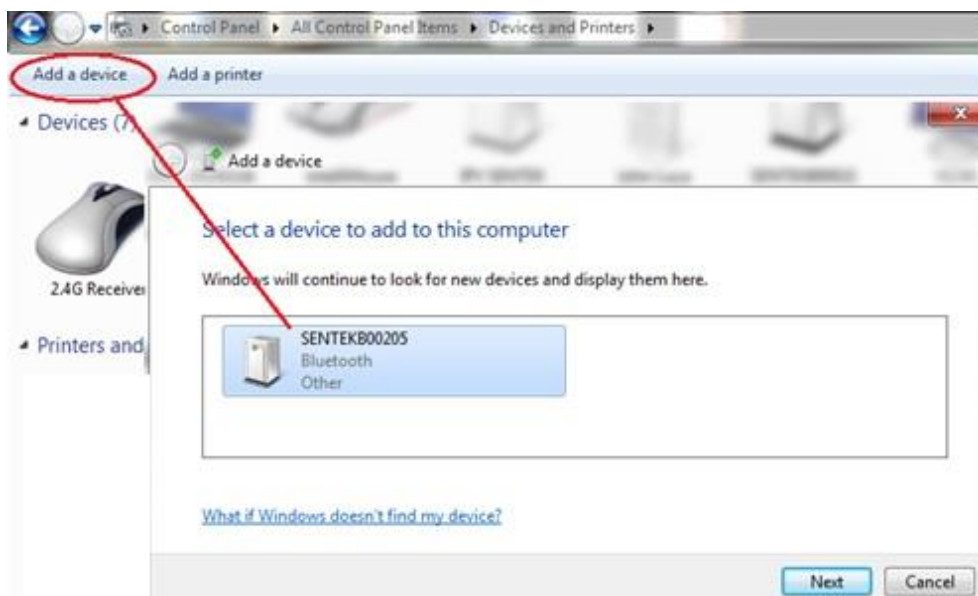
Caution:

Battery will discharge faster when Bluetooth is enabled. After completing the desired tasks we suggest you turn it off, until needed again.

Turn on the All-in-One Bluetooth module by touching the magnet torch for one second to the All-in-One top cap. The activation point is above the red plug or external antenna point (see picture). Until the Bluetooth module is connected an internal buzzer sounds (it will wait 2 minutes for a connection).

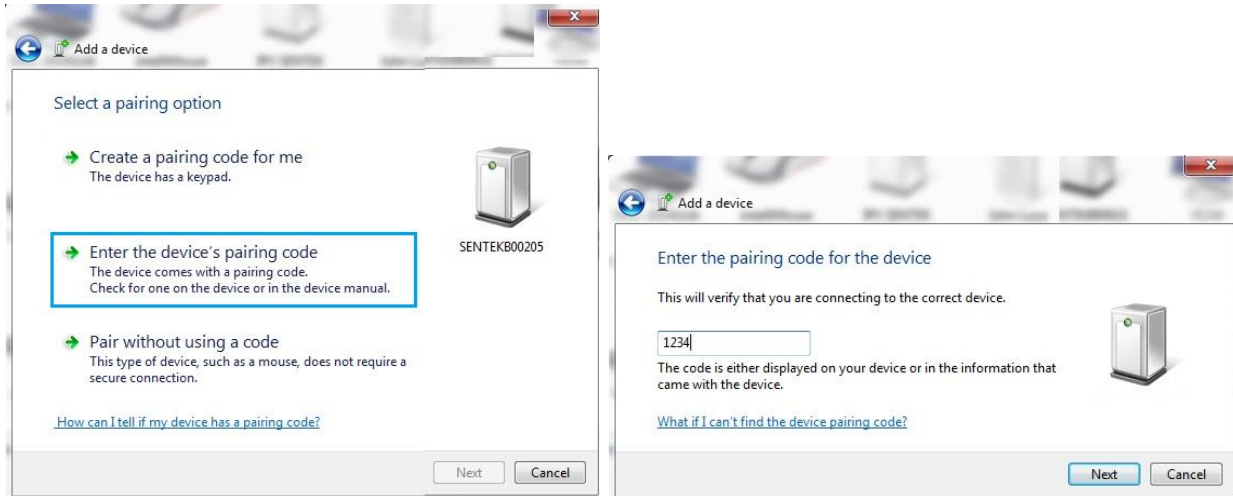


4. Select Windows Devices and select "Add a device". The active All-in-One device should appear. If not, swipe the magnet torch again. Select the device click **Next**.

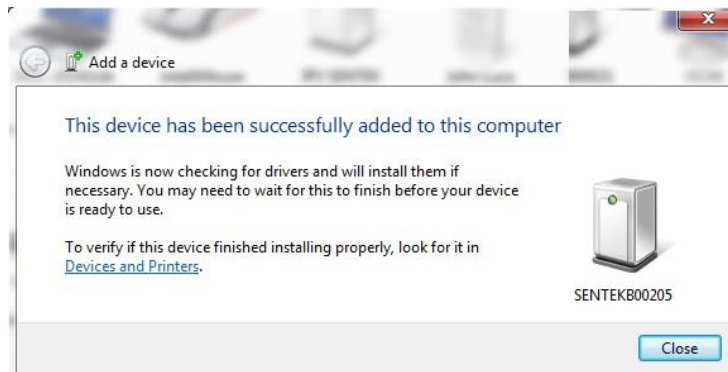


Appendix G - Configuring the Probe using Bluetooth on a Laptop EnviroSCAN Series II 232 interface

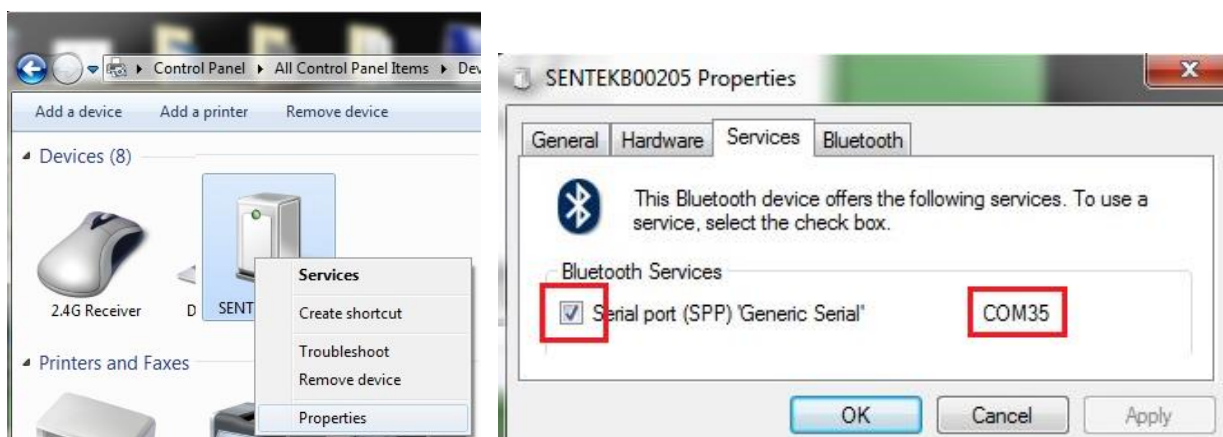
5. Select the "Enter the Device's Pairing" code click **Next** and enter the Pairing code "1234" and click **Next**.



6. The device is now available click **Close**



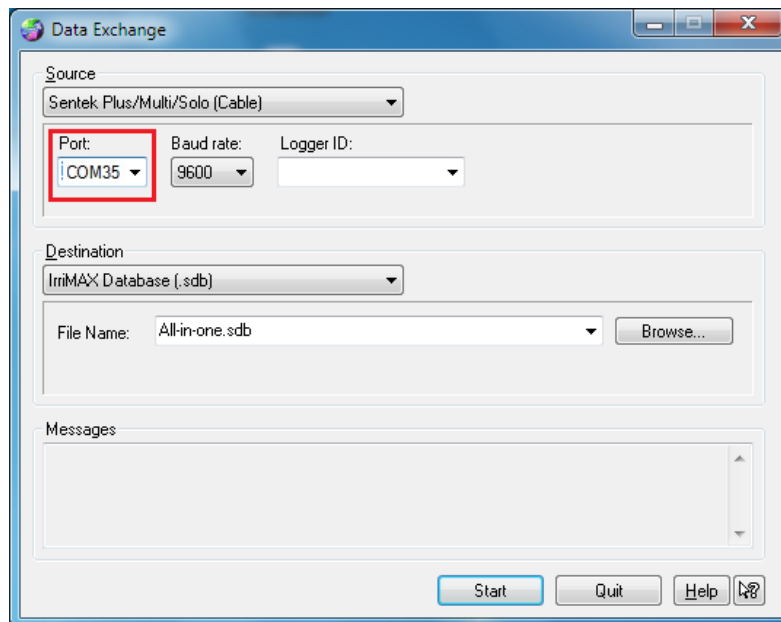
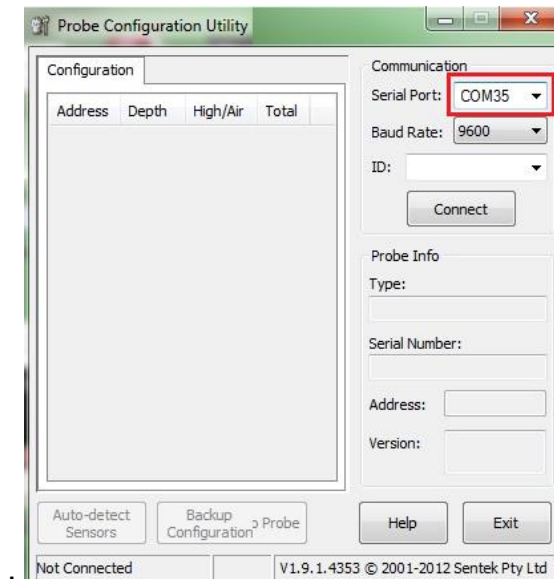
7. In the device list, right click on the Bluetooth device and select **Properties**. In properties check the Serial port checkbox and take a note of the port number for use by PConfig. Click **OK**.



8. Your laptop now has a Bluetooth port that can be used by PConfig. Using the port number discovered in the previous step.

Appendix G - Configuring the Probe using Bluetooth on a Laptop EnviroSCAN Series II 232 interface

9. Additionally you can also use Data Exchange to download data from the source module "Sentek PLUS/Multi/Solo (Cable)".



APPENDIX H - SENTEK PLUS QUICK REFERENCE GUIDE

This appendix is designed to be a short guide for installers of Sentek All-in-One. It can be printed and carried into the field and act as a reminder for the basic steps needed to install and troubleshoot a complete Sentek All-in-One system. It does not replace the manual, it merely supplements it.

PRODUCT SET-UP CHECKLIST

Preparation

1. Select probe and sites. Test signal strengths and decide on system configuration.
2. Organise data transmission and hosting, as detailed in Sentek All-in-One Hardware Manual section *Data Transfer and Hosting*.
3. Using PConfig, for each probe;
 - Check that the interface has the latest version of firmware
 - Configure sensors (Auto-detect, set depths & normalise)
 - Set Clock (Time & sampling interval)
 - Configure Modem Settings (Restore network configuration which matches modem being used)
 - Check system (Test)

(For further information, refer to Sentek All-in-One hardware manual and PConfig Help)

Warning:

Do not leave the 14V battery connected in the housing during transportation or damage may occur

Field Installation

1. Install access tubes as per the Sentek Access Tube Installation Guides (Screw Cap), and as demonstrated during official Sentek training.
 - a) Screw Bottom plastic onto Top cap
 - b) Insert probe rod.
 - c) Plug All-in-One internal plastic into the top of probe rod.
 - d) Connect external antenna if required.
 - e) Ensure the Pink O-ring in All-in-One top cap has a good coating of Silicon Grease.
 - f) Place cap on bottom plastic, rotate counter clockwise until the Pins are seated all the way down the end of the slot in the cap.

Software

Allow probe time to upload readings to the server.

1. Enter the server details into Data Exchange (Edit Server).
2. For each probe, use the New Database Wizard and Download Wizard within an IrriMAX workspace to set up new databases and associated downloads.
3. Create graphs, save the workspace and create a batch file to run the downloads.

Example Batch File: "Path to IrriMax.exe" "path to workspace.sws"
/DOWNLOAD

TROUBLESHOOTING GUIDE

As All-in-One probes are preconfigured before delivery, only user controlled capabilities should be addressed in the field. Any problem that cannot be resolved should be directed to your distributor.

Once a problem has been flagged, troubleshooting should be carried out in this order:

1. Download all data and review graphs, looking at all sensors for problem symptoms and causes.
2. Before picking up any tools, moving cables or altering the system in any way, connect to the probe in PConfig and identify what the current fault is. If you miss this step, you will not know whether you have fixed the original problem or not.

Tip:

Upload readings and back up probe configuration before changing any probe settings.

3. Using Table 5 below as a starting point, begin finding the cause of the fault. Change only one thing at a time and then check to see if it has changed the original symptom of the fault. Try something else if the symptom has not changed.
4. Once the cause and symptom have been found and rectified, test all sensors and upload operation in PConfig. If a new symptom appears, start again at step 2.

Table 5 Troubleshooting

Symptom/Error Message	Possible Cause of Failure	Check	Possible Solution
Cannot connect with any device	Connectors not seated in the sockets	Bluetooth module securely seated to interface	Ensure module screwed to interface
	Battery not connected	Battery plug	Ensure battery plugs clicked together
Cannot connect to probe with PConfig through TTL connection	Wrong COM Port selected in PConfig	Check COM Port number in Windows Device Manager	Ensure cable drivers are installed and correct COM port is selected
	Low power supplied to interface	Measure DC voltage at interface connector	Replace battery if not 14V
			Replace corroded wires or connectors

Symptom/Error Message	Possible Cause of Failure	Check	Possible Solution
			Re-strip and connect all wires
			Ensure power plug is completely clicked in
	Power switched off	Check battery power plug	Make sure cable is fully connected with TTL port on interface Note: The USB port supplied voltage cannot be used to power the interface
	PConfig cable not connected	Visual check	Re-terminate all connections
	Poor probe cable wiring at DTU or Probe (specifically power and ground wires)	check wiring configuration, see <i>Figure 9 EnviroSCAN interface and wiring diagram</i>	Reseat all connectors Replace Interface
Cannot connect to probe with PConfig through Bluetooth	Bluetooth Module not active	The module turns off if connection does not occur within 2 minutes	Swipe magnet torch across top cap activation point
	Wrong COM port selected in PConfig	Ensure the selected COM port number matches the Bluetooth device properties	Try all PConfig COM ports.
	Bluetooth module not in paired device list	Ensure the Identification number on the Probe certification label matches Selected Bluetooth device number e.g.	Add a new paired device to device list, see section <i>Appendix G - Configuring the Probe using Bluetooth</i> on a Laptop

Symptom/Error Message	Possible Cause of Failure	Check	Possible Solution
		SENTEKB00205	
Cannot connect to probe with Android App	Bluetooth Module not active	The module turns off if connection does not occur within 2 minutes	Swipe magnet torch across top cap activation point
	Not connecting to correct probe	Device is in the Scan for devices list If paired device the device identification number matches the probe's number e.g. SENTEKB00205	Exit App and try again. See section <i>Verifying Probe Configuration with Sentek Android App</i> See <i>Android Probe Utility App User Guide</i>
Failure of Modem "Test" upload	Modem not powering with Open session in PConfig	Should be 14V at Pin 3 (brown wire) on interface	Replace probe cable (if power is ok at interface)
		Monitor battery voltage while modem active (modem light is on or flashing)	Replace battery if it drops below 14V
		Probe not configured to match modem type	Download Network settings .cfg files from Sentek web site and restore correct file to probe
	Last Response "053 Connection Failure [Connect Modem]"	Probe not configured to match modem type	Download Network settings .cfg files from Sentek web site and restore correct file to probe

Symptom/Error Message	Possible Cause of Failure	Check	Possible Solution
	Last Response "053 Connection Failure "or "058 Invalid URL"	Upload Internet URL is your assigned web location	Ensure you have the correct ftp://<user name>:<password>@<host/Internet address>/<url-path>
	Last Response other values	See <i>Table 4 Last Response and uploading response codes</i>	Follow suggestions in the table.
	Antenna not connected	Check that antenna is cabled to modem	Tighten antenna connectors
	Poor signal strength	Use \showdetails to check the signal strength parameter CSQ	See section <i>Upload log</i> Replace internal antenna with external antenna
Data uploaded does not show expected (correct) time	Probe Clock incorrect	Connect using Android App or PConfig Clock tab and check probe time	Select option to Synchronize with Computer
Invalid sensor data (0 raw counts), but voltage readings ok	Interface or sensor pins not all in their socket	All connectors	Reseat top cap plug Reseat sensor plugs
Probe not logging one or more sensors	Sensor depth(s) = 0 or Salinity air and water values not normalized (still 65535, 0)	Configuration tab in PConfig	Use PConfig to set depths and Normalize or restore configuration from previously save Backup Configuration.
	Sample Origin in the future	Logger tab in PConfig	Set Oringin date in the past.

RECOMMENDED MAINTENANCE SCHEDULES

Daily

- Use IrriMAX graph to review battery voltage (V1, V2) profile and replace battery when battery voltage shows signs of degradation

6 months (or each time access tube is opened)

- Check probe and access tube for moisture
- Replace silica gel bag

12 months

- Check for dust and/or water ingress into All-in-One housing
- Check cable for damage to outer sheath and wires
- Check antenna is secured tightly
- Ensure all cables are neat
- Clean SIM contacts
- Replace 14V battery

3 years

- Replace All-in-One top cap